DESIGN • CREATE • EXPLORE • DISCOVER • IMPACT

30 YEARS

Undergraduate Research, Scholarship and Creative Activities Conference

Sponsored by: Undergraduate Research Center, Undergraduate Education, Student Affairs, University Library and Global Affairs

POSTER SESSIONS
Friday, April 26, 2019
3:00 - 6:00 pm
ARC PAVILION

ARTS & DESIGN EXHIBIT
Friday, April 26, 2019
3:00 - 6:00 pm
ARC PAVILION

ORAL SESSIONS
Saturday, April 27, 2019
1:00 - 4:30 pm
WELLMAN HALL

UCDAVIS
Undergraduate Research Center
Office of Undergraduate Education

urc.ucdavis.edu

#UCDavisURC

30th Annual Undergraduate Research, Scholarship and Creative Activities Conference

Letter from the Chancellor

April 26, 2019

Dear Students, Colleagues and Guests:

Welcome to UC Davis' 30th annual exhibition of undergraduate research!

UC Davis prides itself as one of the top research universities in the nation. Our scholarship and research addresses some of society's most critical challenges, including climate change, feeding the world and sustaining the health of all living beings. Student researchers, who reflect a wide variety of fields, are the leaders and change makers of tomorrow.

Our students are moving into the future with confidence and creativity like never before. We are guided by UC Davis' 10-year strategic plan, "To Boldly Go," that will build on our research strengths and entrepreneurial spirit to shape a better tomorrow for all. We've also recently announced a collaboration with IBM at Aggie Square, our 25-acre innovation hub that's developing on our Sacramento campus.

Through this conference, we are providing and showcasing educational opportunities that prepare students for career success. Many employers are looking for talented people who not only shine in their research and scholarship, but have the capacity to collaborate and communicate their work in the most impactful manner possible. In addition to the skills developed during research, these oral and poster presentations are a great form of practice as our students prepare for graduate school and the workforce.

I congratulate the student presenters for their dedication and excellent work thus far. They have partnered with faculty mentors and peers in a spirit of problem solving. Now, they can share their work with experts in their fields and our UC Davis community

I also congratulate the Undergraduate Research Center for organizing this important conference and connecting students with important research opportunities, programs and awards. Also, I am deeply grateful to the faculty members who serve as mentors and role models for students.

Finally, I extend my gratitude to the many faculty volunteers who adjusted their busy schedules to moderate the conference sessions. This is exactly the kind of thoughtfulness and synergy between students and faculty that defines UC Davis.

I wish everyone a great conference and to keep on creating and innovating!

Gary S. May
Chancellor

ACKNOWLEDGMENTS

The Undergraduate Research, Scholarship & Creative Activities Conference gratefully acknowledges the faculty sponsors and other individuals whose mentoring has contributed to the research produced by our presenters. We would also like to thank the many programs that generously support and encourage undergraduate research and creative activities at UC Davis. Among these are the following: Beckman Scholars Program; California Alliance for Minority Participation (CAMP); Educational Enrichment Outreach Programs (BUSP, BUSP-Honors, BSHARP-MARC, CURE, ADAR); Internship and Career Center; McNair Scholars Program; Mentor-Mentee Program in Humanities, Arts, Cultural Studies and Social Sciences; Mentorships for Undergraduate Research in Agriculture, Letters and Science (MURALS); Mentorships for Undergraduate Research Participants in the Physical and Mathematical Sciences (MURPPS); Provost's Undergraduate Fellowship; University Honors Program; UC Davis Washington Program; UC Leadership Excellence Through Advanced Degrees (UC LEADS), and Vertically Integrated Projects (VIP).

Thank you to our Sponsors

Global Affairs
Student Affairs
UC Davis Library
Undergraduate Education
Undergraduate Research Center

Conference Chair

Elizabeth M. Nuñez | *Undergraduate Research Center*

Conference Organizing Committee

Lolita Adkins | *Undergraduate Research Center; CAMP, MURPPS*
Alex Falcon | *Undergraduate Student Representative*
Jacques Bowyer | *Graduate Studies, McNair Scholars Program*
Lili Bynes | *Dean's Office, College of Agricultural & Environmental Sciences*
Benjamin Plourde | *Undergraduate Research Center*
Connie Champagne | *College of Biological Sciences; BUSP*
Dee Clark | *Undergraduate Research Center*
Jasmine Durias | *Dean's Office, College of Letters & Science*
Annaliese Franz | *Undergraduate Research Center*
William Madden | *Dean's Office, College of Biological Sciences*
Raynell Hamilton | *Student Academic Success Center; MURALS*
Shadaya Litt | *Dean's Office, College of Engineering*
Subra Muralidharan | *Office of the Provost*
Richard Scalettar | *Undergraduate Council--Committee on Special Academic Programs*

Design and Publications

Steven A. Morse | *Undergraduate Education*

AGENDA

Poster Sessions: Friday, April 26, 2019

3–6 p.m., ARC Pavilion

3–4 p.m. ..... Poster Session A
ARC Pavilion

4–5 p.m. ..... Poster Session B
ARC Pavilion

5–6 p.m. ..... Poster Session C
ARC Pavilion

Arts Exhibit: Friday, April 26, 2019

(concurrent with poster session) 3–6 p.m., ARC Pavilion

3–6 p.m. ..... Arts/Design Exhibit
ARC Pavilion

Oral and Performing Arts Sessions: Saturday, April 27, 2019

1–4:30 p.m., Wellman Hall

Noon–1 p.m. ..... Presenter Check-in
Room 115, Wellman Hall

1–2:30 p.m. ..... Oral Session 1
Wellman Hall Rooms

3–4:30 p.m. ..... Oral Session 2
Wellman Hall Rooms

TABLE OF CONTENTS

PRESENTERS

Abouayash, Joey A.	Session C	Poster 21	5:00 PM	Pavillion ARC
Adachi, Anne Marie	Session C	Poster 151	5:00 PM	Pavillion ARC
Addleman, Jennifer S.	Session 1	Oral	2:00 PM	205 Wellman Hall
Afsarifard, Arash	Session A	Poster 110	3:00 PM	Pavillion ARC
Agezew, Samrawit Mesfin.	Session B	Poster 50	4:00 PM	Pavillion ARC
Agrawal, Anika	Session A	Poster 122	3:00 PM	Pavillion ARC
Ahlquist, Jesse T.	Session A	Poster 99	3:00 PM	Pavillion ARC
Ahluwalia, Tamanna	Session A	Poster 54	3:00 PM	Pavillion ARC
Ahmann, Lauren	Session B	Poster 80	4:00 PM	Pavillion ARC
Ahmed, Arianna R.	Session A	Poster 135	3:00 PM	Pavillion ARC
Ahn, Jennie	Session C	Poster 76	5:00 PM	Pavillion ARC
Akanda, Rifa I.	Session A	Poster 154	3:00 PM	Pavillion ARC
Al Tekreeti, Abdullah	Session A	Poster 136	3:00 PM	Pavillion ARC
Alexander, Rylee	Session B	Poster 95	4:00 PM	Pavillion ARC
Alghassab, Faisal	Session 1	Oral	2:00 PM	226 Wellman Hall
Ali, Amir		A & D Exhibit	3:00 PM	Pavillion ARC
Ali, Rida	Session A	Poster 137	3:00 PM	Pavillion ARC
AlJassar, Sara	Session 1	Oral	2:15 PM	226 Wellman Hall
Almashtoub, Suzan	Session A	Poster 26	3:00 PM	Pavillion ARC
Alvarado, Priscilla	Session B	Poster 63	4:00 PM	Pavillion ARC
Amerman, Autumn Opal.	Session A	Poster 115	3:00 PM	Pavillion ARC
Amin, Sonali	Session A	Poster 106	3:00 PM	Pavillion ARC
Andrade, Marlene Jazmin.	Session A	Poster 91	3:00 PM	Pavillion ARC
Anguiano, Maribel	Session 1	Oral	1:45 PM	205 Wellman Hall
Antoine-Goeas, Xavier	Session A	Poster 19	3:00 PM	Pavillion ARC
Arabit, Jenny Lyn	Session B	Poster 158	4:00 PM	Pavillion ARC
Arkangel, Lindsey	Session A	Poster 54	3:00 PM	Pavillion ARC
Asif, Ali	Session B	Poster 106	4:00 PM	Pavillion ARC
Awwad, Ayah	Session A	Poster 41	3:00 PM	Pavillion ARC
Aylard, Dominik A.	Session 1	Oral	1:00 PM	6 Wellman Hall
Azizi Shalbaf, Farnaz	Session A	Poster 53	3:00 PM	Pavillion ARC
Baba, Hiro	Session A	Poster 140	3:00 PM	Pavillion ARC
Bader, Hadeel	Session A	Poster 59	3:00 PM	Pavillion ARC
Baggett, Julia E..	Session 1	Oral	1:00 PM	103 Wellman Hall
Banga, Lisa V.	Session 1	Oral	1:00 PM	202 Wellman Hall
Banola, Jerice Kent R.	Session C	Poster 111	5:00 PM	Pavillion ARC
Bansal, Riya		A & D Exhibit	3:00 PM	Pavillion ARC
Barrera, Stefania	Session A	Poster 151	3:00 PM	Pavillion ARC
Basharkhah, Sarah	Session C	Poster 149	5:00 PM	Pavillion ARC
Basit, Meral	Session B	Poster 129	4:00 PM	Pavillion ARC
Bass, Aaron William.	Session C	Poster 103	5:00 PM	Pavillion ARC
Batool, Farva	Session A	Poster 159	3:00 PM	Pavillion ARC
Baudrey, Krystina K.	Session 2	Oral	3:00 PM	226 Wellman Hall
Beauregard, Paris	Session 1	Oral	2:15 PM	205 Wellman Hall
Begin, Taylor A..	Session 2	Oral	3:45 PM	230 Wellman Hall
Belt, Ashley	Session B	Poster 108	4:00 PM	Pavillion ARC
Bennett, Noah B.	Session A	Poster 37	3:00 PM	Pavillion ARC
Berrios, David	Session 1	Oral	1:30 PM	229 Wellman Hall
Betz, Oliver k.	Session C	Poster 38	5:00 PM	Pavillion ARC
Bianchi, Catarina A.	Session B	Poster 109	4:00 PM	Pavillion ARC
Biswas, Anoma	Session B	Poster 22	4:00 PM	Pavillion ARC
Black, Brittany V..	Session B	Poster 64	4:00 PM	Pavillion ARC
Block, Maya	Session C	Poster 75	5:00 PM	Pavillion ARC
Bobritsky, Shoshannah M.	Session A	Poster 82	3:00 PM	Pavillion ARC
Bolt, Tayah M.	Session B	Poster 69	4:00 PM	Pavillion ARC
Booras, Alexa	Session A	Poster 152	3:00 PM	Pavillion ARC
Borison, Sophie	Session B	Poster 62	4:00 PM	Pavillion ARC
Bough, Graham Wade.	Session C	Poster 103	5:00 PM	Pavillion ARC
Boyar, Christina	Session B	Poster 41	4:00 PM	Pavillion ARC
Boyle, Erin A.	Session 1	Oral	2:15 PM	106 Wellman Hall
Brackrog, Alyssa L.	Session C	Poster 39	5:00 PM	Pavillion ARC
Brand, Jonathan D.	Session 1	Oral	1:30 PM	6 Wellman Hall
Brashears, Kira	Session 2	Oral	3:00 PM	230 Wellman Hall
Bravo, Martin	Session A	Poster 46	3:00 PM	Pavillion ARC
Brinker, Sam	Session A	Poster 72	3:00 PM	Pavillion ARC
Briones, Jessica D.	Session C	Poster 123	5:00 PM	Pavillion ARC
Brumage, Eleana J.	Session A	Poster 57	3:00 PM	Pavillion ARC
Brundavanam, Sri	Session C	Poster 83	5:00 PM	Pavillion ARC
Buchner, Ryan	Session B	Poster 81	4:00 PM	Pavillion ARC
Bucks, Danielle	Session A	Poster 90	3:00 PM	Pavillion ARC
Bui, Minh-Tam C.	Session B	Poster 85	4:00 PM	Pavillion ARC
Bulsara, Prachi	Session A	Poster 90	3:00 PM	Pavillion ARC
Bumann, Sonja	Session 1	Oral	1:15 PM	207 Wellman Hall
Burk, Andy	Session C	Poster 143	5:00 PM	Pavillion ARC
Burke, Camille Juliet.	Session C	Poster 4	5:00 PM	Pavillion ARC
Burke, Sally	Session B	Poster 125	4:00 PM	Pavillion ARC
Burns, Amanda	Session A	Poster 123	3:00 PM	Pavillion ARC
Burns, Markus	Session 2	Oral	3:30 PM	205 Wellman Hall
Burns, Therese Y.	Session C	Poster 107	5:00 PM	Pavillion ARC
Butler, Corinne	Session A	Poster 130	3:00 PM	Pavillion ARC
Buzel, Talia	Session C	Poster 124	5:00 PM	Pavillion ARC
Caballero, Reca	Session 2	Oral	3:45 PM	26 Wellman Hall
Camacho, Tracy	Session B	Poster 100	4:00 PM	Pavillion ARC
Camilleri, Julia M.	Session B	Poster 17	4:00 PM	Pavillion ARC
Campbell-Grey, Alex A.	Session A	Poster 105	3:00 PM	Pavillion ARC
Canale, Lauren	Session 1	Oral	2:00 PM	106 Wellman Hall
Cao, Sara	Session A	Poster 22	3:00 PM	Pavillion ARC
Cardinale-Lopez, Erica	Session B	Poster 143	4:00 PM	Pavillion ARC
Carmona, Juliana	Session 1	Oral	1:15 PM	212 Wellman Hall
Carriere, Stephanie A.	Session 2	Oral	3:15 PM	2 Wellman Hall

Carroll, Maria	Session 1	Oral	1:45 PM	202 Wellman Hall
Cayabyab, Vannalee	Session A	Poster 157	3:00 PM	Pavillion ARC
Celniker, Chloe Bell.	Session A	Poster 11	3:00 PM	Pavillion ARC
Chan, Karen	Session C	Poster 71	5:00 PM	Pavillion ARC
Chan, Priscilla	Session A	Poster 100	3:00 PM	Pavillion ARC
Chand, Manesh	Session A	Poster 47	3:00 PM	Pavillion ARC
Chang, Maggie		A & D Exhibit	3:00 PM	Pavillion ARC
Chao, Chio	Session C	Poster 157	5:00 PM	Pavillion ARC
Chapman, Sierra	Session 2	Oral	3:30 PM	207 Wellman Hall
Chau, Kelly	Session A	Poster 21	3:00 PM	Pavillion ARC
Chau, Valerie M.	Session A	Poster 129	3:00 PM	Pavillion ARC
Chauhan, Navya	Session C	Poster 110	5:00 PM	Pavillion ARC
Chavez, Micah	Session 2	Oral	3:00 PM	6 Wellman Hall
Cheah, Joleen	Session 2	Oral	3:00 PM	26 Wellman Hall
Chen, Alvin	Session 1	Oral	1:15 PM	119 Wellman Hall
Chen, Cecilia	Session C	Poster 64	5:00 PM	Pavillion ARC
Chen, Elizabeth	Session 1	Oral	2:00 PM	26 Wellman Hall
Chen, Jenny	Session 1	Oral	2:00 PM	119 Wellman Hall
Chen, Matthew	Session B	Poster 150	4:00 PM	Pavillion ARC
Chen, Xi	Session A	Poster 94	3:00 PM	Pavillion ARC
Chen, Yan Yi.	Session B	Poster 85	4:00 PM	Pavillion ARC
Chen, Ye	Session B	Poster 126	4:00 PM	Pavillion ARC
Chen, Yu-Shih	Session A	Poster 153	3:00 PM	Pavillion ARC
Cheng, Iris	Session A	Poster 43	3:00 PM	Pavillion ARC
Cheng, Scarlett	Session C	Poster 63	5:00 PM	Pavillion ARC
Chenh, Ivy	Session B	Poster 35	4:00 PM	Pavillion ARC
Cheung, Sophia	Session A	Poster 41	3:00 PM	Pavillion ARC
Chickering, Kyle R.	Session A	Poster 18	3:00 PM	Pavillion ARC
Chin, Christina	Session B	Poster 21	4:00 PM	Pavillion ARC
Ching, Tianna M.	Session A	Poster 132	3:00 PM	Pavillion ARC
Chittaranjan, Shivani	Session A	Poster 133	3:00 PM	Pavillion ARC
Cho, Rebecca	Session B	Poster 23	4:00 PM	Pavillion ARC
Choat, Tara A.		Perf. Arts	3:00 PM	Pavillion ARC
Chokyi, Chokyi	Session A	Poster 71	3:00 PM	Pavillion ARC
Christie, Anneka	Session B	Poster 107	4:00 PM	Pavillion ARC
Chung, Joanne	Session A	Poster 70	3:00 PM	Pavillion ARC
Chung, Siwon	Session C	Poster 151	5:00 PM	Pavillion ARC
Cisneros, Ariana	Session 2	Oral	3:15 PM	202 Wellman Hall
Cisneros, Sara M.	Session A	Poster 69	3:00 PM	Pavillion ARC
Clark, Danielle	Session C	Poster 85	5:00 PM	Pavillion ARC
Cloud, Bryn E.	Session A	Poster 138	3:00 PM	Pavillion ARC
Cogo, Patrick R.	Session C	Poster 159	5:00 PM	Pavillion ARC
Cohen, Julia	Session 2	Oral	4:00 PM	106 Wellman Hall
Colbert, Kelly J.	Session A	Poster 12	3:00 PM	Pavillion ARC
Colin, Jackie	Session B	Poster 82	4:00 PM	Pavillion ARC
Contreras, Celeste A.	Session A	Poster 70	3:00 PM	Pavillion ARC
Cooper, Kylie R.	Session C	Poster 83	5:00 PM	Pavillion ARC
Cornejo, Karen	Session 1	Oral	2:00 PM	229 Wellman Hall
Correa, David	Session 2	Oral	3:00 PM	103 Wellman Hall
Correa, Julienne	Session 2	Oral	3:15 PM	103 Wellman Hall
Covarrubias, Mayra	Session A	Poster 61	3:00 PM	Pavillion ARC
Cox, Elizabeth G.	Session 2	Oral	3:15 PM	212 Wellman Hall
Cox, Kristin C.		A & D Exhibit	3:00 PM	Pavillion ARC
Craford, Cassidy		A & D Exhibit	3:00 PM	Pavillion ARC
Craig, Matthew L.	Session C	Poster 33	5:00 PM	Pavillion ARC
Cravotto, Julianne MB .	Session 2	Oral	3:00 PM	229 Wellman Hall
Cruz, Danielle M.	Session A	Poster 6	3:00 PM	Pavillion ARC
Cruz-Gutierrez, Lorena	Session B	Poster 159	4:00 PM	Pavillion ARC
Cui, Kristen	Session A	Poster 92	3:00 PM	Pavillion ARC
Curry, Stephen	Session A	Poster 98	3:00 PM	Pavillion ARC
Cuyegkeng, Andrew	Session C	Poster 108	5:00 PM	Pavillion ARC
Dajani, Leah	Session C	Poster 126	5:00 PM	Pavillion ARC
Dang, Brian Q.	Session A	Poster 27	3:00 PM	Pavillion ARC
Darodda, Stephen	Session B	Poster 86	4:00 PM	Pavillion ARC
Davila, Jacqueline	Session B	Poster 45	4:00 PM	Pavillion ARC
De Castro, Francine	Session A	Poster 124	3:00 PM	Pavillion ARC
De Las Alas, Francesca R.	Session 1	Oral	2:00 PM	103 Wellman Hall
de Leon Sanchez, Erin E.	Session C	Poster 127	5:00 PM	Pavillion ARC
Deck, Samuel L.	Session A	Poster 131	3:00 PM	Pavillion ARC
Dedmore, Caleb	Session A	Poster 109	3:00 PM	Pavillion ARC
Dehleh Hossein Zadeh, Saum	Session A	Poster 10	3:00 PM	Pavillion ARC
Delaney, Emmy L.	Session B	Poster 130	4:00 PM	Pavillion ARC
Delp, Emma	Session B	Poster 87	4:00 PM	Pavillion ARC
Denton, Sabrina R.	Session B	Poster 62	4:00 PM	Pavillion ARC
Diabali, Michael Adnan.	Session B	Poster 42	4:00 PM	Pavillion ARC
Dias, Sue	Session A	Poster 116	3:00 PM	Pavillion ARC
Diaz, Yulissa A.	Session B	Poster 111	4:00 PM	Pavillion ARC
Diggs, Andrew	Session B	Poster 124	4:00 PM	Pavillion ARC
Diloretto, Daphne A.	Session B	Poster 19	4:00 PM	Pavillion ARC
Dinh, Alena	Session 2	Oral	3:15 PM	26 Wellman Hall
Dioquino, Jeske Y.	Session A	Poster 52	3:00 PM	Pavillion ARC
Do, Jonathan	Session B	Poster 58	4:00 PM	Pavillion ARC
Dreyer, Brooke	Session B	Poster 33	4:00 PM	Pavillion ARC
Dumas, Evan M.	Session 1	Oral	1:45 PM	106 Wellman Hall
Dunbar, Tia	Session C	Poster 128	5:00 PM	Pavillion ARC
Duong, Charleen	Session B	Poster 59	4:00 PM	Pavillion ARC
Dushane, Elyn	Session B	Poster 160	4:00 PM	Pavillion ARC
Dyer, Ellen Danielle.	Session B	Poster 116	4:00 PM	Pavillion ARC
Ely, Erica Valentine.	Session B	Poster 18	4:00 PM	Pavillion ARC
Emami, Shaheen	Session A	Poster 68	3:00 PM	Pavillion ARC

Escalante, Ariel C.		A & D Exhibit	3:00 PM	Pavillion ARC
Escamilla, Jessica	Session B	Poster 112	4:00 PM	Pavillion ARC
Evangelista, Russell	Session A	Poster 144	3:00 PM	Pavillion ARC
Evans, Emily	Session B	Poster 34	4:00 PM	Pavillion ARC
Eyunni, Vamsi	Session C	Poster 105	5:00 PM	Pavillion ARC
Falcon, Alexandria Kaitlyn.	Session A	Poster 13	3:00 PM	Pavillion ARC
Fang, Yao	Session B	Poster 55	4:00 PM	Pavillion ARC
Farahvash, Yasameen	Session B	Poster 15	4:00 PM	Pavillion ARC
Faridjoo, Samaan	Session A	Poster 23	3:00 PM	Pavillion ARC
Farman, Parisa	Session C	Poster 15	5:00 PM	Pavillion ARC
Fastenau, Caitlyn L.	Session B	Poster 63	4:00 PM	Pavillion ARC
Fehrman, Emily A.	Session A	Poster 67	3:00 PM	Pavillion ARC
Feng, Ningshen	Session B	Poster 37	4:00 PM	Pavillion ARC
Feng, Qian	Session B	Poster 8	4:00 PM	Pavillion ARC
Fitzpatrick, Devon	Session B	Poster 113	4:00 PM	Pavillion ARC
Flisher, Marcus R.	Session 1	Oral	2:00 PM	6 Wellman Hall
Foley, Sarah Marie	Session A	Poster 104	3:00 PM	Pavillion ARC
Fong, Ashley	Session C	Poster 1	5:00 PM	Pavillion ARC
Ford, Elise A.	Session 2	Oral	3:30 PM	229 Wellman Hall
Fortman, Natalie	Session A	Poster 36	3:00 PM	Pavillion ARC
Fragiacomo, Jazzmin L..	Session 1	Oral	1:30 PM	226 Wellman Hall
France, Katelyn N.	Session B	Poster 20	4:00 PM	Pavillion ARC
Frees, Michelle	Session C	Poster 133	5:00 PM	Pavillion ARC
Frey, Maddy R.	Session C	Poster 107	5:00 PM	Pavillion ARC
Frick, Sonia	Session B	Poster 46	4:00 PM	Pavillion ARC
Frost, Tracy	Session C	Poster 32	5:00 PM	Pavillion ARC
Fu, Kelly	Session C	Poster 114	5:00 PM	Pavillion ARC
Fuchs, Abbey L.	Session A	Poster 103	3:00 PM	Pavillion ARC
Gagacheva, Jana	Session B	Poster 84	4:00 PM	Pavillion ARC
Gan, Tian	Session 1	Oral	1:45 PM	2 Wellman Hall
Ganesh, Sid		A & D Exhibit	3:00 PM	Pavillion ARC
Garaffo, Nicholas	Session B	Poster 131	4:00 PM	Pavillion ARC
Garcia, Jackelyne Z.	Session C	Poster 92	5:00 PM	Pavillion ARC
Garikipati, Lohitashwa	Session C	Poster 36	5:00 PM	Pavillion ARC
Geary, Shannon Beverly.	Session B	Poster 40	4:00 PM	Pavillion ARC
George, Cory A.	Session A	Poster 97	3:00 PM	Pavillion ARC
Ghayoumi, Bardia	Session 2	Oral	3:15 PM	205 Wellman Hall
Ghera, Austin S.	Session B	Poster 90	4:00 PM	Pavillion ARC
Ginnell, Kilian	Session B	Poster 40	4:00 PM	Pavillion ARC
Glenn, Isabella S.	Session A	Poster 24	3:00 PM	Pavillion ARC
Godoroja, Nadya	Session C	Poster 24	5:00 PM	Pavillion ARC
Golden, Dante Malik.	Session B	Poster 31	4:00 PM	Pavillion ARC
Gonzalez, Maria D.	Session A	Poster 7	3:00 PM	Pavillion ARC
Gonzalez, Ricardo E.	Session C	Poster 81	5:00 PM	Pavillion ARC
Gonzalo, Costanza	Session C	Poster 158	5:00 PM	Pavillion ARC
Goodman, Kai T.	Session 2	Oral	3:00 PM	207 Wellman Hall
Goradia, Kaanan R.	Session B	Poster 14	4:00 PM	Pavillion ARC
Gost, Victoria	Session 2	Oral	4:00 PM	119 Wellman Hall
Gov, Kaitlynn Khinh.	Session A	Poster 14	3:00 PM	Pavillion ARC
Grandchamp, Jaxon M.	Session B	Poster 24	4:00 PM	Pavillion ARC
Grant, Grace R.	Session A	Poster 154	3:00 PM	Pavillion ARC
Gravley, Gracie H.	Session A	Poster 121	3:00 PM	Pavillion ARC
Grove, Jonas	Session C	Poster 93	5:00 PM	Pavillion ARC
Gu, Alyssa	Session B	Poster 150	4:00 PM	Pavillion ARC
Gu, Claire	Session A	Poster 17	3:00 PM	Pavillion ARC
Guarnieri, Mia	Session A	Poster 117	3:00 PM	Pavillion ARC
Guillen, Jaresley	Session B	Poster 132	4:00 PM	Pavillion ARC
Gupta, Shivam	Session B	Poster 148	4:00 PM	Pavillion ARC
Gutierrez, Paola	Session A	Poster 61	3:00 PM	Pavillion ARC
Hacein-Bey, Camelia	Session C	Poster 154	5:00 PM	Pavillion ARC
Hallmark, Lily A.	Session A	Poster 112	3:00 PM	Pavillion ARC
Hamada, Natalie	Session B	Poster 10	4:00 PM	Pavillion ARC
Hamade, Rafic G.	Session C	Poster 81	5:00 PM	Pavillion ARC
Han, Nina	Session B	Poster 41	4:00 PM	Pavillion ARC
Hapig-Ward, Teska	Session C	Poster 31	5:00 PM	Pavillion ARC
Hardie, Morgan	Session B	Poster 16	4:00 PM	Pavillion ARC
Hart, Neta	Session B	Poster 156	4:00 PM	Pavillion ARC
Haworth, Eleanor L.	Session C	Poster 48	5:00 PM	Pavillion ARC
Haynes, Kalie E.	Session C	Poster 16	5:00 PM	Pavillion ARC
Helms, Malia C.	Session A	Poster 111	3:00 PM	Pavillion ARC
Heng, Bryan	Session C	Poster 125	5:00 PM	Pavillion ARC
Hensley, Nicole	Session B	Poster 3	4:00 PM	Pavillion ARC
Herbolzheimer, Anna	Session A	Poster 83	3:00 PM	Pavillion ARC
Hernandez, Maria	Session B	Poster 72	4:00 PM	Pavillion ARC
Hernandez Ramirez, Eduardo	Session A	Poster 84	3:00 PM	Pavillion ARC
Heydari, Ruha A.	Session C	Poster 32	5:00 PM	Pavillion ARC
Hibbard, Lainey M.	Session 2	Oral	3:45 PM	205 Wellman Hall
Hirota, Rachel M.	Session B	Poster 114	4:00 PM	Pavillion ARC
Hisey, Erin	Session B	Poster 115	4:00 PM	Pavillion ARC
Hjersman, Johannan	Session B	Poster 101	4:00 PM	Pavillion ARC
Ho, Amanda Claire C.	Session 2	Oral	4:00 PM	6 Wellman Hall
Ho, Chun Kit	Session A	Poster 1	3:00 PM	Pavillion ARC
Hogan, Scott	Session B	Poster 106	4:00 PM	Pavillion ARC
Hori, Michael G.	Session B	Poster 47	4:00 PM	Pavillion ARC
Hou, Catherine	Session B	Poster 48	4:00 PM	Pavillion ARC
Hovsepian, Natalie T.	Session 1	Oral	1:45 PM	226 Wellman Hall
Hsiung, Jessica	Session B	Poster 60	4:00 PM	Pavillion ARC
Hsiung, Tanya	Session B	Poster 71	4:00 PM	Pavillion ARC
Hu, Lin-Ya	Session C	Poster 137	5:00 PM	Pavillion ARC
Hua, Julie	Session A	Poster 3	3:00 PM	Pavillion ARC

Huang, Calvin	Session C	Poster 37	5:00 PM	Pavillion ARC
Huang, Jin	Session C	Poster 19	5:00 PM	Pavillion ARC
Huang, Linda		A & D Exhibit	3:00 PM	Pavillion ARC
Huang, Terry	Session B	Poster 151	4:00 PM	Pavillion ARC
Huang, Yuqing	Session C	Poster 102	5:00 PM	Pavillion ARC
Hudson, Nikita	Session C	Poster 40	5:00 PM	Pavillion ARC
Huezo, Elizabeth	Session B	Poster 88	4:00 PM	Pavillion ARC
Huitron Ramirez, Maria	Session A	Poster 58	3:00 PM	Pavillion ARC
Hulse, Timothy A.	Session C	Poster 105	5:00 PM	Pavillion ARC
Hurtado, Rob J.	Session C	Poster 105	5:00 PM	Pavillion ARC
Huynh, Justin Ka.	Session B	Poster 49	4:00 PM	Pavillion ARC
Huynh, Stephanie	Session 1	Oral	1:15 PM	2 Wellman Hall
Hwang, Hyeyeon	Session 1	Oral	1:00 PM	119 Wellman Hall
Ibrahim, Khadeja	Session 2	Oral	3:45 PM	229 Wellman Hall
Ibrahim, Rachel M.	Session B	Poster 20	4:00 PM	Pavillion ARC
Illes, Lisa	Session C	Poster 2	5:00 PM	Pavillion ARC
Iqbal, Zunaira J.	Session 2	Oral	4:15 PM	2 Wellman Hall
Jacobs, Jodie	Session C	Poster 136	5:00 PM	Pavillion ARC
Jacobs, Kyle A.	Session 2	Oral	3:30 PM	26 Wellman Hall
Jamshidi, Sheila	Session A	Poster 93	3:00 PM	Pavillion ARC
Jayakrishnan, Niranjana	Session A	Poster 143	3:00 PM	Pavillion ARC
Jenner, Bradley N..	Session 2	Oral	3:15 PM	6 Wellman Hall
Jeppesen, Kaden	Session A	Poster 139	3:00 PM	Pavillion ARC
Jimenez-Ornelas, Consuelo	Session 1	Oral	1:45 PM	119 Wellman Hall
Johal, Simran	Session 2	Oral	3:30 PM	216 Wellman Hall
Johansson, Kristen	Session A	Poster 88	3:00 PM	Pavillion ARC
Johnson, Chelsea	Session A	Poster 8	3:00 PM	Pavillion ARC
Johnson, Kyle	Session 1	Oral	1:30 PM	106 Wellman Hall
Johnson, Virginia L.	Session B	Poster 127	4:00 PM	Pavillion ARC
Joshee, Shreeya	Session C	Poster 101	5:00 PM	Pavillion ARC
Joudi, Houssam	Session A	Poster 77	3:00 PM	Pavillion ARC
Juarez, Alexes Holguin.	Session A	Poster 126	3:00 PM	Pavillion ARC
Kakonge-Ruyondo, Kemi S.	Session 2	Oral	4:00 PM	103 Wellman Hall
Kao, Jo Hsuan	Session B	Poster 1	4:00 PM	Pavillion ARC
Kao, Lydia		A & D Exhibit	3:00 PM	Pavillion ARC
Karapanos, Nikoletta Dimitrios.	Session C	Poster 67	5:00 PM	Pavillion ARC
Karimi, Mona	Session A	Poster 60	3:00 PM	Pavillion ARC
Katz, Spencer	Session 1	Oral	1:45 PM	216 Wellman Hall
Kaur, Manpreet	Session A	Poster 80	3:00 PM	Pavillion ARC
Kehl, Alex J.	Session C	Poster 116	5:00 PM	Pavillion ARC
Kelly, Amanda	Session 2	Oral	3:30 PM	212 Wellman Hall
Khan, Aminah	Session A	Poster 106	3:00 PM	Pavillion ARC
Khan, Awais	Session A	Poster 1	3:00 PM	Pavillion ARC
Khan, Mahanoor	Session B	Poster 89	4:00 PM	Pavillion ARC
Khan, Shahabal	Session C	Poster 150	5:00 PM	Pavillion ARC
Khan, Umm-E- A.	Session B	Poster 65	4:00 PM	Pavillion ARC
Kinkel, Danielle R.	Session B	Poster 99	4:00 PM	Pavillion ARC
Kirkland, Blake B.	Session B	Poster 4	4:00 PM	Pavillion ARC
Kitamura, Erina	Session A	Poster 144	3:00 PM	Pavillion ARC
Kohn, Jared F.	Session 1	Oral	1:30 PM	202 Wellman Hall
Kolahdouz-Isfahani, Hamid R.	Session 2	Oral	3:15 PM	229 Wellman Hall
Komarla, Aparna	Session B	Poster 102	4:00 PM	Pavillion ARC
Kono, Erica L..	Session B	Poster 1	4:00 PM	Pavillion ARC
Kopetzky, Jennifer L..	Session C	Poster 25	5:00 PM	Pavillion ARC
Kraemer, Niklas	Session 1	Oral	1:00 PM	207 Wellman Hall
Kreun, Ellie Jean.	Session B	Poster 25	4:00 PM	Pavillion ARC
Krueger, Alex	Session A	Poster 21	3:00 PM	Pavillion ARC
Kumar, Matangi N.	Session C	Poster 135	5:00 PM	Pavillion ARC
Kurji, Dinar	Session 1	Oral	1:15 PM	103 Wellman Hall
Kuta, Daphne J.	Session B	Poster 98	4:00 PM	Pavillion ARC
Kwong, Adon C.	Session B	Poster 123	4:00 PM	Pavillion ARC
Kwong, Jessica	Session 2	Oral	3:15 PM	119 Wellman Hall
La, Jennifer	Session C	Poster 23	5:00 PM	Pavillion ARC
Lam, Aileen J.	Session 2	Oral	4:00 PM	202 Wellman Hall
Lamb, Shannon T.	Session A	Poster 107	3:00 PM	Pavillion ARC
Lang, Jacob	Session A	Poster 21	3:00 PM	Pavillion ARC
Laughlin, Joe	Session B	Poster 73	4:00 PM	Pavillion ARC
Law, Bryant	Session B	Poster 51	4:00 PM	Pavillion ARC
Layne, Julia C.	Session A	Poster 11	3:00 PM	Pavillion ARC
Le, Huy	Session C	Poster 131	5:00 PM	Pavillion ARC
Le, Sylvia	Session B	Poster 74	4:00 PM	Pavillion ARC
Leal, Isabella	Session C	Poster 103	5:00 PM	Pavillion ARC
Ledesema, Sofia n.	Session B	Poster 21	4:00 PM	Pavillion ARC
Lee, Andy	Session B	Poster 117	4:00 PM	Pavillion ARC
Lee, Hannah P.	Session C	Poster 54	5:00 PM	Pavillion ARC
Lee, Jessica	Session C	Poster 1	5:00 PM	Pavillion ARC
Lee, Promise	Session C	Poster 115	5:00 PM	Pavillion ARC
Lewin, Grace B.	Session C	Poster 17	5:00 PM	Pavillion ARC
Li, Jing	Session B	Poster 26	4:00 PM	Pavillion ARC
Li, Kevin	Session B	Poster 134	4:00 PM	Pavillion ARC
Li, Wenzhe	Session 2	Oral	3:45 PM	202 Wellman Hall
Liang, Emily	Session A	Poster 41	3:00 PM	Pavillion ARC
Lim, Nelly	Session B	Poster 52	4:00 PM	Pavillion ARC
Lin, Annika	Session A	Poster 81	3:00 PM	Pavillion ARC
Lin, Chang	Session 1	Oral	2:00 PM	2 Wellman Hall
Lin, Yung-Ling	Session B	Poster 5	4:00 PM	Pavillion ARC
Lind, Jennifer	Session B	Poster 75	4:00 PM	Pavillion ARC
Ling, Edmond	Session B	Poster 76	4:00 PM	Pavillion ARC
Linjawi, Hamad	Session B	Poster 20	4:00 PM	Pavillion ARC
Lipowsky, Leib	Session 1	Oral	1:00 PM	230 Wellman Hall

Lippey, Mia K.	Session C	Poster 36	5:00 PM	Pavillion ARC
Little, Jade M.	Session A	Poster 118	3:00 PM	Pavillion ARC
Liu, Caroline	Session B	Poster 53	4:00 PM	Pavillion ARC
Liu, Josh	Session C	Poster 5	5:00 PM	Pavillion ARC
Liu, Lucia	Session B	Poster 77	4:00 PM	Pavillion ARC
Liu, Yiyun	Session B	Poster 120	4:00 PM	Pavillion ARC
Liu, Zhishan	Session B	Poster 85	4:00 PM	Pavillion ARC
Liu, Zhuosheng	Session A	Poster 45	3:00 PM	Pavillion ARC
Lloveras, Jacob R.	Session 2	Oral	3:45 PM	119 Wellman Hall
Lobrutto, Jolie L.	Session A	Poster 9	3:00 PM	Pavillion ARC
Lockett, Leilah-Marie	Session A	Poster 127	3:00 PM	Pavillion ARC
Lods, Delaney L.	Session 1	Oral	2:00 PM	202 Wellman Hall
Loomis, Melissa	Session B	Poster 43	4:00 PM	Pavillion ARC
Lopez, Christopher	Session 1	Oral	1:30 PM	119 Wellman Hall
Lopez, Enrique	Session 2	Oral	3:30 PM	103 Wellman Hall
Lopez, Nefte A.	Session A	Poster 4	3:00 PM	Pavillion ARC
Lopez, Patricia B.	Session B	Poster 39	4:00 PM	Pavillion ARC
Lozano, Celena	Session 1	Oral	1:30 PM	230 Wellman Hall
Lu, Shannon S.	Session C	Poster 55	5:00 PM	Pavillion ARC
Lu, Weifeng	Session 2	Oral	3:00 PM	205 Wellman Hall
Luna, Corey M.	Session 2	Oral	4:15 PM	106 Wellman Hall
Lyu, Peifen	Session 1	Oral	1:30 PM	26 Wellman Hall
Maalouf, Isabelle	Session B	Poster 92	4:00 PM	Pavillion ARC
Maclaren, Julia Catherine.	Session A	Poster 134	3:00 PM	Pavillion ARC
Macmahon, Jeremy	Session B	Poster 142	4:00 PM	Pavillion ARC
Macneill, Mia	Session C	Poster 41	5:00 PM	Pavillion ARC
Maddex, Devon	Session C	Poster 6	5:00 PM	Pavillion ARC
Madrigal, Valerie V.	Session A	Poster 120	3:00 PM	Pavillion ARC
Magallanes, Yessenia	Session A	Poster 66	3:00 PM	Pavillion ARC
Magrath, Sam	Session C	Poster 113	5:00 PM	Pavillion ARC
Mak, Hiu Ling	Session B	Poster 90	4:00 PM	Pavillion ARC
Maldonado, Kimberly L.	Session A	Poster 51	3:00 PM	Pavillion ARC
Maloney, Emma S.	Session 1	Oral	1:45 PM	212 Wellman Hall
Mambretti, Lorenzo	Session 1	Oral	1:15 PM	26 Wellman Hall
Mangalam, Geoffrey	Session C	Poster 14	5:00 PM	Pavillion ARC
Manhas, Rushali	Session B	Poster 93	4:00 PM	Pavillion ARC
Manickam, Vishal	Session C	Poster 100	5:00 PM	Pavillion ARC
Mansooralavi, Niloufar	Session B	Poster 94	4:00 PM	Pavillion ARC
Markham, Zachary E.	Session B	Poster 11	4:00 PM	Pavillion ARC
Martin, Zoe Nicole		A & D Exhibit	3:00 PM	Pavillion ARC
Marwaha, Radhika	Session B	Poster 14	4:00 PM	Pavillion ARC
Mashat, Bayan	Session A	Poster 141	3:00 PM	Pavillion ARC
Mata, Rogelio	Session 2	Oral	3:15 PM	207 Wellman Hall
Mathur, Gautam	Session C	Poster 19	5:00 PM	Pavillion ARC
Mcallister, Liz	Session C	Poster 35	5:00 PM	Pavillion ARC
Mccarthy, Jenna Lee .	Session 2	Oral	3:00 PM	212 Wellman Hall
McGillis, Megan M.	Session 2	Oral	3:00 PM	2 Wellman Hall
Mcmahon, Brooke E.	Session A	Poster 32	3:00 PM	Pavillion ARC
Mcneil, Kyle T.	Session C	Poster 61	5:00 PM	Pavillion ARC
Mederos, Sabrina L.	Session C	Poster 7	5:00 PM	Pavillion ARC
Medina, Linett Guadalupe.	Session A	Poster 5	3:00 PM	Pavillion ARC
Mehiel, Alex A.	Session B	Poster 118	4:00 PM	Pavillion ARC
Melkonian, Joseph	Session C	Poster 30	5:00 PM	Pavillion ARC
Mendoza, Celine An	Session B	Poster 143	4:00 PM	Pavillion ARC
Metz, Trevor	Session B	Poster 147	4:00 PM	Pavillion ARC
Meyers, Emily	Session 1	Oral	1:15 PM	106 Wellman Hall
Milic, Mira	Session B	Poster 121	4:00 PM	Pavillion ARC
Milkey, Alexandra	Session B	Poster 122	4:00 PM	Pavillion ARC
Miller, Avalon	Session B	Poster 78	4:00 PM	Pavillion ARC
Minie, Vanessa A.	Session 2	Oral	3:15 PM	216 Wellman Hall
Minsky, Hana B.	Session 1	Oral	1:15 PM	229 Wellman Hall
Mir, Hafsa	Session B	Poster 144	4:00 PM	Pavillion ARC
Mohamed Rafi, Sabrina	Session C	Poster 91	5:00 PM	Pavillion ARC
Mohammad, Sana	Session B	Poster 9	4:00 PM	Pavillion ARC
Montgomery, Michael P..	Session 1	Oral	1:00 PM	106 Wellman Hall
Montoya, Melanie	Session 2	Oral	3:30 PM	119 Wellman Hall
Moore, Elizabeth A.	Session 1	Oral	1:15 PM	205 Wellman Hall
Moore, Jacqueline	Session A	Poster 129	3:00 PM	Pavillion ARC
Morales Arana, Alexa	Session C	Poster 56	5:00 PM	Pavillion ARC
Morgan, Paige		A & D Exhibit	3:00 PM	Pavillion ARC
Mowers, Chad	Session C	Poster 103	5:00 PM	Pavillion ARC
Mukai, Gabriella	Session C	Poster 9	5:00 PM	Pavillion ARC
Munguia Ramos, Miroslava N.	Session A	Poster 38	3:00 PM	Pavillion ARC
Munoz, Ariel D.	Session B	Poster 79	4:00 PM	Pavillion ARC
Munoz, Maria	Session C	Poster 59	5:00 PM	Pavillion ARC
Muranaka, Jun	Session B	Poster 149	4:00 PM	Pavillion ARC
Muriki, Maneesha	Session C	Poster 42	5:00 PM	Pavillion ARC
Myers, Danielle	Session C	Poster 18	5:00 PM	Pavillion ARC
Mysore, Maya	Session 1	Oral	1:30 PM	205 Wellman Hall
Nase, Nina Allaine P.	Session C	Poster 1	5:00 PM	Pavillion ARC
Navar, Evelyn	Session B	Poster 145	4:00 PM	Pavillion ARC
Navarro, Gloria Nallely.	Session C	Poster 156	5:00 PM	Pavillion ARC
Neal, Kelly A.	Session B	Poster 56	4:00 PM	Pavillion ARC
Negi, Abhay	Session C	Poster 81	5:00 PM	Pavillion ARC
Newens, Joanne	Session 1	Oral	1:15 PM	230 Wellman Hall
Ng, Stephanie	Session B	Poster 146	4:00 PM	Pavillion ARC
Nguyen, Amanda	Session C	Poster 140	5:00 PM	Pavillion ARC
Nguyen, Angela	Session A	Poster 19	3:00 PM	Pavillion ARC
Nguyen, Emily T.	Session C	Poster 43	5:00 PM	Pavillion ARC
Nguyen, Hoai	Session A	Poster 140	3:00 PM	Pavillion ARC

Nguyen, Jeffrey T.	Session A	Poster 73	3:00 PM	Pavillion ARC
Nguyen, Julia P.	Session C	Poster 44	5:00 PM	Pavillion ARC
Nguyen, Katie Q.	Session A	Poster 160	3:00 PM	Pavillion ARC
Nguyen, Tina	Session C	Poster 49	5:00 PM	Pavillion ARC
Nguyen, Tricia T.	Session C	Poster 41	5:00 PM	Pavillion ARC
Nguyen, Tu Tu.	Session C	Poster 57	5:00 PM	Pavillion ARC
Nieh, Kelly	Session B	Poster 67	4:00 PM	Pavillion ARC
Nissen, Adam Taylor.	Session C	Poster 90	5:00 PM	Pavillion ARC
Noon, Mackenzie C.	Session 2	Oral	3:30 PM	202 Wellman Hall
Nugraha, Kahargyan	Session A	Poster 33	3:00 PM	Pavillion ARC
Nur, Munir	Session A	Poster 142	3:00 PM	Pavillion ARC
Obra, Jed L.	Session A	Poster 55	3:00 PM	Pavillion ARC
Ochoa, Christopher	Session 1	Oral	1:15 PM	6 Wellman Hall
Ochoa, Daisy L.	Session 2	Oral	3:45 PM	2 Wellman Hall
Oclaman, Janah Tecson.	Session C	Poster 148	5:00 PM	Pavillion ARC
Olano, Lorenzo Ray T.	Session C	Poster 10	5:00 PM	Pavillion ARC
Oliveros, Darielle Ellice	Session B	Poster 135	4:00 PM	Pavillion ARC
Olney, Marina G.	Session 1	Oral	2:15 PM	202 Wellman Hall
Ormonde, Amanda R.	Session B	Poster 12	4:00 PM	Pavillion ARC
Ornelas, Izaac A.	Session C	Poster 28	5:00 PM	Pavillion ARC
Ornelas, Izaiah J.	Session C	Poster 22	5:00 PM	Pavillion ARC
Otico, Divine Joyce	Session C	Poster 72	5:00 PM	Pavillion ARC
Owens, Chela J..	Session A	Poster 74	3:00 PM	Pavillion ARC
Padilla-Vilchis, Berenice	Session 1	Oral	2:15 PM	103 Wellman Hall
Palacios Lopez, Marialena	Session A	Poster 106	3:00 PM	Pavillion ARC
Palanisamy, Barath	Session C	Poster 99	5:00 PM	Pavillion ARC
Park, Wesley J..	Session 1	Oral	2:15 PM	216 Wellman Hall
Paterson, Shona	Session A	Poster 40	3:00 PM	Pavillion ARC
Pathak, Honey	Session 2	Oral	4:15 PM	6 Wellman Hall
Paulk, Andrea Bourquin	Session 2	Oral	3:45 PM	6 Wellman Hall
Paz, Janie N..	Session B	Poster 119	4:00 PM	Pavillion ARC
Pe, Princess	Session B	Poster 41	4:00 PM	Pavillion ARC
Peer, Kami N.	Session A	Poster 40	3:00 PM	Pavillion ARC
Pell, Alex Johnson.	Session 1	Oral	1:45 PM	207 Wellman Hall
Pelletier, Sophia LM.	Session C	Poster 19	5:00 PM	Pavillion ARC
Pena, Evelyn	Session C	Poster 80	5:00 PM	Pavillion ARC
Perry, Serra	Session B	Poster 62	4:00 PM	Pavillion ARC
Perwez, Adnan	Session 1	Oral	1:30 PM	103 Wellman Hall
Pham, Chi	Session B	Poster 137	4:00 PM	Pavillion ARC
Phan, Kelley K.	Session 1	Oral	1:30 PM	216 Wellman Hall
Phillips, Hannah	Session 2	Oral	3:30 PM	226 Wellman Hall
Phillips, Lindsey M.	Session B	Poster 27	4:00 PM	Pavillion ARC
Pierce, Alice V..	Session B	Poster 6	4:00 PM	Pavillion ARC
Plascencia, Cecilia	Session A	Poster 61	3:00 PM	Pavillion ARC
Pohlhammer, Elise	Session 2	Oral	3:30 PM	2 Wellman Hall
Pokharel, Chesna	Session B	Poster 28	4:00 PM	Pavillion ARC
Pollard, Kenzie N.	Session B	Poster 96	4:00 PM	Pavillion ARC
Pranav, Mira	Session C	Poster 160	5:00 PM	Pavillion ARC
Prasad, Akaash	Session A	Poster 28	3:00 PM	Pavillion ARC
Prathi, Puja	Session 1	Oral	1:00 PM	226 Wellman Hall
Prendergast, Rowan	Session A	Poster 128	3:00 PM	Pavillion ARC
Puertas Acosta, Sonia JE.		A & D Exhibit	3:00 PM	Pavillion ARC
Quan, Phung Chieu.	Session 2	Oral	4:00 PM	26 Wellman Hall
Quintero, Diana	Session A	Poster 63	3:00 PM	Pavillion ARC
Quintero, Ulises	Session A	Poster 78	3:00 PM	Pavillion ARC
Quynn, Sophie	Session A	Poster 96	3:00 PM	Pavillion ARC
Rafique, Rebecca	Session C	Poster 119	5:00 PM	Pavillion ARC
Ram, Yancy	Session A	Poster 48	3:00 PM	Pavillion ARC
Ramey, Aidan B.	Session C	Poster 105	5:00 PM	Pavillion ARC
Ramirez, Andrea	Session 2	Oral	4:00 PM	2 Wellman Hall
Ramirez-Barba, Jasmine	Session 2	Oral	3:15 PM	230 Wellman Hall
Ramos-Maciel, Stephanie	Session 2	Oral	3:00 PM	216 Wellman Hall
Ramstein, William	Session 1	Oral	1:00 PM	212 Wellman Hall
Rane, Niharika N.	Session 2	Oral	3:00 PM	106 Wellman Hall
Rappel, Charlotte	Session C	Poster 62	5:00 PM	Pavillion ARC
Rara, Marianne	Session C	Poster 79	5:00 PM	Pavillion ARC
Rasmussen, Alycia R.M..	Session B	Poster 83	4:00 PM	Pavillion ARC
Reddy, Vijay G.	Session C	Poster 147	5:00 PM	Pavillion ARC
Reeley, Naomi	Session A	Poster 61	3:00 PM	Pavillion ARC
Rees, Huck C.	Session C	Poster 130	5:00 PM	Pavillion ARC
Remstedt, Anna	Session C	Poster 19	5:00 PM	Pavillion ARC
Ren, Sunny	Session C	Poster 60	5:00 PM	Pavillion ARC
Reynolds, Lauren	Session C	Poster 117	5:00 PM	Pavillion ARC
Rillamas, Cassandra Aleli.	Session C	Poster 83	5:00 PM	Pavillion ARC
Rivas, Daniel	Session C	Poster 69	5:00 PM	Pavillion ARC
Roberts, Elizabeth T.	Session C	Poster 132	5:00 PM	Pavillion ARC
Robertson, Wyatt	Session C	Poster 26	5:00 PM	Pavillion ARC
Robinson, Foxy P.	Session 1	Oral	2:15 PM	229 Wellman Hall
Rocha, Sienna	Session C	Poster 146	5:00 PM	Pavillion ARC
Rockeman, Olivia	Session A	Poster 95	3:00 PM	Pavillion ARC
Rodas, Krystal S.	Session C	Poster 66	5:00 PM	Pavillion ARC
Rodriguez, Dennett Angelica.	Session A	Poster 161	3:00 PM	Pavillion ARC
Rodriguez, Sarina V.	Session A	Poster 155	3:00 PM	Pavillion ARC
Roman, Salvador Salvador.	Session C	Poster 27	5:00 PM	Pavillion ARC
Romero, Jennifer M..	Session C	Poster 118	5:00 PM	Pavillion ARC
Roth, Katerina	Session B	Poster 70	4:00 PM	Pavillion ARC
Rubio, Victoria	Session C	Poster 86	5:00 PM	Pavillion ARC
Ruch, Sara K.	Session C	Poster 154	5:00 PM	Pavillion ARC
Ruiz, Eduardo M.	Session 1	Oral	1:00 PM	205 Wellman Hall
Ruiz Anaya, Brenda	Session C	Poster 11	5:00 PM	Pavillion ARC

Ruiz Malagon, Juan Carlos	Session A	Poster 102	3:00 PM	Pavillion ARC
Rusit, Xylina G.	Session B	Poster 138	4:00 PM	Pavillion ARC
Sakazaki, Jodie	Session B	Poster 151	4:00 PM	Pavillion ARC
Salinas, Abraham		A & D Exhibit	3:00 PM	Pavillion ARC
Sanchez Ortega, Lucila	Session 1	Oral	2:15 PM	119 Wellman Hall
Sandhoefner, Aidan	Session C	Poster 73	5:00 PM	Pavillion ARC
Sandoval, Jose A.	Session C	Poster 145	5:00 PM	Pavillion ARC
Sandoval Espinoza, Jose A .	Session C	Poster 81	5:00 PM	Pavillion ARC
Sanghavi, Priyanka	Session 2	Oral	3:45 PM	103 Wellman Hall
Santos, Darren P.	Session A	Poster 64	3:00 PM	Pavillion ARC
Santoyo, Diana A..	Session A	Poster 89	3:00 PM	Pavillion ARC
Saravanakumar, Supraja	Session B	Poster 136	4:00 PM	Pavillion ARC
Sarian, Melina	Session C	Poster 68	5:00 PM	Pavillion ARC
Sastry, Savita C..	Session A	Poster 162	3:00 PM	Pavillion ARC
Savage, Adam p.	Session 2	Oral	4:15 PM	229 Wellman Hall
Scarbrough, Dalal H. Audeesh	Session 2	Oral	3:15 PM	226 Wellman Hall
Schmidt, Krista N.	Session A	Poster 119	3:00 PM	Pavillion ARC
Schmitz, Hannah R.	Session B	Poster 17	4:00 PM	Pavillion ARC
Schweibold, Reece	Session B	Poster 1	4:00 PM	Pavillion ARC
Scott, Alexandria M.	Session A	Poster 75	3:00 PM	Pavillion ARC
Scott, Jeffrey A.	Session C	Poster 41	5:00 PM	Pavillion ARC
Scott, Valencia G.	Session B	Poster 153	4:00 PM	Pavillion ARC
Scranton, Breezy	Session B	Poster 107	4:00 PM	Pavillion ARC
Seaver, Sammy	Session A	Poster 156	3:00 PM	Pavillion ARC
Self, Matthew M.	Session 2	Oral	3:45 PM	207 Wellman Hall
Serrano, Erlin	Session B	Poster 35	4:00 PM	Pavillion ARC
Shahbaz, Momna	Session A	Poster 41	3:00 PM	Pavillion ARC
Shaheed, Avneet	Session A	Poster 163	3:00 PM	Pavillion ARC
Shahrvini, Tara	Session C	Poster 144	5:00 PM	Pavillion ARC
Shamun Darbrudy, Talin	Session B	Poster 13	4:00 PM	Pavillion ARC
Shao, Tianyi	Session C	Poster 34	5:00 PM	Pavillion ARC
Sharma, Madhav	Session C	Poster 70	5:00 PM	Pavillion ARC
Shastry, Shashank	Session A	Poster 27	3:00 PM	Pavillion ARC
Shetty, Nikita D..	Session A	Poster 79	3:00 PM	Pavillion ARC
Shih, Megan	Session C	Poster 93	5:00 PM	Pavillion ARC
Shuen, Ashley	Session C	Poster 12	5:00 PM	Pavillion ARC
Shupp, Sabrina	Session 1	Oral	1:15 PM	226 Wellman Hall
Siddeek, Mohamed Hisham	Session 1	Oral	1:45 PM	229 Wellman Hall
Silva, Ryan J.	Session C	Poster 83	5:00 PM	Pavillion ARC
Silva, Selena	Session 1	Oral	2:00 PM	212 Wellman Hall
Sims, Loreena B.	Session C	Poster 45	5:00 PM	Pavillion ARC
Singh, Alexis	Session C	Poster 89	5:00 PM	Pavillion ARC
Singh, Christine M.	Session A	Poster 29	3:00 PM	Pavillion ARC
Singson, Jason	Session C	Poster 46	5:00 PM	Pavillion ARC
Sinha, Sankalp	Session B	Poster 157	4:00 PM	Pavillion ARC
Siniora, Tarik	Session A	Poster 101	3:00 PM	Pavillion ARC
Slack, Ian S.	Session B	Poster 154	4:00 PM	Pavillion ARC
Smith, Madison		A & D Exhibit	3:00 PM	Pavillion ARC
Smith, Tayler B.	Session C	Poster 139	5:00 PM	Pavillion ARC
Smith, Tyler T.	Session A	Poster 65	3:00 PM	Pavillion ARC
Smolkin, Michael	Session C	Poster 138	5:00 PM	Pavillion ARC
Snelgrove, Paige A.	Session 2	Oral	4:15 PM	216 Wellman Hall
Snyder, Cassie	Session C	Poster 74	5:00 PM	Pavillion ARC
Som, Vanessa	Session C	Poster 78	5:00 PM	Pavillion ARC
Son, Bokyoung	Session A	Poster 76	3:00 PM	Pavillion ARC
Song, Zehan	Session 1	Oral	1:00 PM	2 Wellman Hall
Sorrell, Clifton Elexander.	Session 2	Oral	4:00 PM	229 Wellman Hall
Soto, Chris M.	Session A	Poster 85	3:00 PM	Pavillion ARC
Sousa, Alisha P .	Session C	Poster 94	5:00 PM	Pavillion ARC
Sridharan, Samvardhini	Session C	Poster 134	5:00 PM	Pavillion ARC
Sriram, Aditya	Session A	Poster 145	3:00 PM	Pavillion ARC
Stack, Emily M.	Session 1	Oral	1:15 PM	202 Wellman Hall
Stokes, Arianna	Session C	Poster 58	5:00 PM	Pavillion ARC
Stowell, Rachelle	Session B	Poster 128	4:00 PM	Pavillion ARC
Stuart, Sophia	Session C	Poster 129	5:00 PM	Pavillion ARC
Sulca, Debbie Fernanda.	Session A	Poster 125	3:00 PM	Pavillion ARC
Sulman, Muhammad	Session A	Poster 19	3:00 PM	Pavillion ARC
Sun, Xianzheng	Session C	Poster 142	5:00 PM	Pavillion ARC
Sylvestre, Duncan	Session 1	Oral	2:15 PM	2 Wellman Hall
Ta, Carolyn G.	Session C	Poster 111	5:00 PM	Pavillion ARC
Takeshita, Ashley	Session A	Poster 49	3:00 PM	Pavillion ARC
Tam, Allison	Session C	Poster 141	5:00 PM	Pavillion ARC
Tang, Andrea K.	Session C	Poster 50	5:00 PM	Pavillion ARC
Tang, Teresa	Session A	Poster 50	3:00 PM	Pavillion ARC
Tankka, Isabelle G.	Session C	Poster 95	5:00 PM	Pavillion ARC
Targos, Karina	Session A	Poster 34	3:00 PM	Pavillion ARC
Tarver, Kathryn A.	Session B	Poster 150	4:00 PM	Pavillion ARC
Tasmim, Tahmina	Session 2	Oral	3:15 PM	106 Wellman Hall
Tea, Marcella	Session C	Poster 120	5:00 PM	Pavillion ARC
Templin, Emily	Session B	Poster 66	4:00 PM	Pavillion ARC
Teng, Lay Heng	Session B	Poster 36	4:00 PM	Pavillion ARC
Tenorio, Alejandro	Session C	Poster 98	5:00 PM	Pavillion ARC
Thai, Eric	Session 1	Oral	1:15 PM	216 Wellman Hall
Thiesen, Katherina L.	Session A	Poster 114	3:00 PM	Pavillion ARC
Thomas, Russell	Session 2	Oral	3:30 PM	230 Wellman Hall
Thurston, Melissa	Session C	Poster 13	5:00 PM	Pavillion ARC
Tibrewala, Yash	Session 1	Oral	1:00 PM	26 Wellman Hall
Tilley, Emma K.	Session A	Poster 146	3:00 PM	Pavillion ARC
Tjeerdema, Evan R.	Session B	Poster 97	4:00 PM	Pavillion ARC
Toh, Eugene	Session A	Poster 147	3:00 PM	Pavillion ARC

Tong, Derek	Session A	Poster 98	3:00 PM	Pavillion ARC
Torres, Ares	Session A	Poster 129	3:00 PM	Pavillion ARC
Tra, Linh V.	Session A	Poster 19	3:00 PM	Pavillion ARC
Tran, Allisa	Session C	Poster 96	5:00 PM	Pavillion ARC
Tran, Daphne	Session 1	Oral	2:15 PM	230 Wellman Hall
Tran, Elaine	Session A	Poster 30	3:00 PM	Pavillion ARC
Tran, Kathy H.	Session B	Poster 61	4:00 PM	Pavillion ARC
Tran, Ngoc Han T.	Session A	Poster 148	3:00 PM	Pavillion ARC
Tran, Reed J.	Session B	Poster 1	4:00 PM	Pavillion ARC
Tran, Thuy-Linh D.	Session B	Poster 139	4:00 PM	Pavillion ARC
Tribble, Emma	Session C	Poster 121	5:00 PM	Pavillion ARC
Tu, Lien	Session A	Poster 15	3:00 PM	Pavillion ARC
Tucher, Oliver	Session A	Poster 149	3:00 PM	Pavillion ARC
Tune, Elizabeth	Session C	Poster 88	5:00 PM	Pavillion ARC
Tyagi, Annanya	Session A	Poster 107	3:00 PM	Pavillion ARC
Uchicua Huaman, Margot		A & D Exhibit	3:00 PM	Pavillion ARC
Urena-Valdes, Ivan	Session 1	Oral	1:00 PM	216 Wellman Hall
Vadlaputi, Pranjali P.	Session 2	Oral	4:15 PM	202 Wellman Hall
Valadez, Teresa I.	Session C	Poster 110	5:00 PM	Pavillion ARC
Van, Richard	Session 1	Oral	2:00 PM	230 Wellman Hall
Van Buskirk, Heather	Session 1	Oral	1:30 PM	212 Wellman Hall
Vang, Jenifer P..	Session A	Poster 86	3:00 PM	Pavillion ARC
Vang, Molly	Session A	Poster 1	3:00 PM	Pavillion ARC
Varallo, Alexandra S.	Session B	Poster 45	4:00 PM	Pavillion ARC
Varona, Natascha S.	Session C	Poster 4	5:00 PM	Pavillion ARC
Vazquez, Emmanuel	Session A	Poster 25	3:00 PM	Pavillion ARC
Vegliante, Sarah	Session B	Poster 68	4:00 PM	Pavillion ARC
Velasquez, Lauren	Session C	Poster 140	5:00 PM	Pavillion ARC
Venkatesh, Rasika	Session 2	Oral	4:00 PM	216 Wellman Hall
Vernoy, Brandon J.	Session A	Poster 107	3:00 PM	Pavillion ARC
Vicuna, Victoria	Session C	Poster 16	5:00 PM	Pavillion ARC
Villanueva, Elia J.	Session C	Poster 85	5:00 PM	Pavillion ARC
Vishwakarma, Nina	Session 2	Oral	3:45 PM	216 Wellman Hall
Viswanathan, Jayashri	Session 1	Oral	1:30 PM	207 Wellman Hall
Vo, Christopher K.	Session 2	Oral	4:15 PM	26 Wellman Hall
Vo, Thanh T.	Session C	Poster 109	5:00 PM	Pavillion ARC
Vo, Tram N.	Session B	Poster 32	4:00 PM	Pavillion ARC
Von Klan, Elizabeth L.	Session C	Poster 112	5:00 PM	Pavillion ARC
Wai, Myat M.	Session C	Poster 153	5:00 PM	Pavillion ARC
Wallace, Samantha	Session 1	Oral	1:45 PM	230 Wellman Hall
Wang, Hannah M.	Session 2	Oral	3:00 PM	119 Wellman Hall
Wang, Komay	Session A	Poster 39	3:00 PM	Pavillion ARC
Wang, Rui	Session C	Poster 51	5:00 PM	Pavillion ARC
Wang, Sadira Y.	Session 1	Oral	1:00 PM	229 Wellman Hall
Wang, Yinwen	Session C	Poster 152	5:00 PM	Pavillion ARC
Wang, Zimmy	Session B	Poster 7	4:00 PM	Pavillion ARC
Warfield, Dawn M.	Session B	Poster 155	4:00 PM	Pavillion ARC
Warrier, Lakshmi S.	Session B	Poster 140	4:00 PM	Pavillion ARC
Wei, Chloe	Session A	Poster 150	3:00 PM	Pavillion ARC
Wei, Derek	Session C	Poster 70	5:00 PM	Pavillion ARC
Wei, Tiffany	Session B	Poster 151	4:00 PM	Pavillion ARC
Wen, Amy	Session C	Poster 47	5:00 PM	Pavillion ARC
West, Megan	Session B	Poster 30	4:00 PM	Pavillion ARC
Wielenga, Maaike R.	Session B	Poster 57	4:00 PM	Pavillion ARC
Williams, Catherine H.	Session 2	Oral	3:30 PM	6 Wellman Hall
Williams, Mark	Session 2	Oral	3:00 PM	202 Wellman Hall
Williams, Tiana A.	Session 2	Oral	4:15 PM	119 Wellman Hall
Wilson, Reese	Session A	Poster 31	3:00 PM	Pavillion ARC
Winchell, Wylen	Session A	Poster 107	3:00 PM	Pavillion ARC
Wong, Breana	Session A	Poster 16	3:00 PM	Pavillion ARC
Wong, Melissa	Session A	Poster 56	3:00 PM	Pavillion ARC
Woodard, Walter J.	Session B	Poster 104	4:00 PM	Pavillion ARC
Wu, Betty	Session B	Poster 103	4:00 PM	Pavillion ARC
Wu, Yifan	Session A	Poster 87	3:00 PM	Pavillion ARC
Xian, Shirley	Session 2	Oral	3:45 PM	212 Wellman Hall
Xiong, Breanna	Session A	Poster 40	3:00 PM	Pavillion ARC
Xuan, Jia Yu	Session C	Poster 143	5:00 PM	Pavillion ARC
Xue, Yingying	Session C	Poster 77	5:00 PM	Pavillion ARC
Yan, Andy	Session 1	Oral	1:45 PM	6 Wellman Hall
Yang, Cliff		A & D Exhibit	3:00 PM	Pavillion ARC
Yang, Jiayin	Session 1	Oral	1:45 PM	103 Wellman Hall
Yang, Pahoua	Session A	Poster 1	3:00 PM	Pavillion ARC
Yang, Tian	Session C	Poster 87	5:00 PM	Pavillion ARC
Yap, Amanda	Session C	Poster 85	5:00 PM	Pavillion ARC
Yee, Victoria	Session C	Poster 122	5:00 PM	Pavillion ARC
Yerraguntala, Anusha	Session C	Poster 52	5:00 PM	Pavillion ARC
Yokota, Seiji	Session A	Poster 35	3:00 PM	Pavillion ARC
Yoo, Ray	Session B	Poster 38	4:00 PM	Pavillion ARC
Young, Kat E.	Session 2	Oral	3:45 PM	106 Wellman Hall
Yu, Eric	Session C	Poster 53	5:00 PM	Pavillion ARC
Yu, Gary	Session A	Poster 151	3:00 PM	Pavillion ARC
Yu, Julia	Session A	Poster 151	3:00 PM	Pavillion ARC
Yu, Zixin	Session C	Poster 8	5:00 PM	Pavillion ARC
Yuan, Yinyu	Session 2	Oral	3:30 PM	106 Wellman Hall
Yuen, Brian	Session C	Poster 97	5:00 PM	Pavillion ARC
Zagala, Cassey R.	Session A	Poster 81	3:00 PM	Pavillion ARC
Zhang, Chi	Session B	Poster 141	4:00 PM	Pavillion ARC
Zhang, Keith		A & D Exhibit	3:00 PM	Pavillion ARC
Zhang, Wenjing	Session 2	Oral	4:00 PM	205 Wellman Hall
Zhang, Yuanxin	Session A	Poster 113	3:00 PM	Pavillion ARC

Zhen, Tong	Session B	Poster 7	4:00 PM	Pavillion ARC
Zheng, Susanna	Session B	Poster 29	4:00 PM	Pavillion ARC
Zhu, Yier	Session A	Poster 134	3:00 PM	Pavillion ARC
Zhuang, Jianfeng	Session 1	Oral	2:00 PM	216 Wellman Hall

Arts and Design Exhibit Session

2 Wellman Hall, Moderator: Mariana Barboza

1:00 PM **Song, Zehan - Clinical Nutrition**
Impact of Milk Osteopontin on the Development of the Intestinal Mucosal System

1:15 PM **Huynh, Stephanie - Neurobiology, Physiology and Behavior**
Effects of Post-Translational Modifications of Bovine Milk Osteopontin on Intestinal Proliferation

1:45 PM **Gan, Tian - Clinical Nutrition**
Major Nutrients in Complementary Foods and Their Possible Implication on Infants

2:00 PM **Lin, Chang - Food Science**
Quantifications of Total Phenols in Olive Oil: A Comparison of Methods

2:15 PM **Sylvestre, Duncan - Clinical Nutrition**
Metabolomic analysis of plasma from relapsing-remitting multiple sclerosis patients reveals changes in metabolites associated with neurocognitive and structural changes in brain

6 Wellman Hall, Moderator: Janine Lasalle

1:00 PM **Aylard, Dominik A. - Biological Sciences**
The Role of the BRAHMA Chromatin Remodeling Protein Complex in Maintaining Circadian Physiology and Healthspan

1:15 PM **Ochoa, Christopher - Biochemistry and Molecular Biology**
Phosphorylation of TIMELESS Regulates its Function in the Drosophila Circadian Clock

1:30 PM **Brand, Jonathan D. - Biomedical Engineering**
Single-Cell Comparison Between Antibody- and Complement-Mediated Phagocytosis

1:45 PM **Yan, Andy - Neurobiology, Physiology and Behavior**
Producing and Characterizing SMAD4-GFP Reporter For BMP Signaling Dynamics

2:00 PM **Flisher, Marcus R. - Biochemistry and Molecular Biology**
Investigating the Maturation Potential of Virgin Beta Cells Within Mouse Pancreatic Islets

26 Wellman Hall, Moderator: Mohamed Hafez

1:00 PM **Tibrewala, Yash - Chemical Engineering**
Droplet Conductivity Strongly Influences Bump and Crater Formation on Electrodes During Charge Transfer

1:15 PM **Mambretti, Lorenzo - Mathematical and Scientific Computation**
Anomalies in discrete time statistic for Langevin dynamics

1:30 PM **Lyu, Peifen - Materials Science and Engineering**
Characterization of Antiferromagnetic Domain Patterns in Perovskite Oxide Microstructures

2:00 PM **Chen, Elizabeth - Mechanical Engineering**
Simultaneous Heat and Mass Transfer Model to Estimate Drying Time for Wet Cowhide

103 Wellman Hall, Moderator: Erika Strandjord

1:00 PM **Baggett, Julia E.. - History**
Comparative Analysis of Islamic Hadith Concerning Women and Menstruation

1:15 PM **Kurji, Dinar - Religious Studies**
How Do Hinduistic Elements And Characteristics In The Devotional Literature Of The Ginans In South Asia Reveal Core Theological Principles About Ismailism?

1:30 PM **Perwez, Adnan - Religious Studies**
An Endowment of Justice: Examining the Dynamism of the Political Agency of the Common People in Classical Islamic Thought

1:45 PM **Yang, Jiayin - Computer Science**
A Computer Vision Approach to Make Broadside Ballads of Seventeenth Century Accessible as Text, Art, Music, and Cultural Records

2:00 PM **De Las Alas, Francesca R. - Religious Studies**
War of the Spirits: A Psychological Analysis of Modern Demonic Deliverance Prayers

2:15 PM **Padilla-Vilchis, Berenice - Spanish**
Reconstructing a Lost Manuscript: The Quest for Felipe de Pamanes' Notables del Perú

106 Wellman Hall, Moderator: Kate Scow

1:00 PM **Montgomery, Michael P.. - Marine and Coastal Science--Oceans and the Earth System**
The Geography of Association: Exploring Longitudinal Gradients in Marine Symbioses in the Indo-West Pacific

1:15 PM **Meyers, Emily - Evolution, Ecology and Biodiversity**
Effects of the Marine Macroalga Ulva sp. on the Microhabitat Distribution of Mesograzers in Eelgrass (Zostera marina) Beds in Bodega Bay, CA (USA)

1:30 PM **Johnson, Kyle - Environmental Science and Management**
Behavioral Responses of Black Widow Spiders to Olfactory Cues in an Urban Context

1:45 PM **Dumas, Evan M. - Biotechnology**
Organic Fertilizers Lead to Greater Ecological Stability for Soil Bacterial Communities as Compared to Inorganic Fertilizers

2:00 PM **Canale, Lauren - Biological Sciences**
Adaptation to Altitude: Reconstructing Diet and Parental Investment in the High Andes 7000 years ago

2:15 PM **Boyle, Erin A. - Anthropology**
Age of Weaning and Post-Weaning Childhood Diets in a Late Holocene Pre-contact Site near Suisun Marsh

119 Wellman Hall, Moderator: Angela Haczku

1:00 PM **Hwang, Hyeyeon - Computer Science**
Machine Learning of Diagnostic Predictors for Autism Spectrum Disorders

1:15 PM **Chen, Alvin - Biotechnology**
Continuation of CHARGE - ECHO and Beyond

1:30 PM **Lopez, Christopher - Biochemistry and Molecular Biology**
The Regulation of Skeletal Muscle Connective Tissue Following Exercise

1:45 PM **Jimenez-Ornelas, Consuelo - Neurobiology, Physiology and Behavior**
Epilepsy alters theta oscillations and disrupts the septo-hippocampal circuit

2:00 PM **Chen, Jenny - Cell Biology**
HMA: A New Drug for Treating Cancer

2:15 PM **Sanchez Ortega, Lucila - Biomedical Engineering**
OCT-based Measurements of Cartilage Quality in a Non-surgical rat Model of Osteoarthritis.

202 Wellman Hall, Moderator: Matthew Stratton

1:00 PM **Banga, Lisa V. - Comparative Literature**
A Touch of Magic: Reconceptualizing the Female Experience Through Magical Realism

1:15 PM **Stack, Emily M. - English**
"The little O, the earth": Theatrical Land and Shakespeare's Tragedies

1:30 PM **Kohn, Jared F. - English**
Non Serviam: Dismantling Normativity in James Joyce's Ulysses

1:45 PM **Carroll, Maria - English**
Urban Desert: Landscape Anxiety in 1930s Los Angeles Literature

2:00 PM **Lods, Delaney L. - English**
The Translation of Transformation in Ovid's Metamorphoses

2:15 PM **Olney, Marina G. - English**
Examining Maternal Mortality among African American Mothers: Using Critical Discourse Analysis to Identify Bias

205 Wellman Hall, Moderator: David Hawkins

1:00 PM **Ruiz, Eduardo M. - Biochemistry and Molecular Biology**
The Putative Roles of Geosmin Synthase and Cyclase in Myxococcus xanthus Predation and Development

1:15 PM **Moore, Elizabeth A. - Microbiology**
The Putative Roles of Geosmin Synthase and Cyclase in Myxococcus xanthus Predation and Development

1:30 PM **Mysore, Maya - Biomedical Engineering**
Characterizing Chemoattractant-Specific Features of CDC42 Signaling Activity in Neutrophil-Like Cells

1:45 PM **Anguiano, Maribel - Neurobiology, Physiology and Behavior**
The Role of Cerebellum in Emotional Learning and its Extinction

2:00 PM **Addleman, Jennifer S. - Neurobiology, Physiology and Behavior**
Establishing Best Practice Use for Accelerometry in Gait Biomechanics: Time Synchronization, Accuracy, and Location Sensitivity

2:15 PM **Beauregard, Paris - Neurobiology, Physiology and Behavior**
Hippocampal Morphology and Adult Neurogenesis in Chd8-Haploinsufficient Mice

207 Wellman Hall, Moderator: Dylan Murray

1:00 PM **Kraemer, Niklas - Pharmaceutical Chemistry**
Photochemical Preparation of 1,2-Dihydro-3H-indazol-3-ones in Aqueous Solvent at Room Temperature

1:15 PM **Bumann, Sonja - Chemical Physics**
Characterization of a Supersonic Molecular Beam for Astrochemical Kinetics Studies

1:30 PM **Viswanathan, Jayashri - Biochemistry and Molecular Biology**
Function-Oriented Synthesis Yields an Improved Psychoplastogenic Analog of Iboga Alkaloids

1:45 PM **Pell, Alex Johnson. - Chemical Engineering**
Function-Oriented Synthesis Yields an Improved Psychoplastogenic Analog of Iboga Alkaloids

212 Wellman Hall, Moderator: Bagher Modjtahedi

1:00 PM **Ramstein, William - Economics**
An Examination of the Driving Forces Behind the Rapid Growth of China's Fintech Industry.

1:15 PM **Carmona, Juliana - Economics**
An Examination of the Driving Forces Behind the Rapid Growth of China's Fintech Industry.

1:30 PM **Van Buskirk, Heather - Sociology**
Effect of Livelihood Diversification on Extreme Poverty Across Seven Sub-Saharan African Nations

1:45 PM **Maloney, Emma S. - Managerial Economics**
The Economic Advantages of a Multilingual Workforce: Cognitive, Personal, Academic, Social, and Global Benefits Associated with the Wage Premium

2:00 PM **Silva, Selena - Community and Regional Development**
Female Representation in Executive Management and Board Positions in Emerging Growth Initial Public Offerings

216 Wellman Hall, Moderator: Amanda Opperman

1:00 PM **Urena-Valdes, Ivan - International Relations**
Hosting or Boasting? Mega-Sporting Events and Globalization

1:15 PM **Thai, Eric - Political Science**
Exploring the European Union's Trade Strategy With Developing Countries

1:30 PM **Phan, Kelley K. - Political Science**
Political - Religious Landscape: Conditions and Patterns

1:45 PM **Katz, Spencer - Political Science--Public Service**
The Swing Voter and the Ground Campaign: How Political Practitioners and Political Scientists Understand Persuadable Voters.

2:00 PM **Zhuang, Jianfeng - Economics**
Income Inequality between Urban and Rural Residency in China

2:15 PM **Park, Wesley J.. - Philosophy**
Virtue Ethics and the Problem of Abortion

226 Wellman Hall, Moderator: Suad Joseph

1:00 PM **Prathi, Puja - Middle East/South Asia Studies**
The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Asia-Minor" in the New York Times (1900-1909)

1:15 PM **Shupp, Sabrina - International Relations**
The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Mohammedan" in the New York Times (1900-1909)

1:30 PM **Fragiacomo, Jazzmin L.. - Anthropology**
The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Jewish" in the New York Times (1900-1909)

1:45 PM **Hovsepian, Natalie T. - Anthropology**
The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Greek Orthodox/Eastern Orthodox" in the New York Times (1900-1909)

2:00 PM **Alghassab, Faisal - History**
Nomads Through the Colonial Lens: An Analysis of the term "Kurd" in the New York Times (1900-1909)

2:15 PM **AlJassar, Sara - Anthropology**
The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Islam" in the New York Times (1900-1909)

229 Wellman Hall, Moderator: Philipp Zerbe

1:00 PM **Wang, Sadira Y. - Neurobiology, Physiology and Behavior**
Investigating the Antifungal Activity of Diterpenes Produced by Enzymes of Setaria italica

1:15 PM **Minsky, Hana B. - Global Disease Biology**
Maize Dolabralexins Confer Anti-Fungal Properties

1:30 PM **Berrios, David - Biochemistry and Molecular Biology**
Characterizing the Sesquiterpene Synthase Family in Setaria italica

1:45 PM **Siddeek, Mohamed Hisham - Neurobiology, Physiology and Behavior**
Studying CENH3 mediated haploid induction utilizing CAS9 genome elimination in crop plant Solanum tuberosum.

2:00 PM **Cornejo, Karen - Neurobiology, Physiology and Behavior**
Evaluating the Molecular Determinants of Kv2-dependent Induction of Neuronal Endoplasmic Reticulum-Plasma Membrane Junctions

2:15 PM **Robinson, Foxy P. - Biochemistry and Molecular Biology**
BRCA1/BARD1 Ubiquitin Ligase Activity Regulates DNA Repair and Meiosis in Caenorhabditis elegans

230 Wellman Hall, Moderator: Koen Van Rompay

1:00 PM **Lipowsky, Leib - Neurobiology, Physiology and Behavior**
Dysfunction of Degradative Enzymes in Liver Tissue Due to Ibuprofen Treatment

1:15 PM **Newens, Joanne - Neurobiology, Physiology and Behavior**
The effect of ibuprofen on peroxisomal beta oxidation and oxidative stress

1:30 PM **Lozano, Celena - Neurobiology, Physiology and Behavior**
Antioxidant Activity in Brains from Ibuprofen-Treated Mice

1:45 PM **Wallace, Samantha - Genetics and Genomics**
Fast Green FCF as an Alternative to Ponceau S for Normalization of Western Blots

2:00 PM **Van, Richard - Biochemistry and Molecular Biology**
Automated Image Analysis of Fluorescence-Based Cell Identification and Quantification in Pancreatic Islets

2:15 PM **Tran, Daphne - Microbiology**
Evaluating Type II Diabetes Mellitus Status and Severity Among Patients at Paul Hom Asian Clinic at UC Davis

2 Wellman Hall, Moderator: Silvia Carrasco

3:00 PM McGillis, Megan M. - Psychology
Adult Interaction Strategies for Children with Low Language

3:15 PM Carriere, Stephanie A. - Human Development
Adult Interaction Strategies for Children with Low Language

3:30 PM Pohlhammer, Elise - Human Development
Should Multiethnic Adolescents Be Considered Their Own Ethnic Group?

3:45 PM Ochoa, Daisy L. - Human Development
Spatial Navigation in Aging

4:00 PM Ramirez, Andrea - Psychology
Infant Directed Speech in Bilingual Parents

4:15 PM Iqbal, Zunaira J. - Psychology
The Syntax-Space Effect in American Sign Language

6 Wellman Hall, Moderator: TBA

3:00 PM Chavez, Micah - Biochemistry and Molecular Biology
Investigation Into Two Candidate Genes for Spikelets per Spike Using TILLING Mutant Populations of Tetraploid (Triticum turgidum ssp.durum) Wheat

3:15 PM Jenner, Bradley N.. - Biotechnology
Assessing Somatic Compatibility Conversion and Genetic Recombination among Strains of Fusarium circinatum

3:30 PM Williams, Catherine H. - Global Disease Biology
Identification of an Additional Antifungal Compound Produced by Collimonas arenae Cal35

3:45 PM Paulk, Andrea Bourquin - Global Disease Biology
Fusarium falciforme is a previously unrecognized pathogen of cowpeas, present in California

4:00 PM Ho, Amanda Claire C. - Environmental Science and Management
Stormwater Bioremediation: Testing the Efficacy of Biochar for Reducing Nutrient Pollution, and Greenhouse Gases in Bioreactors

4:15 PM Pathak, Honey - Global Disease Biology
Screening for Potential Microbial Biocontrol of Fire Blight

26 Wellman Hall, Moderator: Soichiro Yamada

3:00 PM Cheah, Joleen - Biological Sciences
Force-induced Recruitment of LIM Domain Containing Proteins

3:15 PM Dinh, Alena - Neurobiology, Physiology and Behavior
Identifying the Molecular Machinery of Cell Fusion in Epithelial Cells

3:30 PM Jacobs, Kyle A. - Biomedical Engineering
Identifying Mechanosensitive Protein-Protein Interactions Surrounding Zyxin

3:45 PM Caballero, Reca - Biomedical Engineering
Optimizing Cell Synchronization Methods to Identify Zyxin Proximal Proteins during Mitosis

4:00 PM Quan, Phung Chieu. - Chemical Engineering
Compartmentalized Self-Replication (CSR) Evolution of DNA Polymerases for Difficult Sequence Amplification

4:15 PM Vo, Christopher K. - Microbiology
Engineering Adhesion-Induced Probiotic Strain for Enhanced Survivability and Efficacy Under Environmental Stress

103 Wellman Hall, Moderator: Monica Torreiro-Casal

3:00 PM Correa, David - Economics
Effects of Financial Stress on Latinx Students

3:15 PM Correa, Julienne - Sociology
Organizations Supporting Formerly Incarcerated Students in Higher Education

3:30 PM Lopez, Enrique - Sociology
Documenting the Undocumented High School Student Perception of Depression and Mental Health.

3:45 PM Sanghavi, Priyanka - Cognitive Science
Development of Optimism Across the Lifespan

4:00 PM Kakonge-Ruyondo, Kemi S. - Environmental Policy Analysis and Planning
Sustainable Water Treatment and Sanitation for Public Schools in Kampala, Uganda: The Impact of Drinking Water Filters on Student Outcomes

106 Wellman Hall, Moderator: Andy Edwards

3:00 PM **Rane, Niharika N. - Biotechnology**
Effect of Measles Booster Vaccination on CD4+ T Helper Cell Responses

3:15 PM **Tasmim, Tahmina - Animal Biology**
Dogs and Demographics: Neuter Status and Vaccine History in Canine Patients from Underserved Communities

3:30 PM **Yuan, Yinyu - Animal Science**
Straightforward method for singularized and region-specific CNS microvessel isolation

3:45 PM **Young, Kat E. - Global Disease Biology**
Comparative Fitness of St. Louis Encephalitis Virus in Mice

4:00 PM **Cohen, Julia - Animal Biology**
Estrogen and Prolactin Cooperatively Activate STAT5 in the Mammary Epithelium of Pigs

4:15 PM **Luna, Corey M. - Global Disease Biology**
Veterinary Clinical Research: A Shortcut on the Path to Medical Innovation?

119 Wellman Hall, Moderator: Mark Kessler

3:00 PM **Wang, Hannah M. - Communication**
Kids in the Basement: Space and Virtuality in American and South Korean Esports

3:15 PM **Kwong, Jessica - Art History**
Contemporary Paintings of the Chinese Diaspora: The 1.5 Generation

3:30 PM **Montoya, Melanie - Design**
An Unspoken Relationship: Fashion and Designed Experiences

3:45 PM **Lloveras, Jacob R. - Cinema and Digital Media**
The Cinema of You

4:00 PM **Gost, Victoria - Design**
Designing The Academy: Shields Library in the Digital Age

4:15 PM **Williams, Tiana A. - Cinema and Digital Media**
Forgotten Radicals: The Legacy of the United States Prisoner's Rights Movement

202 Wellman Hall, Moderator: Kenneth Kaplan

3:00 PM **Williams, Mark - Cell Biology**
Suppression of Micronuclei by Autophagy

3:15 PM **Cisneros, Ariana - Cell Biology**
Septins constrain cortical movement of Atg9-vesicles during autophagy

3:30 PM **Noon, Mackenzie C. - Genetics and Genomics**
Replication stress-induced nucleophagy is required for rDNA contraction

3:45 PM **Li, Wenzhe - Biological Sciences**
Functions of Lis1-Nudel/NudE and Dynactin on Dynein's Motor Activity

4:00 PM **Lam, Aileen J. - Biochemistry and Molecular Biology**
Determination of the Tau Domain Responsible for Condensate Formation

4:15 PM **Vadlaputi, Pranjali P. - Biomedical Engineering**
Multiple Variables Constrain Crossover Rate During Meiosis

205 Wellman Hall, Moderator: Wolf Heyer

3:00 PM **Lu, Weifeng - Biological Sciences**
Single Particle Reconstruction of Major Outer Membrane Protein of Chlamydia trachomatis

3:15 PM **Ghayoumi, Bardia - Biochemistry and Molecular Biology**
Ab initio Modeling of Solvent-Exposed Variable Loops of Chlamydia Major Outer Membrane Protein

3:30 PM **Burns, Markus - Biochemistry and Molecular Biology**
Conjugation of Chlamydial Immunogen to HEV Nanoparticles Towards Mucosal Vaccine Delivery

3:45 PM **Hibbard, Lainey M. - Biological Sciences**
Structural Characterization of Tumor Microenvironment Using Multicellular Tumor Spheroid Models

4:00 PM **Zhang, Wenjing - Biochemistry and Molecular Biology**
Vaccine Design Against Chlamydia Using Hepatitis E Viral Nanoparticle for Mucosal Delivery

207 Wellman Hall, Moderator: Andrew Wetzel

3:00 PM **Goodman, Kai T. - Materials Science and Engineering**
Optimizing Electrosynthesis of Superconducting $Ba_{1-x}K_xBiO_3$ Single Crystals

3:15 PM **Mata, Rogelio - Physics**
Survey of Magnetic Properties of Ferromagnetic Materials

3:30 PM **Chapman, Sierra - Physics**
The Abundance of Dark Matter Halos Near the Milky Way Galaxy

3:45 PM **Self, Matthew M. - Physics**
Weak Lensing 2.0: The Velocity Field

212 Wellman Hall, Moderator: Julia Chamberlain

3:00 PM **Mccarthy, Jenna Lee . - Human Development**
Evaluating the Development and Integration of Learning Assistant Programs in General and Organic Chemistry

3:15 PM **Cox, Elizabeth G. - Chemistry**
Did You Think About Studying: Metacognitive Survey Analysis Findings Across Two Cohorts

3:30 PM **Kelly, Amanda - Neurobiology, Physiology and Behavior**
Lecture Capture and Implications of its Use by Students in General Chemistry

3:45 PM **Xian, Shirley - Biomedical Engineering**
Student Perceptions and Use of Lecture Capture

216 Wellman Hall, Moderator: Brian Trainor

3:00 PM **Ramos-Maciel, Stephanie - Neurobiology, Physiology and Behavior**
Sex-specific Transcriptional Changes in CRFR1 are Induced by Social Defeat Stress in California Mice

3:15 PM **Minie, Vanessa A. - Neurobiology, Physiology and Behavior**
Environmental Enrichment: Methods for Reducing Stereotypy-Like Behavior in California Mice

3:30 PM **Johal, Simran - Psychology**
Changes in White Matter Integrity and the Development of Introspection Ability: A Longitudinal Analysis

3:45 PM **Vishwakarma, Nina - Neurobiology, Physiology and Behavior**
The Role of Context-Specific Neurons in the Ventral Hippocampus During Fear Memory Retrieval

4:00 PM **Venkatesh, Rasika - Biotechnology**
The Role of Context-Specific Neurons in the Ventral Hippocampus During Fear Memory Retrieval

4:15 PM **Snelgrove, Paige A. - Psychology**
What are the Quality Indicators of Journal Articles?

226 Wellman Hall, Moderator: Suad Joseph

3:00 PM **Baudrey, Krystina K. - International Relations**
The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Orient" in the New York Times (1900-1909)

3:15 PM **Scarbrough, Dalal H. Audeesh - Anthropology**
The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term “Middle East” in the New York Times (1900-1909)

3:30 PM **Phillips, Hannah - History**
The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Gulf of Arabia" in the New York Time (1900-1909)

229 Wellman Hall, Moderator: TBA

3:00 PM **Cravotto, Julianne MB . - History**
"In God We Trust": Religious Opposition to the Vietnam War and the Birth of the Bay Area Sanctuary Movement, 1971-1972

3:15 PM **Kolahdouz-Isfahani, Hamid R. - History**
Shah Abbas I and the Safavi Gunpowder Revolution

3:30 PM **Ford, Elise A. - History**
Edna Woolman Chase: A Microhistory

3:45 PM **Ibrahim, Khadeja - Middle East/South Asia Studies**
Economic Normalization in Palestine

4:00 PM **Sorrell, Clifton Elexander. - History**
Blood Stained Sugar and the Burning Island: Turmoil, Power and Slave Resistance in 18th Century Jamaica

4:15 PM **Savage, Adam p. - English**
Butcher's Crossing: An Examination of the Demythologized West

230 Wellman Hall, Moderator: Nidia Banuelos

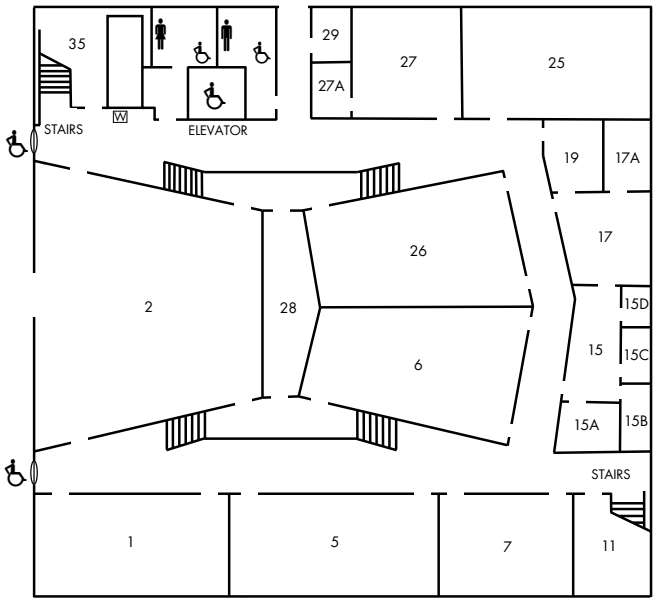
3:00 PM **Brashears, Kira - Sociology**
Cross-Cultural Competence in Spanish-Immersion Schools

3:15 PM **Ramirez-Barba, Jasmine - Chicana/Chicano Studies**
“They never believed I would graduate!:” Defining Culturally Competent School Counselors and Needs of Low-income Students Through Surveys

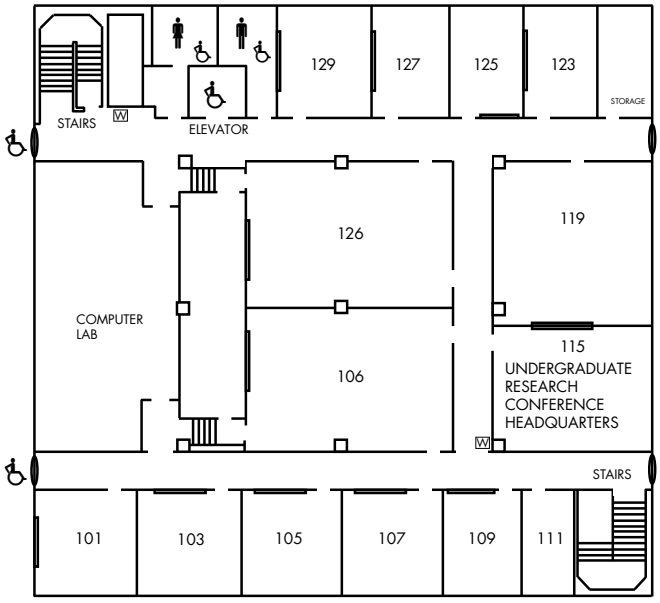
3:30 PM **Thomas, Russell - Gender, Sexuality and Women's Studies**
Gender Crisis: Bio-Necro Collaboration in the Governance of Gender

3:45 PM **Begin, Taylor A.. - Sociology**
Social Media and Self

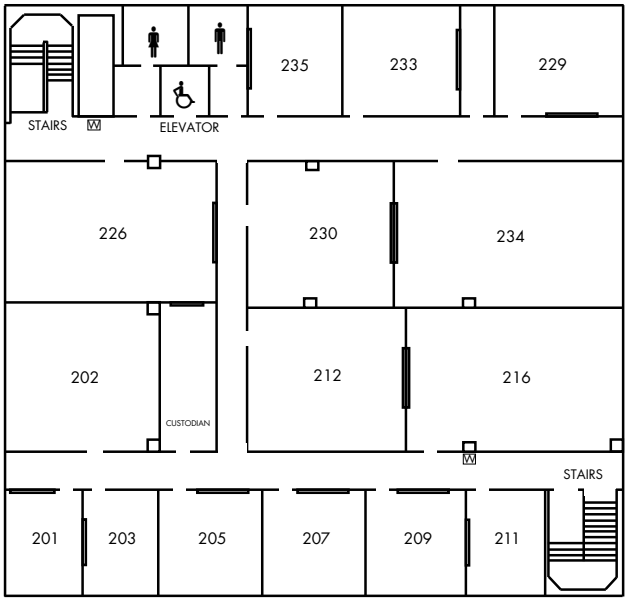
Lower Level

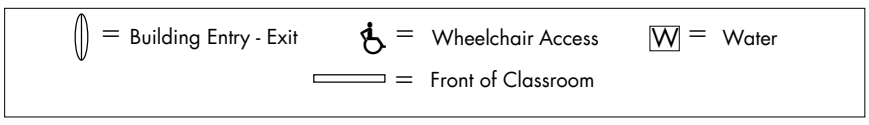


1st Floor



2nd Floor





DESIGN • CREATE • EXPLORE • DISCOVER • IMPACT

30 YEARS

ABSTRACTS

#UCDavisURC

Development of Bioluminescent Probes for *In Vivo* Imaging of Metals

Joseph Abouayash
Sponsor: Marie anne Heffern, Ph.D.
Chemistry

It is well established that metals are essential for proper biological function, and their dysregulation is associated with a range of diseases including diabetes, obesity, and several cancers. To gain a detailed understanding of the mechanisms underlying these observations, it is crucial to develop new tools to study the concentration, flux, and storage of metals in biological systems. To this end, we are developing molecular imaging probes that use bioluminescence to detect metals in living systems. Bioluminescence is the emission of light via a substrate-enzyme reaction between small molecules, known generally as luciferins, and their respective enzymes, luciferases. We are modifying the synthetic luciferin, coelenterazine 400a, with a moiety that will undergo chemoselective cleavage by the metal analyte of interest yielding the bioactive luciferin that can then interact with its luciferase for light emission. If successful, these probes will be translatable to the detection of metal pools in whole-animal models.

Effect of Temperature and Cold Stratification on Seed Germination of California Jewelflowers

Anne Marie Adachi
Sponsor: Johanna Schmitt, Ph.D.
Evolution & Ecology

Seeds carefully exploit specialized germination strategies to better ensure their chances of survival in their natural environment. Temperature and other environmental effects, including an initial chilling period (cold stratification), have been previously investigated as factors that can trigger or delay germination. Seeds utilize various life history strategies such as primary and secondary dormancy periods to allow for optimal timing of germination to ultimately increase the probability of seedling viability. We experimentally investigated the effects of temperature and cold stratification on the germination timing of California Jewelflowers Streptanthus and closely related Caulanthus, members of the Streptanthoid complex. We exposed seeds of 12 species from 20 different populations to 6 temperatures and 2 chilling treatments. Preliminary data show that cold stratification suppressed germination in most species with few exceptions in some populations. Seed germination was relatively higher at warmer temperatures, suggesting that the optimal temperature ranged from 20 to 30 degrees. We will perform further statistical analysis to determine significant differences in germination response across different species and populations.

Establishing Best Practice Use for Accelerometry in Gait Biomechanics: Time Synchronization, Accuracy, and Location Sensitivity

Jennifer Addleman
Sponsor: David Hawkins, Ph.D.
Neuro Physio & Behavior

Wearable accelerometer devices provide an opportunity to collect ecologically relevant gait (walking and running) mechanics data that relate to injury risk; however, there are currently no standards for best practice use of these devices. This research was conducted to provide a best practice guide for accelerometer use in gait applications. Three accelerometers were used to test (1) the timing synchrony among multiple monitors, (2) the accuracy of signal magnitude, and (3) the sensitivity of signal magnitude and timing to anatomical locations during gait. Monitors accurately quantified a 1g acceleration within 0.2g. They were not temporally synchronized ($p<0.001$). There was no significant difference among peak acceleration magnitude ($p>0.38$) and timing ($p>0.97$) of multiple monitors placed near the right hip, but there were significant differences ($p<0.001$) among monitors located at the hip, knee, and ankle and at the right hip, sacrum, and left hip ($p<0.01$). Best practice recommendations include incorporating tests to time synchronize and calibrate device accelerations. Though precise monitor placement is not required to estimate anatomical site acceleration, any models of gait biomechanics using acceleration values should only use accelerations obtained from the anatomical sites used to develop the model.

Impact of pH on Protein Hydrolysis and Particle Size Distribution of Almond Milk during Simulated Digestion

Arash Afsarifard
Sponsor: Gail Bornhorst, Ph.D.
Biological & Ag Engineering

Protein and Lipid hydrolysis may vary based on gastric which may also influence the particle size during digestion. The objective was to determine the impact of pH on almond milk during in-vitro digestion. Almonds were soaked in water(140g/L) overnight, blended and sieved to produce almond milk. Almond milk was mixed with simulated saliva, gastric juice and intestinal juice and incubated at 37^{o} for up to 3 hours. During the gastric phase, one of 3 dynamic or 6 static pH models was used. The dynamic models had pH ranges of pH 6.4-4.1, pH 4.9-2.0, and 6.5-4.7 based on in-vivo data. The static models had pH adjusted to 2, 2.5, 3, 4, 5, or 6.5. Particle size was determined using the Mastersizer 3000E. Percent relative abundance of protein was determined using SDS-PAGE. Protein hydrolysis was significantly influenced by the gastric pH($p<0.001$). pH 2 digestions had significant breakdown of the 22kDa protein band while pH 5 had very little change. The d50 of lipid particles in static digestions increases from neutral pH to 4, then decreases with further pH drops.

Regulation of SCN1A Expression as Pathogenic Mechanism and Path to Treatment in SCN1A-associated Epilepsy

Samrawit Agezew
Sponsor: Alexander Nord, Ph.D.
Neuro Physio & Behavior

SCN1A is a gene that codes for the sodium channel Nav1.1, whose mutations are associated with epilepsy including the childhood-onset disorder Dravet Syndrome (DS). Loss-of-function coding mutations in SCN1A account for ~80%of DS cases, but the rest 20% of patients do not have any known mutations. We produced a transgenic mouse line with a deletion of a regulatory element of SCN1A to assess whether this could reproduce an epilepsy phenotype. Western blot will be used to characterize changes in Nav1.1 protein expression between homozygous deletion, heterozygous and wild-type controls, all from the same litter. Following regional dissection of brain into cortex, hippocampus and cerebellum, the tissue will be homogenized, and the lysate will be prepared for SDS-PAGE via sonication. After transferring onto PVDF membrane anti-Nav1.1 antibodies will be tested. The most effective antibody will be used to compare changes in protein expression between genotypes and measure if deletion of a regulatory element of SCN1A is sufficient to alter Nav1.1 protein expression in mouse brain. If successful, this could provide new targets for treatment of SCN1A-associated epilepsies including DS.

Microplastic Ingestion in Mole Crabs, *Emerita analoga*

Anika Agrawal
Sponsor: Gary Cherr, Ph.D.
Environmental Toxicology

Increased global plastic production and mismanagement of the resulting waste has drastically impacted marine ecosystems. Microplastics, a large class of plastic pollutants, are less than 5mm in size and organisms often mistake them for prey or accidentally ingest them during filter feeding. This therefore exposes them to harmful contaminants that are contained within plastics or those that adsorb onto the surface of plastics. Mole crabs (Emerita analoga), filter feeders that inhabit the swash zone on the sandy coastline, bury themselves in the sand and therefore are being exposed to microplastics. They are an important food source for shorebirds along the California coast, and information about these organisms can provide valuable information about other crustaceans' responses to microplastics. This study looks at whether mole crabs ingest microplastics in a laboratory setting and if there are any differences in microplastic ingestion between different populations of mole crabs found on parts of the coast with differing plastic pollution. It is hypothesized that ingestion of microplastics in the laboratory will lead to decreased fitness. Furthermore, there will be differences in ingestion between populations depending on the areas from which they are collected. Experiments are still being conducted and data is forthcoming.

Deep Learning Low Dose CT for Liver Imaging

Jesse Ahlquist
Sponsor: Guobao Wang, Ph.D.
MED: Diagnostic Radiology

Long has the motto, "do no harm" been at the center of healthcare; however, this core mission also limits the potential effectiveness of medical imaging. Computed Tomography (CT) has the great potential to evaluate liver disease which affects one third of U.S. population. However, wide use of liver CT in the clinic has been limited due to the potential risk of radiation exposure, in particular for longitudinal follow-up of chronic liver disease where multiple imaging scans are needed. With the advent of deep learning, the potential to revolutionize current methods of liver CT imaging would allow utilization of minimal radiation doses while producing high quality CT images for diagnosis and treatment evaluation. In this work, we explore the use of convolutional neural networks (CNN) to reduce the high noise associated with low-dose CT. Using realistic computer simulations and physical phantom scans, we demonstrate that the CNN method can achieve up to a 5-fold dose reduction without compromising liver CT image quality. Future work will further test the deep learning low-dose method using real patient scans.

Development of Prosocial Behavior in Sprague-Dawley Rats

Tamanna Ahluwalia
Sponsor: Melissa Bauman, Ph.D.
MED: Psychiatry & Behav Sci

Autism Spectrum Disorder (ASD) is a uniquely human developmental disorder characterized by impairments in social behavior. Empathy, or an individual's ability to share and understand the feelings of others, is an essential component of human social interactions and may be impaired in those with ASD. Sprague-Dawley rats are a good pre-clinical model for studying social behavior and have been used to investigate empathetically motivated prosocial behaviors, such as releasing a conspecific from an enclosure. However, little research has been done to evaluate development of prosocial behaviors in Sprague-Dawley rats and, furthermore, research has predominantly only included males. This study aims to establish baseline levels for both male and female prosocial empathy behavior using a motivation test developed by Dr. Peggy Mason and refined by Dr. Robert Berman and colleagues at UC Davis. We will investigate how rats respond to a trapped cagemate and measure how long it takes subjects to release the cagemate. Comparing performance at both juvenile and adulthood timepoints will establish baseline data for both sexes to inform future experimental studies relating to empathy and empathy development over time. Moreover, by including females in our study, we hope to shed light on the effects of hormones on behavior.

Double Strand Break Repair Choice in *Caenorhabditis elegans* Male Germ Cells

Lauren Ahmann
Sponsor: Joanne Engebrecht, Ph.D.
Molecular & Cellular Bio

C. elegans BRCA1/BRC-1-BARD1/BRD-1 complex functions in DNA recombination, repair, and meiosis. Spontaneous or meiotically-induced double stranded breaks (DSBs) are repaired by two major pathways: homologous recombination (HR) and non-homologous end joining (NHEJ). In the female germ line BRC-1 promotes repair through HR, while in the male germ line it appears to play an early role in repair pathway choice. BRC-1 promotes repair choice in somatic cells by opposing the function of p53 binding protein 1 (53BP1), which binds DNA ends and recruits NHEJ machinery. The C. elegans 53BP1 ortholog, HSR-9, promotes repair by NHEJ when HR is blocked during oogenesis. To investigate the role of BRC-1 and 53BP1/NHEJ during male meiosis, I am examining localization patterns of HSR-9 and CKU-80 in male germ cells. CKU-80 is part of the NHEJ pathway; double brc-1; cku-80 mutants show decreased progeny viability. We expect HSR-9 and CKU-80 to co-localize at select DSB sites and have enhanced co-localization in the absence of BRC-1. These studies will provide important information about repair choice in male meiosis and the role of BRC-1 in promoting genome integrity.

Post-translational Modifications Regulate IGF1R Activity in MTAP-deleted RCCs

Arianna Ahmed
Sponsor: Ching-hsien Chen, Ph.D.
MED: Div Of Internal Med

The insulin-like growth factor-1 receptor (IGF1R) plays an important role in regulating multiple pathophysiological processes. Accumulating evidence has confirmed an aberrant activation of IGF1R in aggressive cancer cells; however, the molecular mechanism underlying how IGF1R is activated remains to be established. Previously, we found IGF1R activity is upregulated in renal cell carcinomas cells (RCCs) in response to the loss of the metabolic enzyme methylthioadenosine phosphorylase (MTAP). In light of the fact that an increase in protein phosphorylation level results from upregulation of the gene expression and/or protein translational modifications, we suspected that IGF1R activation is attributed to increased IGF1R expression. By using both Western blots and reverse transcription quantitative polymerase chain reaction assays, we demonstrated no significant difference in IGF1R protein and mRNA levels between MTAP wild type (WT) and knockout (KO) RCCs. Since the MTAP substrate methylthioadensine (MTA) serves as a selective inhibitor of protein arginine methyltransferase family to alter protein methylation, we performed immunoprecipitation to determine if MTAP-mediated MTA accumulation regulates IGF1R methylation and showed that symmetric arginine dimethylation level of IGF1R is decreased in MTAP-KO RCCs. Our results suggest that protein translational modification is a possible regulatory pathway in controlling IGF1R protein activity.

Improving fruit quality in tomato

Ye Jin Ahn
Sponsor: Neelima Sinha, Ph.D.
Plant Biology

Introgression lines from a cross between the cultivated tomato M82 cultivar and a wild relative, S. pennellii, have genes mostly from M82 but contain small pieces of DNA from S. pennellii. One introgression line, BIL 260, showed increased yield and fruit sugars. BIL 260 has 1.5X more yield than M82, and fruit BRIX of 4.9° compared to 3.8-4.0° in M82. Thus the introgressed region of S. pennellii influences yield and BRIX in BIL 260. One of the genes originating from S. pennellii in BIL260 was a bHLH (basic Helix-Loop-Helix) transcription factor. The Arabidopsis homolog, ABS5, expresses in both flowers and leaves similar to the Tomato version, while the S. pennellii version is expressed at very low levels in flowers only. The coding region between Tomato and S. pennellii is the same, and differences in the promoter region suggest that expression regulation of this bHLH could contribute to improved fruit BRIX. We identified CRISPR lines mutated at the bHLH gene in M82, and are phenotyping and genotyping these lines. I will study how bHLH promoter expression is different in M82, S. pennellii, and BIL 260. Understanding bHLH gene regulation would elucidate its function and provide a roadmap for producing sweeter tomatoes.

Unveiling the Social Determinants of Opioid Use

Rifa Akanda
Sponsor: Patricia Roberson, Ph.D.
Human Ecology

In 2017, the United States declared the opioid epidemic to be a national public health emergency. Research has shown that the greatest threat remains concentrated in rural, low-income areas of the United States. Thus, it is important to research other potential social determinants that influence opioid use. The research question to be investigated is: Does socioeconomic status (SES) influence whether individuals use opioids? In order to address this research problem, data from a pilot study conducted by the University of California, Davis was used. The study surveys patients who have attended Remote Area Medical Clinic in rural Appalachia with limited health access and asks patients about their opioid use. Results from this study will suggest how a low socioeconomic status (measured by insurance coverage, geographical setting, income, and education level) influences participant opioid use. The results of this study will emphasize the importance of creating and implementing educational programs that target individuals who may be at a higher risk of opioid abuse before they become users. Additionally, the results will provide evidence supporting the need for addiction programs and treatment interventions that target uninsured populations with limited health access.

Early Detection of Neurodegenerative Disease through Olfactory Epithelium Assay

Abdullah Al Tekreeti
Sponsor: Qizhi Gong, Ph.D.
MED: Cell Biology & Human Anat

Early detection of neuroinflammation in the brain is challenging due to the lack of reliable and accessible biomarkers. The olfactory nerve is one of the few peripheral nerves that directly connect to the CNS, which makes it a possible mode of neuroinflammatory recognition in the brain. Communication between the brain and the olfactory system is not limited to anterograde signals but can also happen retrogradely. Retrograde signaling could impact gene expression in olfactory epithelium due to inflammation in the brain. Therefore, we hypothesize that neuroinflammation in the olfactory bulb signals retrogradely to the olfactory epithelium. To test this hypothesis, we stereotaxically injected inflammatory factors into the mouse olfactory bulb. These inflammatory factors included Interferon-λ, Lipopolysaccharides, and Amyloid ß-42 (An Alzheimer's disease agent). Olfactory epithelium and olfactory bulb tissues were collected at different times post-injection (PI) for gene expression analysis. We observed significant upregulation of IFIT3 and OAS1 gene expression in the OE 24hrs PI, and IL6 upregulation 48hrs PI when compared to PBS controls; with no significant changes in cerebellum. Hence, we propose that that olfactory epithelium's change in gene expression may serve as a mode of early detection of neurodegenerative and viral diseases.

***Musculista senhousia* and its effects on community composition within Tomales Bay eelgrass beds**

Rylee Alexander
Sponsor: John Stachowicz, Ph.D.
Evolution & Ecology

Recruitment of non-native ecosystem engineers increase the likelihood of an invasional meltdown. When non-native foundation species build habitats, they may facilitate recruitment of non-native species. Musculista senhousia is a prolific invader and ecosystem engineer worldwide. It builds habitats for macro-epifauna which use the mussel matrices as a predator refuge. Northern California, however, has not experienced as intense an invasion as other locations. This could be attributed to the colder waters intrinsic to northern California. Despite not being invasive, the mussel is present in eelgrass ecosystems. We tested how mussel densities in eelgrass beds affected species compositions. We placed high-density, low-density, and no-mussel treatments in eelgrass beds and cleared plots. We expect that subplots with high-density M. senhousia will contain greater numbers of non-native species and mobile species—those with the ability to move to safety. We hypothesize increased effects of the mussel's ecosystem engineering on community composition the more mussels reside in each plot. Given the inevitability of warming waters, it is possible that M. senhousia will become invasive in northern California. Learning how climate change affects densities of an ecosystem engineer and the subsequent community composition changes will provide insight on shifting estuary communities in a warming world.

Nomads Through the Colonial Lens: An Analysis of the term "Kurd" in the New York Times (1900-1909)

Faisal Alghassab
Sponsor: Suad Joseph, Ph.D.
Anthropology

My research analyzes the New York Times' (NYT) representation of the Middle East through textual data from the decade of 1900-1909. I analyzed a total of 253 articles out of 495 articles. I found 39 articles that mentioned the term "Kurd" and which were relevant to my research. The articles examined were generally in the context of the Ottoman Empire during the eruptive first decade of the twentieth century. I noticed that "Kurds" were generally mentioned in relation to the Armenian massacres of the late nineteenth and early twentieth century. This issue was highly politicized and used by the European powers to pressure the Ottoman authorities to keep the Kurdish element in check. I argue that the representation of Kurdish people in the New York Times was based on oriental ideas of the classification of man. My research attempts to pin down the precursors and the historical basis of this representation by using linguistic evidence such as word choice, and by scrutinizing the context of the events being portrayed in the articles. This research is part of a larger project analyzing 150 years of The New York Times conducted in the lab of Professor Suad Joseph.

Delivery of Recombinant Proteins Across the Placental Barrier for Angelman Syndrome

Rida Ali
Sponsor: David Segal, Ph.D.
MED: Biochem & Molecular Med

Angelman Syndrome (AS) is a rare genetic disorder that impacts the nervous system of 1 in 12,000-20,000 individuals. It is characterized by delayed development, intellectual disability, and severe speech impairment. Most affected children suffer from epilepsy and microcephaly. AS is caused by the loss of function of the gene for Ubiquitin-protein ligase E3A (Ube3a) which plays a pivotal role in protein degradation.

Using a novel recombinant protein that causes epigenetic changes, which was developed in the Segal Lab prior, the goal of the project is to demonstrate that delivery across the placental barrier is possible. To show biological activity, this version of the protein that will be cloned will allow for creation of an injectable purified protein; a potential therapeutic approach. That protein will enter the bloodstream, cross the placental barrier and bind to the Ube3a gene in the developing animal brain. Once in neurons, it will bind upstream of the promoter for Ube3a and cause epigenetic change. To test this, pregnant mice will be injected with the therapeutic protein sequentially for several days prior to parturition. Obtained brain tissue will be sectioned and stained, demonstrating the crossing the placental barrier and causing a biological effect.

SOFA CONNECT - Bloom

Amir Ali
Sponsor: Jiayi Young, M.F.A.
Design Program

The UC Davis submission for the Sculptural Objects Functional Art & Design CONNECT competition is an immersive installation titled, BLOOM. Our Design Department emphasizes social responsibility, human-centered practice and sustainability. We are uniquely poised with a biodesign program which gives us the opportunity to work with innovative and sustainable materials. Given the opportunity to build an exhibit for an international audience, we dedicated BLOOM to tackling the negative environmental impact of consumerism by providing a comfortable, desirable and modern lounge space, with everything except the electronics composed completely of biodegradable materials. We provided the audience with an environment in which they could connect with the environment through materials like mycelium –a unique biomaterial grown from root-like strings that extend from underneath mushrooms. They were able to experience an immersive exhibit in which they could engage in social activity and feel comfortable in a lounge space that was 97% biodegradable. They were also given the opportunity to interact with a coded projection that moved as they did. BLOOM proves that products aren't limited by their life spans.

The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Islam" in the New York Times (1900-1909)

Sara AlJassar
Sponsor: Suad Joseph, Ph.D.
Anthropology

My research is dedicated to analyzing the New York Times' (NYT) representation of the Middle East from 1900 to 1909. I have examined 176 articles out 588 where the term "Islam" was used. Out of the 176 articles, I have critically analyzed 61 for their relevance to the term. From my research I have found that the Middle East is represented through a narrow, essentializing lens. Furthermore, the first major trend I have found is the term "Islam" used inferiorly to Christianity. The NYT has highlighted many Christian conferences in which speakers would emphasize the necessity of introducing Christianity in the region and converting as many to become fully developed people. In addition, the rise of Pan-Islamism has led the NYT to represent the Sultan of the Ottoman Empire as volatile and the movement as a "propaganda." These illustrations of the Middle East are essential to make note of because the narrative of "Islam" and the region still persists today. This research is part of a larger analytical project of the New York Times over 150 years conducted in Dr. Suad Joseph's lab in Anthropology.

Effects of Electrode Nanostructuring and DNA Probe Density on Electrochemical Nucleic Acid Biosensor Performance using Nanoporous Gold as the Model Electrode Material

Suzan Almashtoub
Sponsor: Erkin Seker, Ph.D.
Elect & Comp Engr

Advances in materials science and chemistry have led to the development of a wide range of nanostructured materials for building novel electrochemical biosensors. A systematic understanding of the challenges related to electrode morphology involved in designing such sensors is essential for developing effective biosensing tools. In this study, we use nanoporous gold (np-Au) thin film electrode coatings with submicrometer thicknesses, as a model system to investigate the influence of nanostructuring on the performance of nucleic acid biosensors. Np-Au electrode coatings produced by alloy corrosion process have played significant role in enhancing the performance of electrochemical nucleic acid biosensors owing to their three-dimensional nanoscale network of pores and ligaments, electrical conductivity, facile surface functionalization, and biocompatibility. However, biosensing phenomena on a nano-level scale has yet to be fully understood to allow for the optimal electrode design. Np-Au was used to investigate the influence of DNA capture probe grafting density and extent of electrode nanostructuring on the efficiency of target DNA hybridization to the probe DNA. This study provides fundamental understanding on how the electrode nanostructuring affects optimal electrochemical nucleic acid sensor performance, but also helps in expanding the fundamental understanding of how biomolecules interact in nanoporous environments.

Age- and Language-Related Positivity Effect in Episodic Memory

Priscilla Alvarado
Sponsor: Beth Ober, Ph.D.
Human Ecology

Memory for positive items (e.g., parrot) is generally better than memory for negative items (e.g., snake), the positivity bias. We investigated potential differences in positivity bias, based on age (younger vs. older adults) or language (young native English speakers vs. non-native); a significant difference in positivity bias between two groups is a positivity effect. The age-related positivity effect is the finding that older adults remember a greater quantity of positive versus negative stimuli compared to younger adults. The language-related positivity effect is the finding that non-native speakers show a larger memory advantage for positive versus negative stimuli compared to native speakers. Our prior memory study for lists of positive and negative words, from several semantic categories (e.g., animals) was conducted with young adult native English speakers vs. non-native. Results showed a significant interaction of Group by Emotion, a language-related positivity effect. Our current study is designed to replicate the language-related positivity effect, while determining whether an age-related positivity effect will be present with our list-memory paradigm. Preliminary results show a robust language-related positivity effect. However, the positivity bias for the (combined) younger and older native English speakers only approaches significance, and there is no indication of an age-related positivity effect.

Goat Colostrum Density

Autumn Amerman
Sponsor: E Depeters, Ph.D.
Animal Science

A goat's placenta does not allow immunoglobulins to pass from the dam to the newborn. Consequently, goat kids are born either aggamaglobulinemic or hypogammaglobulinemic. Colostrum, the first secretion produced by the mammary gland prior to parturition, contains immunoglobulins (Ig). The intake and absorption of Ig through colostrum, provides passive immunity and protects the kids from pathogens in the environment. The aim of this study is to determine whether or not density could be used to determine the IgG concentration and thus the quality of colostrum being fed to newborn kid goats. Colostrum samples were collected immediately following parturition from goats at the UC Davis Goat Barn and from SkyHill Napa dairy. A digital refractometer will be used to measure Brix. A pycnometer will be used to measure liquid density. IgG concentration will be determined using an enzyme-linked immunosorbent assay, ELISA, kit. The relationship between either Brix and density and Ig concentration will be evaluated. Establishing whether colostrum density is an effective form of determining colostrum quality is an important step towards allowing producers to analyze their colostrum quality quickly and accurately on site and allowing them to put into effect appropriate management practices that support the health of newborn kids.

An Examination of the Relationship Between Language Ability and Attention-Deficit/Hyperactivity Disorder(ADHD) Symptoms in Young Children

Sonali Amin
Sponsor: Julie Schweitzer, Ph.D.
MED: Psychiatry & Behav Sci

For children, developing self-control is a critically important step toward success in academic settings and social relationships, yet there are few non-pharmacological approaches that successfully contribute to increased self-control. The present study focused on parent and teacher reports to help us better understand how language skills in early childhood are related to hyperactivity and inattention, symptoms often associated with a diagnosis of ADHD. Preliminary analysis focused on two screening measures: the NIH Toolbox Picture Vocabulary Test (TPVT) and ADHD Rating Scales. The TPVT is a measure of language skills and is commonly used as a brief cognitive screener. The ADHD Rating Scales are a measure of hyperactivity and inattention in children. The scores from both of these measures were analyzed to examine the relationship between hyperactivity, inattention, and language skills. Preliminary results show small negative correlations between hyperactivity and language skills as well as between inattention and language skills for males and females. These findings suggest further research could be useful to show how symptoms associated with disorders such as ADHD relate to language and cognitive abilities, and thus provide more information how to approach hyperactivity and inattention in the classroom and at home.

Phonetic repair strategies for Siri versus a human voice: An investigation of non-native English speakers

Marlene Andrade
Sponsor: Georgia Zellou, Ph.D.
Linguistics

This study investigates how non-native English speakers modify their speech toward a technological virtual assistant such as Siri. Since the launch of Siri, the virtual assistant has been able to respond to speakers' commands with ease yet misunderstandings still occur. The main focus of the study is to test how non-native English speakers adapt their speech when Siri or a human make an error. A total of 16 native Mandarin speakers (L2 English) participated in an interactive with a Siri or to a real human voice ("Melissa"), producing 22 target words in the same carrier phrase. Subjects received feedback from Siri/Melissa in 3 error conditions: correct, incorrect vowel, and incorrect coda. We measured three acoustic properties (vowel space expansion, vowel duration, and vowel nasality) and analyzed each in a separate linear mixed effects model. We predict that non-native speakers will produce greater vowel space expansion and segment duration for speech directed toward a Siri versus a human voice. These findings will be compared to results of the same paradigm run on native-English speakers. Overall, this study provides insight to the speech modifications speakers make based on their interlocutor and their language background.

The Role of Cerebellum in Emotional Learning and its Extinction

Maribel Anguiano
Sponsor: Diasynou Fioravante, Ph.D.
Neuro Physio & Behavior

The cerebellum has been known to be a center for motor control but emerging research has opened doors for its possible involvement in cognitive and emotional functions. The purpose of this study is to determine if the cerebellum plays a role in emotional learning. We reasoned that if neural microcircuits in the cerebellum are necessary for learned emotion, then a perturbation of synaptic communication in them would be expected to affect learned emotional responses. One way to impose a subtle perturbation on cerebellar microcircuits is by removing Munc13-3, a protein that is predominantly expressed in the cerebellar cortex and that regulates short-term plasticity at synapses on Purkinje neurons (output neurons of cerebellum), without affecting basal transmission. We investigated the effect of genetic deletion of munc13-3 on auditory fear conditioning, where we paired a foot shock stimulus, which elicits naturalistic behavior of freezing, with a tone, which does not elicit freezing on its own. After 5 such pairings, the tone is thought to become associated with and predict shock, which elicits learned freezing, indicating fear. We hypothesize that Munc13-3 knockout mice will show impaired learned freezing compared to wildtype controls. A positive result would suggest that the cerebellum regulates emotional learning.

Exploring Students' Interactions with Graduate and Undergraduate Teaching Assistants in Chemistry Laboratories

Xavier Antoine-Goeas
Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Beginning in Fall 2017, the Chemistry Department at UC Davis started a pilot program through which undergraduate teaching assistants, formally known as Emerging Scholars (ES), have been working with graduate teaching assistants (TA) in laboratory settings. In order to observe and study the differences in student interactions with the TAs and the ESs, every TA and ES was asked to audio record their conversations during two lab sessions. After the audio data were collected, they were first transcribed, and student interactions with the lab instructors were coded using Laboratory Observation Protocol for Undergraduate STEM (LOPUS). Findings of this study will reveal whether students are more comfortable approaching TAs or ESs, and how the teaching styles may vary between the two lab instructors. Student inquiries and TA's or ES's responses will be carefully examined to better understand the instructional styles in the labs. These observations and analyses will reveal the efficacy of the Emerging Scholars program and provide the guidelines to enhance student learning experiences.

Developing a Low Cost Thermal Imager Using a Raspberry Pi

Jenny Lyn Arabit
Sponsor: Lynne Arcangel, M.S.
Graduate Division

This project investigates a low-cost thermal imaging device using a raspberry Pi, a small single board computer, and an inexpensive camera. This prototype would cost under $200, which is considerably lower in cost compared to existing thermal imagers. The final design can be used in industry, such as fire prevention and casting iron, and in research to measure the temperature of a glowing object's surface. The device utilizes color pyrometry, which reduces the need for the user to input parameters. To determine the possibility of this application, still images of a glowing steel ball bearing (in temperatures ranging from 800 to 1100° C) in a furnace were taken using the raspberry pi camera. These tests were conducted using various camera settings such as ISO and shutter speed. The expected results will determine the accuracy and the sensitivity of the measuring device. It will also provide insight on the optimal camera settings for a given application.

Development of Prosocial Behavior in Sprague-Dawley Rats

Lindsey Arkangel
Sponsor: Melissa Bauman, Ph.D.
MED: Psychiatry & Behav Sci

Autism Spectrum Disorder (ASD) is a uniquely human developmental disorder characterized by impairments in social behavior. Empathy, or an individual's ability to share and understand the feelings of others, is an essential component of human social interactions and may be impaired in those with ASD. Sprague-Dawley rats are a good pre-clinical model for studying social behavior and have been used to investigate empathetically motivated prosocial behaviors, such as releasing a conspecific from an enclosure. However, little research has been done to evaluate development of prosocial behaviors in Sprague-Dawley rats and, furthermore, research has predominantly only included males. This study aims to establish baseline levels for both male and female prosocial empathy behavior using a motivation test developed by Dr. Peggy Mason and refined by Dr. Robert Berman and colleagues at UC Davis. We will investigate how rats respond to a trapped cagemate and measure how long it takes subjects to release the cagemate. Comparing performance at both juvenile and adulthood timepoints will establish baseline data for both sexes to inform future experimental studies relating to empathy and empathy development over time. Moreover, by including females in our study, we hope to shed light on the effects of hormones on behavior.

Under, Over, but Never Spot On: Rules of Thumb for a Population Proportion Interval Estimate Miss the Mark

Ali Asif
Sponsor: Shelley Blozis, Ph.D.
Psychology

Many introductory statistics textbooks suggest a rule-of-thumb for computing an interval estimate of the population proportion, that is to say, the proportion of 'successes' relative to the number of observations. The rule is that, given a random sample, sample size times the population proportion and sample size times the value of 1 minus the population proportion should both be at least equal to 10. We investigated this rule for situations in which combinations of sample size and population proportions just satisfied this rule. That is, combinations yielded sample size values close to 10 (but not below). Using a Monte Carlo data simulation study design, we evaluated this rule along with two other amended procedures intended to improve estimates. Even if the population proportion was close to 0.5, the interval estimates overestimated the interval, with this tendency for overestimation worsening as the population proportion moved towards the extreme value of 0.1.

Effects of Excess Iron on Cognition in a Suckling Rat-Pup Model

Ayah Awwad
Sponsor: Bo Lonnerdal, Ph.D.
Nutrition

There have been several recent reports suggesting excess supplemental iron is detrimental to infant brain development. Little is known about the mechanisms underlying these effects. To learn more, we are investigating the cognitive outcomes of excess postnatal iron supplementation in a suckling rat-pup model, through behavior tests, gene expression, and iron status assessment. Pups were supplemented with ferrous sulfate, an iron chelate (Ferrochel), or sucrose vehicle control beginning postnatal day (PD) 2. Some pups were euthanized at PD 15, while others were supplemented until weaning and underwent behavioral testing at PD 50. By PD 15, hemoglobin and hematocrit increased significantly in the iron-supplemented groups, as well as liver and spleen iron stores. This suggests that iron absorption is under-regulated during the postnatal period. Two cognitive tests were performed: T-Maze spontaneous alternation and Passive Avoidance. Spontaneous alternation results showed no significant difference among groups for males or females. However, males who received Ferrochel had a significant increase in latency compared to those given ferrous sulfate or control, indicating improved cognitive function. Although more studies are needed to explain these results, effects of iron excess are likely form-dependent. These findings are relevant for health professionals giving advice on infant nutrition.

The Role of the BRAHMA Chromatin Remodeling Protein Complex in Maintaining Circadian Physiology and Healthspan

Dominik Aylard
Sponsor: Joanna Chiu, Ph.D.
Entomology/Nematology

The circadian clock regulates the timing and coordination of daily biological processes. In Drosophila melanogaster, the BRAHMA (BRM) protein complex interacts with key clock transcription factors to orchestrate daily cycles of chromatin condensation and relaxation. By altering the chromatin landscape, BRM can regulate the daily rhythms in transcription and activities of target proteins. Given that chromatin instability and degradation of circadian rhythm are hallmarks of aging, I hypothesize that BRM plays a role in healthy aging in animals. To test this hypothesis, I subjected brm mutant flies to an array of physiological and molecular aging assays. I assessed the lifespan and healthspan of brm mutants by measuring their respective survivorship and age-related decline in climbing ability. To measure aging at the molecular level, I used quantitative PCR to measure circular mRNA accumulation, an aging biomarker, and compared the myofibril protein degradation of brm mutants using protein silver staining. In summary, my results support an important role of BRM in regulating aging rate. Reduction or misregulation of BRM function resulted in decreased lifespan, healthspan, and a greater accumulation of molecular aging markers, whereas enhanced BRM function prolonged lifespan, healthspan, and decreased the buildup of aging biomarkers.

Neuropathic Pain Following Mid-Thoracic Moderate Spinal Cord Contusion Injury

Farnaz Azizi Shalbaf
Sponsor: Karen Moxon, Ph.D.
Biomedical Engineering

Approximately 53% of individuals who suffer from spinal cord injury (SCI) develop chronic neuropathic pain (CNP) either at-, above-, or below- the level of the lesion site. It has been suggested that these different pain phenotypes may arise from different pathophysiological mechanisms, yet few pain studies test for all of these different types of CNP. Therefore, the aims of the present study were to understand if the mid-thoracic SCI model in the rat could be used to study these different types of CNP, and to gain a more comprehensive understanding of the relationship between these types of CNP. All animals were tested for tactile allodynia on the dorsal trunk (at-level,) the forepaws (above-level), and the hind paws (below-level), and signs of painful responses were quantified. We found that (1) this model produced different proportions of animals which developed CNP in all three locations, (2)at-level CNP was the pain phenotype most likely to develop, and (3) the misinterpretation of an at-level pain response is unlikely. While all locational pain phenotypes are expressed by this model, these results suggest that this model is well suited for the study of at-level CNP.

Effects of Heating Element Geometry on the Formation and Propulsion of Vapor Bubbles in a Channel Flow

Hironori Baba
Sponsor: Vinod Narayanan, Ph.D.
Mechanical & Aerospace Engr

Heat generation in electrical components in space applications requires appropriate heat dissipation for proper operation. For high heat density, boiling of cooling fluid has been proven to be an effective means of heat removal. In terrestrial boiling, buoyancy removes vapor bubbles from the heated surface. However in space applications due to the absence of buoyancy, hot regions created as a result of vapor accumulation will lead to electronics burnout. To mitigate this accumulation, thermally-actuated vapor pumping using asymmetric heater geometry is proposed and tested to determine whether passive movement of vapor bubbles during boiling in microgravity is possible. The asymmetry in geometry is in the form of repeating millimetric-scale ratchets. In laboratory experiments, ratchet heaters mimicking actual electronics are submerged in a dielectric coolant. Selective nucleation sites are engineered into one of the faces of the ratchet. High speed videos are recorded to observe the formation, propulsion, and transport of vapor bubbles within a channel. It is demonstrated that bubbles emanate from localized nucleation sites, grow normal to, and are propelled outward perpendicular from, the ratchet face. The findings in this experiment are positive indicators that such mechanism could result in passive cooling systems for microgravity applications.

Assessing Sublethal Effects of California Wildfire Ash on *Hyalella Azteca*

Hadeel Bader
Sponsor: Richard Connon, Ph.D.
VM: Anat Physio & Cell Biology

The incidence of wildfires in California has significantly increased over the past decade, is directly associated with climate change, and is likely to worsen. As a consequence, there is growing concern over the impact of ash deposits in aquatic environments; increasing the risk posed by associated chemical compounds that further deteriorate water quality and endanger public and aquatic health. Native, epibenthic aquatic organisms such as Hyalella azteca are detritivores and are directly exposed to ash deposits. H.azteca is used as a model species for water column and sediment toxicity tests. In the proposed study, an acute toxicity test evaluating genes involved in general stress, immunity, and oxidation response will be performed to determine specific sublethal impacts following exposure to effluent from wildfire ashes. Behavior (motility) will also be evaluated as an endpoint. The wildfire ash in this study has been collected and chemically analyzed by collaborators at UC Davis. This study is geared at developing a biological assay that can be used to determine the effects of ash deposits on aquatic organisms.

Comparative Analysis of Islamic Hadith Concerning Women and Menstruation

Julia Baggett
Sponsor: Mairaj Syed, M.D.,Ph.D.
Religious Studies

An Islamic hadith from the Sunan Abu Dawud, a compilation of hadith from the 9th century, states that the Prophet Muhammad said that women are deficient in religion because they do not pray or fast when they menstruate. However, not all versions of this hadith identify a deficiency in women tied to menstruation and multiple do not mention a deficiency at all. These hadith consequently have very different implications for Islamic views of women and menstruation. My research project is a comprehensive analysis of all different versions of this hadith that seeks to determine what causes textual variations in the hadith. This analysis involves an examination of the authorities listed as transmitters of the hadith. By locating the time and place of each authority in this record of transmission, we may trace where the hadith originated and how it spread. While I am still in the process of examining the transmissions of each hadith, I suspect that textual variations correspond to regional cultural ideas surrounding menstruation. This project therefore sheds light not only on the development of Islamic ideas concerning menstruation, but also on the elements guiding hadith transmission.

A Touch of Magic: Reconceptualizing the Female Experience Through Magical Realism

Lisa Banga
Sponsor: Elizabeth Freeman, Ph.D.
English

Amidst a time of political and social turmoil in the mid-twentieth century, Latin American writers flourished, and their works spread across the globe. This Latin American Boom popularized magical realism, a genre that recounts the magical as the real and blends the fantastical with the mundane. Latin American writers such as Gabriel García Márquez and Jorge Luis Borges have used the genre as a tool to reclaim their histories, weaving fiction into the past to critique the falsities existing in their countries' official histories. While magical realism criticism has discussed the ability to rewrite and to reclaim history, a smaller body of research exists on how magical realism reimagines female histories, specifically female bodies and female sexuality. My research examines how female Latin American writers reconceptualize individual, personal female histories using magical realism. Looking specifically at Laura Esquivel's Like Water For Chocolate and Isabel Allende's The House of the Spirits, I explore how female characters interact with the magical elements of their narratives and how the magical functions as an extension of their bodies and as a reimagining of their sexualities.

Infants' Misinterpretation of Native Language Speech Sounds

Jerice Kent Banola
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Language development in infants is a phenomenon still not fully understood. We are studying how infants interpret words with endings that are acoustically different, but belong to the same phoneme category in order to understand the development of phoneme representations—how infants know what sounds are the same and which are different. In English, when the word "hat" occurs with a pronounced "t" sound or a light "t" sound, the word is still interpreted as "hat" because they are allophones of the same phoneme category. However, in other languages, the released-t versus reduced-t sounds are distinct phonemes. We are testing how infants interpret sounds that are allophones in their native language. In this study, monolingual English 14-month-olds view one object on a screen while hearing a novel word with a pronounced "t." After many repetitions, the ending changes to a lighter "t" sound, while still playing the same object. If the infants look longer after the change, it signals that they notice the difference and think the two variations are actually different words. Thus far, infants seem to interpret lighter "t" and pronounced "t" signal two different words, indicating that they are incorrectly categorizing these allophones as two distinct words.

Student-Facilitated Course on Writing Books for Pediatric Patients in Underserved Healthcare Communities

Riya Bansal
Sponsor: Marina Crowder, Ph.D.
Molecular & Cellular Bio

Oftentimes, there is a lack of reading material in the waiting rooms at clinics and children's hospitals; this is especially true for healthcare facilities in low income communities both locally and abroad. In order to engage students in creating books for children in these communities, we designed a first year seminar (FYS) entitled "Writing for Wellness: Creating Children's Books to Support Pediatric Patients in Underserved Communities". The main objectives of the course were to practice incorporating empowering messages within stories written for a younger audience and discussing the impact of how socioeconomic disparities found in low income communities hinder children's psychological and academic growth. Combining our knowledge of and experience in writing books for pediatric patients and working in low income healthcare communities both locally and abroad, we designed weekly lectures, reading and writing assignments, discussion questions, and in-class activities that encompassed these themes. Importantly, we designed a final project that resulted in students writing and illustrating original story books with a positive messages, to be printed and distributed to low income communities locally and abroad for children in these communities to read and enjoy.

Summer Literacy Development: Bilingual Books for Emergent Spanish-English Bilinguals

Stefania Barrera
Sponsor: Yuuko Tonkovich, Ed.D.
Education

The population of emergent Spanish-English bilinguals is growing in the United States. However, these bilingual children from low-income environments are experiencing a decline in English skills over the summer. In this study, we will examine how bilingual children spend their summers. We will focus on the following questions: 1) How much Spanish and English do Spanish-English bilinguals hear and use during the summer? and 2) How do Spanish-English bilinguals spend their typical summer days? Then, we aim to identify an effective summer reading program that may help prevent summer literacy decline. We provided bilingual books to four children and conducted focus group interviews with their parents. Preliminary results suggest that language exposure in Spanish and English is varied. Our focus group interviews suggest that Spanish-English speaking children from low-income homes may not have access to literacy resources over the summer and, thus, are unable to further develop their literacy skills. However, both parents and children would actively engage in literacy activities over the summer if provided with the appropriate resources tailored to their interests and that accommodate for social factors that may limit their accessibility to resources. The findings suggest that providing library resources to parents may be helpful.

The Association Between Neural Activity to Food and Socioeconomic Status

Sarah Basharkhah
Sponsor: Johnna Swartz, Ph.D.
Human Ecology

Rising obesity rates signal a public health concern in the United States. Previous studies demonstrated a link between low socioeconomic status (SES) and obesity, which could be explained in part by associations between SES and behaviors related to delay of gratification (DG), the process of declining a short-term reward for a better, long-term outcome. The goal of the current study was to test the hypothesis that SES is related to neural activity to food within regions related to DG, including the nucleus accumbens and orbitofrontal cortex. Data from the Adolescent Health and Brain study was used to test this hypothesis. Adolescent participants completed a food viewing task during a functional Magnetic Resonance Imaging (fMRI) scan. Adolescents and their parents also completed self-report measures, including parent education level to measure SES. Initial analysis of the fMRI data indicated that responses to food occurred in regions separate from those chosen a priori. Results from this research have implications for understanding how DG may relate to food preferences and obesity risk.

Commissioning of a Fiber-Coupled Equation-of-State Diagnostics Package in the UC Davis Shock Compression Lab

Meral Basit
Sponsor: Sarah Stewart-Mukhopadhyay, Ph.D.
Earth And Planetary Sciences

The UC Davis shock compression lab uses light gas guns to generate shock waves in rock and mineral samples, recreating the conditions found in planetary interiors and during large impacts. Impact surface area on a sample is constrained, particularly at high velocities where low-mass, small-diameter projectiles are required. Diagnostics are mounted to the back of the target plate, and are also limited by the diameter of the projectile. Due to these constraints, it can be difficult to fit diagnostics that collect both particle velocity and temperature data, which are necessary to determine the equation-of-state (EOS). Here, we present recent developments for EOS experiments using all fiber-coupled diagnostics on the UC Davis two-stage light gas gun. We have recently commissioned a compact commercial Photon Doppler Velocimeter (PDV), a streaked optical spectrometer (350-850 nm) and have modified a visible/near infrared (NIR) 6-channel pyrometer (650-5000 nm) for flexible simultaneous velocimetry and broadband temperature measurements. These tools allow for flexible configuration and multi-point measurement in a compact target design and simultaneous pressure/temperature observations for complete EOS studies.

Sensors and Algorithms for CubeSat Attitude Determination

Aaron Bass
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The Remote Experimentation and Analysis of LEO Phenomena (REALOPs) is a 2U CubeSat development project focused on data acquisition for use in STEM education. The objective of the Attitude Determination and Control System (ADCS) is to develop low-cost solutions that meet mission orientation and stability requirements. This presentation discusses sensors and underlying algorithms that determine the small satellite's orientation in space and controls the magnetorquer coils and reaction wheels. Attitude, location, and angular velocities are determined using a gyroscope, accelerometer, magnetometer, sun sensors, horizon sensors, and Global Positioning System (GPS). The sensor data is given in the body frame of the CubeSat. Models are used to translate attitude and rotation in the body-frame to the inertial-frame, which is then used for attitude control. An Extended Kalman Filter is utilized to combine sensor data, mitigate sensor noise, account for external forces, and proportionally weigh inputs to achieve higher accuracy with a short computation time. This is crucial for the mission objectives, which require a high degree of angular accuracy. The REALOP mission aims to develop and integrate an accurate, precise, and low-cost network of sensors and corresponding algorithms for the current and future CubeSat missions.

Supporting a Sense of Belonging in Freshmen and Transfer Students with Videos Focused on UC Davis Students' Transition Experiences

Farva Batool
Sponsor: Kali Trzesniewski James, Ph.D.
Human Ecology

Transition to college is one of the most difficult phases for many students. The continuous notion of not being able to adjust in college can increase their risk of dropping out of college and not believing in themselves to achieve their future goals. Previous research has shown that a belonging intervention can students better understand their struggle of transition by normalizing their struggles. That is, helping students understand that they are not the only one going through the struggle and the challenges they might face are very common. In the current study, 2018 incoming UCD freshman and transfer students participated in a randomized trial of this belonging intervention. Half of the incoming students participated in a live panel, in which they asked current students questions about adjusting in college. The other half saw a video in which current students talked about their transition experiences with a focus on belonging messages. The results for freshman showed that the students who participated in the belonging activity had 0.14-0.19 higher GPA, 3-4% of higher rates of good standing, and overall 2% low rates of D's or F's received during their first year. Results for transfer students will also be presented.

The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Orient" in the New York Times (1900-1909)

Krystina Baudrey
Sponsor: Suad Joseph, Ph.D.
Anthropology

This research is part of a larger project, conducted in the lab of Doctor Suad Joseph, that analyzes how the Middle East, Arabs, Muslims and Islam have been represented in The New York Times over a 150 year period. I searched the ProQuest New York Times Newspaper database for the term "Orient" for the years 1900-1909 which produced 16,759 results. Thus far, I have examined 644 articles from January to April 1900 alone of which 24 are relevant to my research. First, I have found that the term "Orient" was used to generalize Asia and the Middle East into one geographical category. I argue that the civilizations in these regions of the world were grouped together with complete disregard for cultural and religious distinctions. Second, many articles shared the common theme of alienating the "Orient" from the "Occident." In doing so, people of the "Orient" were described in inferior terms and often belittled. Lastly, these articles often insinuated the mistreatment of women in the "Orient," in which the involvement of religion was frequently emphasized.

Hippocampal Morphology and Adult Neurogenesis in *Chd8*-Haploinsufficient Mice

Paris Beauregard
Sponsor: Alexander Nord, Ph.D.
Neuro Physio & Behavior

The chromatin-remodeling factor (CRF), CHD8, has emerged as a key risk gene for neurodevelopmental disorders (NDDs). Chd8-haploinsufficient mice (Chd8+/-) present ASD-like phenotypes, increased cortical proliferation dynamics and macrocephaly. The hippocampus, which corresponds to one of the main regions that exhibit adult neurogenesis (AN) in the brain, was identified as one of the enlarged structures in Chd8+/- mice, possibly contributing to the macrocephalic phenotype. By linking specific Chd8 expression patterns in the hippocampus, increased cortical proliferation, and the fact that CHD8 haploinsufficiency appears to act in convergent mechanisms across the brain, we hypothesize that proliferation of neural progenitors in the subgranular zone (SZ) of the dentate gyrus is disturbed in Chd8+/- mice. To characterize hippocampal neuroanatomy and AN in Chd8+/- mice, we performed immunohistochemistry (IHC) using region specific markers (RGS14) and maturation markers (Doublecortin and Calbindin). Cellular proliferation was also evaluated by IHC using the marker Ki67 and performing EdU labeling experiments in the adult brain. This set of experiments defined hippocampal neuroanatomy and AN rates in a mouse model that recapitulates ASD-relevant phenotypes, helping to elucidate the role of CHD8, and possibly CRF-haploinsufficiency in general, in affecting the cellular and neuronal substrates underlying AN and cell fate.

Social Media and Self

Taylor Begin
Sponsor: David Mccourt, Ph.D.
Sociology

With the case study of Instagram, which debuted late 2011, my research analyzes how the tools of this application and how it operates affects the way we interact, present, and police ourselves and others. Through interviews, developed with questions from past literature, this research aims to illustrate how the use of Instagram has facilitated the development of digital norms for how people interact and create themselves on this platform. Additionally, I am considering certain questions that examine ways Instagram has the ability to share tacit knowledge while simultaneously creating a form of tacit knowledge with how to use the application. Preliminary analysis suggests there is an underlying form of information sharing and norm communication, specific to this online platform, that is related to how individuals use it to create their virtual self image. I hypothesize that this will appear in ways such as, what is appropriate to post online or more commonly, what is known as 'Instagram worthy'.

Comparing Fecal Sand Output Between Yearlings and Mares with the Use of Psyllium as a Preventative for Sand Colic in Clinically Normal Equine and Alterations to the Hind-gut Microbial Populations

Ashley Belt
Sponsor: Michael Mienaltowski, D.V.M.,Ph.D.
Animal Science

Colic is a leading cause of premature death in horses. Nearly one in twenty colic incidents is caused by sand, particularly for horses that live in sandy, soil rich environments. Preventative oral supplementation of psyllium has been recommended to enhance passage of ingested sand from the gastrointestinal tract. However, much is still unknown about psyllium's mechanism of action. We hypothesize that feeding psyllium as marketed by supplement suppliers will increase the passage of sand in the feces as well as alter the hindgut microbiome thus reducing the risk of sand colic. Psyllium husk pellets (0.5 oz/100 lbs bodyweight) were fed once daily for a week as a supplement to their current diet. Voluntarily-voided feces were collected from 12 clinically normal horses – 6 yearlings and 6 broodmares- over the course of 29 days, prior, during, and after treatment. Fecal samples were divided into two containers, one for microbial evaluation and one for measuring silica levels. Microbial DNA was isolated, and PCR amplified at the V4/V5 16S ribosomal RNA gene and then sequenced to analyze microbial diversity. Fecal samples were analysed using Acid Detergent Fiber concentration followed by ashing methods to determine the silica concentration output.

The Effect of Herbivory and Resource Competition on the Survival and Fitness of *Quercus douglasii* Seedlings

Noah Bennett
Sponsor: Susan Harrison, Ph.D.
Environmental Science & Policy

The Blue Oak (Quercus douglasii) is a widely revered shade-tree endemic to California. Throughout its natural range, Q. douglasii recruitment rates are too low to replace current adult populations. To prevent Q. Douglasii from becoming a species of concern, action must be taken to identify the cause and potential solution to early life-stage population decline. This study looked at the effect of herbivory and resource competition on Q. Douglasii seedlings. Common acorn predators include mule deer, acorn woodpeckers and various species of rodent. Data was collected on 156 acorns planted at Quail Ridge Natural Reserve in treatments excluding predators and competition. Acorns were placed under cages to prevent predation, in plots cleared of competing biomass or given both treatments. Height measurements were taken bi-weekly and used as a measure of fitness. Research is still in progress at the time of submission, however it is hypothesized that acorns will have greater survival and growth rates with protection from herbivory and lack of resource competition. The results of this experiment can advise restoration ecologists on best practices to maximize Q. douglasii seedling yield and health.

Characterizing the Sesquiterpene Synthase Family in *Setaria italica*

David Berrios
Sponsor: Philipp Zerbe, Ph.D.
Plant Biology

Setaria italica is a grain that possesses impressive drought tolerance and potential as a model for investigating environmental adaptation in major food crops like rice and maize. The aim of our project is to identify novel stress-inducible sesquiterpenes specific to S. italica by characterizing its sesquiterpene synthase (STPS) family. In related crops, inducible bioactive terpenes are key components of the defense against pests and diseases. Therefore, we hypothesize that the S. italica STPS family forms metabolites of similar yet possibly unique function, which have potential use as biopesticides or enhancers of stress resistance. We will investigate the biological importance of the S. italica STPS family by identifying enzyme functions through combinatorial biochemical characterization using Agrobacterium-mediated co-expression assays in Nicotiana benthamiana and identification of enzyme products via gas chromatography-mass spectrometry and nuclear magnetic resonance analysis. Additionally, inducible gene expression of STPSs will be measured using quantitative real-time PCR to examine the roles in the response to biotic and abiotic stressors. In parallel, the structure-activity relationships defining sesquiterpene bioactivity will be examined using in vitro fungal growth assays in presence of S. italica metabolites. Together, these studies will provide insight into the biosynthesis and biological activity of stress-inducible sesquiterpenes in S. italica.

Characterization of root plasticity in pistachio UCB-1 rootstocks for better nutrient uptake and stress response.

Oliver Betz
Sponsor: Georgia Drakakaki, Ph.D.
Plant Sciences

The California agricultural sector is experiencing a massive growth in pistachio that necessitates increased attention. Rising demand coupled with soil salinization and temperature increase due to climate change require that crop improvement match its growth. The goal of our research is to understand the different mechanisms behind root adaptability of the UCB-1 rootstock on a cellular level. We are currently implementing confocal microscopy in conjunction with chemical staining to map sodium sequestration and identify root structural differences that are induced under salinity stress. Thus far, we have identified increased deposition of suberin and lignin at the root endodermis and exodermis of salt stressed pistachio seedlings. The endodermis and exodermis act as a barrier regulating ion and water transport. The endodermis additionally prevents the backflow of nutrients from the stele thereby fine-tuning nutrient acquisition. Stress induced changes to these cellular structures hold true for one of the UCB-1 parental lines, P atlantica, under salinity stress. Further characterization of the trait in this parental line will help understand its genetic basis. Given that UCB-1 is the most popular grown rootstock, insights gained will assist in the development of better agricultural practices under saline and other abiotic stress conditions.

Clinically Relevant Mouse Models Discovered Through the KOMP2 Project

Catarina Bianchi
Sponsor: Kristin Grimsrud, D.V.M.,Ph.D.
MED: Pathology & Lab Medicine

Animal models are informative for understanding disease mechanisms in patients. Novel genome editing technologies enable recapitulation of human genetic variation in mice to model disease phenotypes and accelerate the translation of benchtop research to clinical decision-making. The Mouse Biology Program has used CRISPR/Cas9 to generate several mouse models that mimic human disease and specific patient phenotypes through the Knockout Mouse Production and Phenotyping (KOMP2) project. Here we investigate the correlation between KOMP2 mouse models and human disease. We provide a review and comparative analysis of both rodent and human models for neurological, skeletal, cardiovascular, and urinary systems. Within each physiological system, we present specific diseases found in humans that have also been studied in rodent models. A comprehensive review of mouse models for certain diseases establishes a testing platform for distinguishing between genes and genetic variants causative versus associated with disease. Further, mouse models will continue to be an essential tool for developing targeted therapies for numerous human diseases. Animal modeling continues to have a profound impact on the future of translational and clinical research and its utility will continue to be significant as new discoveries progress.

Understanding Infant's Selective Attention: The Effect of Visual- Short Term Memory

Anoma Biswas
Sponsor: Lisa Oakes, Ph.D.
Psychology

Infants' visual attention (i.e., where they look) is influenced by bottom-up processing, in which features of the stimulus automatically capture attention, and top-down processing, in which factors such as previous experiences influences where we look. For example, infants' memory of what they have seen before may influence where they look, and they may look less at a familiar chair than at an unfamiliar bag of groceries. By 10 months infants can use information stored in memory to determine where they look in visual search arrays (Mitsven et al, 2018). Here we asked whether 6-month-old infants' looking is also influenced by what information is stored in memory. On a series of trials, we first present infants with an image of a single object and then present them with a 6-item search array that may or may not contain the familiar item. In each of these arrays, one item is unique and the other 5 items are identical. If infants' looking is determined solely by bottom- up processing, they will always look longer at the unique (pop-out) item. However, if they incorporate top-down processing, their looking will be influenced by whether that pop-out item was presented alone prior to the search array.

Perceived self-efficacy and adherence to treatment plans

Brittany Black
Sponsor: Patricia Roberson, Ph.D.
Human Ecology

Perceived self-efficacy, assessment of one's own capabilities, has emerged as an important aspect of health. For instance, research has found that self-efficacy may predict individual adherence to treatment programs. People with lower levels of self-efficacy are less likely to follow physician prescribed treatment plans and are at increased risk for relapse compared to individuals with higher levels of self-efficacy. Self-efficacy has also been positively associated with increased health habits and greater ability to regulate one's diet. One population in which there has been little research with self-efficacy and adherence to treatment plans is the diabetic community. With 30.3 million individuals affected by diabetes in the United States, it is increasingly important to understand the psychosocial factors influencing an individual's adherence to a specific treatment plan. The present study analyzes data collected from the Midlife in the United States data set which studied various behavioral and psychosocial factors influencing one's health including questions assessing perceived self-efficacy. More specifically, this study analyzes whether there is a relationship between level of self-efficacy and individual ability to follow a physician prescribed diet among diabetic individuals. This research could demonstrate the importance of integrating psychosocial factors into diabetes treatment plans.

Early Replicating Fragile Sites are Hotspots for Chromosomal Damage and Genomic Instability

Maya Block
Sponsor: Jacqueline Barlow, Ph.D.
Microbiology & Molec Genetics

Common Fragile Sites (CFSs) and Early Replicating Fragile Sites (ERFSs) are genomic loci that, while fundamentally different, are both prone to damage during replication. Because of their instability, mutations and genome rearrangements are frequently observed at CFSs and ERFSs in cancer cells. My project focuses on comparing the fragility of CFSs and ERFSs and I hypothesized that both are equally susceptible to damage during replication. To test this hypothesis, I analyzed metaphase plates treated with two components of replicative stress: the use of Xrcc2 KO cells and ATR inhibitor drug. The Xrcc2 KO cells, which are deficient in homologous recombination, coupled with the effects of the ATR inhibitor, which interferes with DNA repair, amplified the levels of chromosomal instability and amount of visible damage. This amplification of damage helped reveal the chromosomal locations that were most populated with damage. With this information, I compared the amount of damage localized at CFSs and at ERFSs to determine if one type of fragile site was more fragile than the other. The data showed that ERFSs accumulate a significantly higher amount of damage than CFSs, suggesting that ERFSs are more fragile and susceptible to chromosomal rearrangements than CFSs, negating my hypothesis.

Social Support as a Buffer Against Stress-Related Impairments in Working Memory

Shoshannah Bobritsky
Sponsor: Camelia Hostinar Caudill, Ph.D.
Psychology

Previous research suggests acute stress may have negative effects on certain aspects of cognition such as working memory. However, research suggests that social support can serve as a buffer to mitigate stress, suggesting it may also have protective effects for cognition. In the current study, the effects of acute stress and social support on working memory were examined in 9-10-year-olds. Children completed a laboratory public speaking stress test, the Trier Social Stress Test (TSST) modified for use with children, followed by the Memory for Sentences task. We recruited 112 participants who were aged 9 to 10 years old. Participants were randomly assigned to three conditions: stress with parent social support beforehand, stress without parents support, and no stress. The Memory for Sentences task was completed after the TSST. We predicted that stress would impair children's working memory as measured in the Memory for Sentences task. However, we also predict that children receiving social support will perform better on the working memory task than children who do not receive support. Results from this study may determine whether social support from parents can help children perform better in stressful environments.

Fungal Toxin Influence Over Transcriptional Regulation of the Plant Shikimate Pathway

Tayah Bolt
Sponsor: Daniel Kliebenstein, Ph.D.
Plant Sciences

The plant shikimate biosynthetic pathway controls defense metabolism by creating aromatic amino acid precursors. These aromatic amino acids serve as precursors for natural products, including key metabolites involved in plant defense against pathogenic attacks. One of these pathogens is Botrytis cinerea, a generalist plant pathogen that causes annual crop losses of up to $100 billion dollars worldwide. As a necrotrophic pathogen it creates toxic molecules that target the plant's own defense mechanisms to kill the host tissue in order to feed. One of these toxins, Botrydial, was found to regulate transcription factors (TFs) that bind promoters for the genes in the plant shikimate pathway. Conversely, the expression of the shikimate pathway allows the production of the plant defense metabolite camalexin which can kill Botrytis cinerea. Using a genomic Yeast-1-hybrid and co-expression analysis, we identified 21 prospective TFs to test for their ability to regulate the shikimate pathway response to Botrytis. By analyzing mutated lines of Arabidopsis thaliana deprived of individually targeted TFs, the influence of fungal toxins on the regulation of the pathway was observed. Additionally, the statistical analysis of attributes of infected tissues with and without mutation was used to determine and quantify the detrimental effects of mutation-infection intersectionality.

The Effects of Semantic and Temporal Context on Retrieval Induced Forgetting and Facilitation

Alexa Booras
Sponsor: Charan Ranganath, Ph.D.
Psychology

Repeated testing improves retention of tested material, and it can also affect material that was not tested. Some studies show that testing increases retention of related information (retrieval induced facilitation, RIFA) but others have found the opposite result (retrieval induced forgetting, RIFO). Here, we tested whether semantic and temporal relatedness and the duration of the retention interval determines whether testing will facilitate or inhibit retrieval of non-tested information. Participants studied scene-word pairs, with each scene paired with two words. We manipulated semantic relatedness and temporal distance between word pairs. For some scenes, participants were prompted to recall a paired word. A final test was given after a short (10 minute) or long (24 hour) delay. The short delay group showed RIFA for temporally close items and RIFO for temporally far items, regardless of semantic relatedness. The long delay group showed similar results, except that RIFA was observed for temporally close, semantically related items. Results suggest that retrieval broadly improves retention of contextually and temporally linked information, but retention improvement of semantically related information is delay dependent.

Phenotypic Traits of *Plantago lanceolata* as Related to Population Structure and Herbivory

Sophie Borison
Sponsor: Jennifer Gremer, Ph.D.
Evolution & Ecology

This project is a continuation of a study on the globally-distributed perennial plant Plantago lanceolata that has been conducted annually since 2015. This study uses the protocol of Plant Pop Net, an international project, which aims to understand the factors driving the spatial dynamics of plant populations in response to climate change using data from P. lanceolata populations around the world. At our site in Davis, CA, we measured abundance and phenotypic traits of P. lanceolata for three years. Trait data included floral characteristics, phenology, morphology, and signs of herbivory. Using these data, we will compare density and herbivory experienced by different plants within our transect, as well as how how the population structure has changed over time. The results of this study can be used to further understand how plants respond to herbivory and competition, and a continuation of this study will allow us to ask questions in the future about the factors influencing these traits, including disease and climate change.

Sensors and Algorithms for CubeSat Attitude Determination

Graham Bough
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The Remote Experimentation and Analysis of LEO Phenomena (REALOPs) is a 2U CubeSat development project focused on data acquisition for use in STEM education. The objective of the Attitude Determination and Control System (ADCS) is to develop low-cost solutions that meet mission orientation and stability requirements. This presentation discusses sensors and underlying algorithms that determine the small satellite's orientation in space and controls the magnetorquer coils and reaction wheels. Attitude, location, and angular velocities are determined using a gyroscope, accelerometer, magnetometer, sun sensors, horizon sensors, and Global Positioning System (GPS). The sensor data is given in the body frame of the CubeSat. Models are used to translate attitude and rotation in the body-frame to the inertial-frame, which is then used for attitude control. An Extended Kalman Filter is utilized to combine sensor data, mitigate sensor noise, account for external forces, and proportionally weigh inputs to achieve higher accuracy with a short computation time. This is crucial for the mission objectives, which require a high degree of angular accuracy. The REALOP mission aims to develop and integrate an accurate, precise, and low-cost network of sensors and corresponding algorithms for the current and future CubeSat missions.

University Honors Program Mental Health Initiative

Christina Boyar
Sponsor: Eva Schepeler, Ph.D.
Psychology

The state of mental health among college students is an issue that has been thoroughly studied in recent years after increased public awareness. What is lacking, however, is research specifically on honors students' mental health which we suspect is uniquely at risk because of the high expectations to succeed placed on them by themselves and others. This study aims to shed light on this issue by administering a survey to students in the University Honors Program (UHP) at UC Davis asking students about their UHP experiences, their mental state, and their knowledge of campus mental health resources. The preliminary results of this investigation suggest that honors students are stressed about honors classes, lack of support from UHP staff, and program requirements (i.e. GPA). The ultimate results of this survey will be used to produce a series of mental health workshops for honors students and will provide insight to UHP staff on how to best support students in UHP. Overall, these results will serve as a starting point for shifting the culture surrounding mental health in honors students, so that future UHP students will be better prepared to manage their stress and consistently prioritize their mental health.

Age of Weaning and Post-Weaning Childhood Diets in a Late Holocene Pre-contact Site near Suisun Marsh

Erin Boyle
Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

Breastfeeding is a universal practice and hunting and gathering societies, despite being energetically costly to the mother. Well-fed children are a long-term investment as they will eventually grow to produce labor and future generations. Populations and individuals can balance the costs and benefits of breastfeeding by adjusting a range of culturally-mediated behaviors such as the age at weaning, alloparental support, and the quantity and quality of provisioned foods after weaning. Parental investment and childcare norms will affect a population's child mortality rate, the perceived importance of male and female labor, and subsistence structure. This poster presents a stable isotope analysis of human first molars from CA-SOL-11, a late Holocene pre-contact archaeological site in central California, to reconstruct sex-specific estimates for age at weaning and post-weaning diet. Results provide insight into parental investment strategies within this hunting and gathering society, and will be compared to other populations over time and space as insight into broader human behavioral strategies for breastfeeding and provisioning of children.

Weeding Out Cryptic Hosts: Investigating the Host Status of Common Weeds to the Fusarium Wilt Pathogen of Tomato

Alyssa Brackrog
Sponsor: Cassandra Swett, Ph.D.
Plant Pathology

Fusarium wilt of tomato caused by Fusarium oxysporum f.sp. lycopersici race 3 (Fol R3) is a widespread, soilborne, fungal pathogen that can cause devastating yield losses. Previous studies have shown that weeds can be symptomless reservoir hosts, allowing the pathogen to persist in the absence of tomatoes. As this study did not examine weeds common in California, the significance of weeds to Fusarium wilt epidemiology is currently unknown. This study's goal was to determine whether there are reservoir weed hosts in California tomato fields, which growers can target for control. We first evaluated host status by inoculating three 300 ft rows with a strain of Fol R3 and evaluated colonization in eleven weedy species (10 plants/species); neither localized root infections nor systemic shoot infections were detected. We then evaluated host status by transplanting five weed species into pots, and inoculating in the greenhouse in a completely randomized design using Fol R3 (5-8 plants/species; 1-2 non-inoculated controls). Analysis of colonization is underway. By identifying which weed species are hosts to Fol R3, tomato growers will be able to target specific weed species throughout the year so that the population of Fol R3 does not increase in the soil.

Single-Cell Comparison Between Antibody- and Complement-Mediated Phagocytosis

Jonathan Brand
Sponsor: Volkmar Heinrich, Ph.D.
Biomedical Engineering

Neutrophils, the most common type of white blood cell in our bodies, engulf and neutralize pathogens in a process called phagocytosis. To facilitate the detection and phagocytosis of pathogens, the host immune system tags their surfaces with IgG antibodies and complement proteins, which are then recognized by specific neutrophil receptors. An oft-cited study published in 1977 reported that antibody-mediated and complement-mediated phagocytosis are characterized by different morphological features, implying target-specific mechanistic differences between these types of phagocytosis. Since then, several publications have called this result into question. In this project, we address this controversy by studying interactions between individual neutrophils and target particles coated either with IgG or with C3b complement protein. Using our dual-micropipette manipulation technique, we brought target particles into soft contact with human neutrophils, recording videos of the resultant interactions. Quantitatively analyzing the videos yielded results about neutrophil morphology, including the cells' cortical tension and target pull-in speed. We found no significant quantitative difference between the two types of phagocytosis, which suggests that there is a definite mechanistic step where antibody-mediated and complement-mediated phagocytosis converge.

Cross-Cultural Competence in Spanish-Immersion Schools

Ceara Brashears
Sponsor: Caitlin Patler, Ph.D.
Sociology

Along with teaching bilingualism, one of the main goals of Spanish immersion schools is to promote cross-cultural competence amongst their students. However, despite aspiring to provide a setting in which students from different backgrounds can mutually benefit from cross-cultural interactions, consumptive contact theory predicts that programs with predominantly white native-English speakers (known as one-way immersions) value Spanish as a commodity. Meanwhile, intergroup contact theory predicts that programs with a more even mix of native-English and native-Spanish speakers (known as two-way immersions) value Spanish as a heritage language. Building off this research, in my comparative case study, I conducted 10 original in-depth interviews with teachers at two different schools, 5 who teach at a one-way immersion and 5 who teach at a two-way immersion. I examine how these teachers promote cross-cultural competence in their classrooms with the following research questions: How do teachers promote cross-cultural competence in Spanish-immersion schools? How does this compare across schools?

Synthesis of Imine N-Sulfonyl Substrates for the Investigation of Diastereoselective Reactions using Nucleophilic Alkenes

Martin Bravo
Sponsor: Jared Shaw, Ph.D.
Chemistry

A common way to achieve stereocontrol in organic synthesis is through nucleophilic additions to alpha chiral sp2 carbon centers. To this end, many models have been devised over the years to help organic chemists predict the stereochemical outcome for such a reaction. For example, the polar Felkin-Ahn model predicts that a nucleophile's trajectory is dictated by the preferred conformation of the alpha chiral electrophile. In the absence of chelating agents, the Felkin-Ahn model predicts anti products to be the major stereochemical outcome. However, in the presence of chelating agents, the syn product is favored as the chelation model will predict the pre-organization of the substrate and result in the nucleophile approaching from a different face of the reactive center. These aforementioned models have not been consistent in predicting the stereochemistry of alpha substituted imines. As a result further investigation is needed in order to construct a new model that applies to said substrates. Various imines have been synthesized and characterized using NMR and X-ray crystallography. These compounds have been used in nucleophilic additions in order to determine the resulting stereochemistry and what factors may affect it.

Repertoire: A New Way to Cluster Genetic Sequence Data

Samuel Brinker
Sponsor: Lynn Epstein, Ph.D.
Plant Pathology

Orthologous genes are particularly informative for determining phylogenetic groups. The presence or absence of a single nucleotide polymorphism (SNP) in a gene can reveal evolutionary changes that have taken place between two species. There are programs currently available to the public that can help identify SNPs, however, they are often limited in search capabilities or flawed in how the data is processed. Repertoire is a Python-based shell script program which utilizes NCBI's local BLAST software. Repertoire gives researchers more control of how they analyze their data, increases the number of genomes that can be examined at once, and provides optional tools for finding data of interest. Repertoire is broken up into a series of small subprograms which allows for modular analysis of genomic data. While the program was initially built to find and locate effectors used in fungal plant infection, these subprograms can be used to identify potential gene models within given genomes.

Identifying Protein Partners of SynDIG4 to Determine its Mechanism in Brain Plasticity

Jessica Briones
Sponsor: Elva Denise Diaz, Ph.D.
MED: Pharmacology

The trafficking of AMPA-type glutamate receptors (AMPAR) to the synapse is a key component in memory formation and learning. The Diaz Lab recently discovered a protein called SynDIG4 involved with this AMPAR trafficking in the brain. SynDIG4 is currently hypothesized to maintain a pool of extrasynaptic AMPARs that is later transported for use in the synapse during plasticity. Understanding the mechanism in which SynDIG4 orchestrates AMPARs for synapse development is critical for gaining insight on learning, memory, and brain plasticity. My research with the Diaz Lab aims to identify neighboring proteins that interact with SynDIG4 to further clarify SynDIG4's mechanism. By fusing BirA—a biotinylating enzyme—to SynDIG4, proteins in proximity to SynDIG4 will be tagged with biotin. This enzyme-tagging method called "protein proximity labelling" will allow identification of protein-protein interactions with SynDIG4 using affinity chromatography. I am currently validating protein expression of the BirA-SynDIG4 fusion protein in COS cells before continuing this experiment in neuronal cell culture. Identifying potential protein partners of SynDIG4 will provide clues into SynDIG4's relationship with AMPAR localization during plasticity.

Geochemical Effects of Fires on Paleoclimate Signals in a California Stalagmite

Eleana Brumage
Sponsor: Isabel Montanez, Ph.D.
Earth And Planetary Sciences

Recent increases in California fire frequency and intensity have been attributed to climatic temperature variation and aridity. To understand the link between fire activity and climate variability, we need geologic records of both. Cave calcite deposits record climate variability above a cave through trace element signatures. Biomass burning volatilizes ash-related heavy metals into the atmosphere as aerosols that are dissolved into the groundwater. Past studies have suggested certain trace elements found in drip-water to be potential fire proxies. Fire-related trace element concentrations in drip water and stalagmite analyses have the potential to affect interpretation of paleoclimate signals. We hypothesize that comparison between elemental concentrations and fire incident reports from the past year will reveal a correlation between organic matter combustion and the chemical composition of vadose zone karst systems. Here, we analyze drip-water samples and stalagmite calcite in a sub- to high-alpine, central Sierra Nevadan Cave for potential fire-related trace elements B, Na, Fe, K, Si, and Pb. By exploring relationships between elemental variation in drip water and stalagmite calcite to surface fire events, we aim to improve the accuracy of the interpretation of speleothems as paleoclimate fire records.

Optimization and Analysis of PCB Magnetorquer Coils for CubeSats

Srikumar Brundavanam
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The Remote Experimentation and Analysis of LEO Phenomena (REALOPs) is a 2U CubeSat development project focused on data acquisition for use in STEM education. The objective of the Attitude Determination and Control System (ADCS) is to develop low-cost solutions that meet mission orientation and stability requirements of the small satellite. Magnetorquer coils provide active magnetic attitude control; they are responsible for detumbling maneuvers and preventing saturation of reaction wheels. This presentation discusses the embedded magnetorquer coil design of the ADCS. Embedded coils provide a similar magnetic moment but higher heat dissipation and easier integrability than air coils; they also provide more reliable control than torquerrods. The inexpensive embedded coils are produced by CNC milling PCBs. Trend analysis of magnetic and thermal behavior is conducted to ensure accurate modeling and prediction of board properties and to optimize designs for low volume interference, low energy consumption, and high heat dissipation. The REALOP mission aims to demonstrate the utility of embedded coils and their synergy with reaction wheels for effective attitude controls.

Can point mutations in centromeric histone H3 produce haploids in tomatoes?

Ryan Buchner
Sponsor: Anne Britt, Ph.D.
Plant Biology

In the state of California alone in the year of 2018, around 10 million tons of tomatoes were grown, accounting for 230,000 acres of cropland and making it a valuable crop to the state's economy. When breeding tomatoes, as with other crops, breeders seek to create true-breeding individuals. Such plants create predictable offspring since they are homozygous for all genes, and are also important for creating hybrid lines. Generally, seven to eight generations of self-pollination are required to create a true-breeding line. CENH3 mediated haploid induction has already been proven to work in the model plant Arabidopsis, and we are working to replicate the results in tomato. In our current approach, we are using a CRISPR/Cas9 system to knock out the endogenous CENH3 and complement the mutation with CENH3 point and double point mutations to create haploid inducers. Haploid plants can be treated with spindle inhibitors to create true breeding diploid plants in one generation. We have obtained several T0 lines from the plant transformation facility and are in the process of analyzing them. Our updated findings on this project will be discussed.

Pitch Variation In Infant-Directed Speech

Danielle Bucks
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Infant-directed speech is a phenomenon in which parents speak differently to their children than to other adults. The current study examines one aspect of infant-directed speech (IDS), variation in pitch. Parents tend to speak in a higher pitch in IDS than in adult-directed speech (ADS). We are testing whether parents also use more complex pitch patterns in IDS compared to ADS. Parents participate in tasks with their infant and separate tasks with an adult experimenter. The sessions are recorded and later analyzed for the specific target words that parents were instructed to use during the tasks. Using linguistic software, the target words' pitch contours are categorized as five distinct shapes (e.g. rising, falling, rising to falling, falling to rising, flat) to determine if there is a difference in pitch category frequencies between the IDS and ADS. When speaking to infants, we expect that caretakers may use variable pitch categories (e.g., rising to falling) more often than in ADS to enrich the interaction between themselves and the child and to act as a learning mechanism for language acquisition.

Assessing Angiogenic Activity of microRNAs let-7b and miR-92a in Human Umbilical Vascular Endothelial Cells (HUVECS)

Minh Tam Bui
Sponsor: Zeljka Mcbride, Ph.D.
MED: Ophthalmology

Diabetic retinopathy involves neovascularization that causes ocular blood leakage and can lead to blindness. We wanted to test angiogenic activity of candidate microRNAs that we found dysregulated in ocular fluids of diabetic patients. A Matrigel-based tube formation in vitro assay was used to quantify the angiogenic modulatory activity of these microRNAs at different concentrations and time points. Human adult retinal pigment epithelial (ARPE-19) cells were transfected with let-7b or miR-92a at 0nM, 10nM, and 25nM. Conditioned media containing regulatory factors were collected at 12h, 24h, and 48h, then incubated with HUVECS. Tube formations were visualized using Calcein Red-Orange AM staining, ImageXpress Micro high-content screening system, and MetaXpress software. The miR-92a (25nM/24h) showed the strongest statistically significant inhibitory activity ($p<0.01$) compared to 0nM for total tube length (FC=-2.64), total tube area (FC=-3.15), and number of nodes (FC=-2.05). MicroRNA let-7b (25nM/24h) also showed statistically significant ($p<0.05$) inhibition for total tube length (FC=-1.56) and area (FC=-1.61). Generally, miR-92a demonstrated more inhibition than let-7b with the strongest at 24h. Further research of these interactions is crucial for the advancement of anti-angiogenic miRNA therapy for diabetic retinopathy.

Pitch Variation in Infant-Directed Speech

Prachi Bulsara
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Infant-directed speech is a phenomenon in which parents speak differently to their children than to other adults. The current study examines one aspect of infant-directed speech (IDS), variation in pitch. Parents tend to speak in a higher pitch in IDS than in adult-directed speech (ADS). We are testing whether parents also use more complex pitch patterns in IDS compared to ADS. Parents participate in tasks with their infant and separate tasks with an adult experimenter. The sessions are recorded and later analyzed for the specific target words that parents were instructed to use during the tasks. Using linguistic software, the target words' pitch contours are categorized as five distinct shapes (e.g. rising, falling, rising to falling, falling to rising, flat) to determine if there is a difference in pitch category frequencies between the IDS and ADS. When speaking to infants, we expect that caretakers may use variable pitch categories (e.g., rising to falling) more often than in ADS to enrich the interaction between themselves and the child and to act as a learning mechanism for language acquisition.

Characterization of a Supersonic Molecular Beam for Astrochemical Kinetics Studies

Sonja Bumann
Sponsor: Kyle Crabtree, Ph.D.
Chemistry

Observations of the interstellar medium (ISM) and star-forming regions in space have indicated the presence of complex organic molecules (COMs)—carbon-based molecules containing six or more atoms—many of which are important for biology on Earth. However, a detailed understanding of their formation and evolution in space remains elusive due to a lack of fundamental experimental data, namely chemical reaction rates at low temperatures (T<100 K). In the Crabtree group, we have recently designed a pulsed Laval nozzle which produces a uniform molecular beam via an isentropic supersonic expansion that is ideal for studying collisional processes under astrophysically relevant conditions. The molecular beam is coupled with excimer laser photolysis, chirped-pulse Fourier transform microwave spectroscopy, and laser-induced fluorescence spectroscopy to study the kinetics of gas-phase reactions involving COMs. In this presentation, we will discuss the characterization of the supersonic beam properties to verify flow uniformity and temperature, as well as the prospects for laboratory investigations of the kinetics of COMs relevant for astrophysical environments.

Studies on the Fungal Pathogen and Insect Vector of Thousand Cankers Disease, an Emerging Threat to Walnut Orchard Health and Sustainability

Andy Burk
Sponsor: Richard Bostock, Ph.D.
Plant Pathology

Thousand cankers disease (TCD) is a disease of the phloem of walnut trees that is manifested by localized lesions in the inner and outer bark. The causal agent, Geosmithia morbida, is a fungus vectored by the walnut twig beetle (WTB), Pityophthorus juglandis. Upon mass attack by WTB, numerous lesions form and coalesce leading to girdling of branches and dieback of tree crowns. TCD poses a threat to many walnut species in the USA including Juglans regia and Juglans nigra, both of which are the basis of significantly large industries. Little is known about G. morbida in regards to the molecular and genetic basis of infection. To address this, an Agrobacterium tumefaciens-mediated transformation technique was developed in which two G. morbida isolates were transformed with green fluorescent protein (GFP). Some fungi can be resistant to transformation, and previous attempts to transform G. morbida have been unsuccessful. The method we developed provides an important basis for further molecular studies of G. morbida. Transformants can be used to better understand the molecular basis of infection through utilizing gene knock-out mutants, or visualizing the progression of fungal growth within bark tissue via fluorescence microscopy. These applications can further our understanding of the TCD pathosystem.

Carbon Incorporation into Magnesium Silicate via Laser Ablation

Sally Burke
Sponsor: Alexandra Navrotsky, Ph.D.
Chemical Engineering

Carbon storage in the earth's interior is an ongoing subject of research and the question of how carbon can incorporate into silicates remains unanswered. A class of materials called polymer-derived ceramics (PDCs) have demonstrated the potential for carbon to substitute for oxygen in silicate tetrahedra. Silicon oxycarbide (SiOC) synthesized from polymeric precursers have been found to contain amorphous regions of SiC_xO_{4-x} ($x = 4$) tetrahedra. In addition, thermodynamic studies have shown that SiOC PDCs are more stable than their crystalline components. The stability of these materials suggests that they could form by other methods, including in natural geological processes. Laser ablation is one example of synthesis method that has similarity to natural processes. In this study, significant carbon incorporation is found in the product of ablated magnesium silicate. Following decades of research with collaborators across the globe, these findings add to the potential for carbon substitution into silicates to be another method of carbon storage in the earth's interior.

Culturing and Identification of Beneficial Microorganisms for Coral in *Montipora digitata*

Camille Burke
Sponsor: Raquel Peixoto, Ph.D.
UC Davis Genome Center

In recent years, coral bleaching events have become a worldwide phenomenon causing massive die-offs of reefs. Bleaching occurs when coral symbionts, which supply their host with essential nutrients, leave the coral. The term Beneficial Microorganisms for Coral (BMC) has been recently proposed to define specific symbionts that promote coral health. The aim of this study is to develop and optimize culturing strategies to grow and identify BMCs using the coral Montipora digitata. Symbionts were grown on varying media, Marine Broth Agar, Marine Broth Gelzan™ and Agar containing Coral fragments ("Coral Juice"). Isolates grown on Marine Broth Agar had the highest yield for different colonies averaging 2.9 morphotypes per plate from a 1/1000 diluted stock solution, whereas Marine Broth Gelzan™ yielded 2.2 morphotypes per plate. Gelzan™ and Agar plates with Coral Juice yielded the lowest with 2.1 and 0.6 different colonies per plate, respectively, using a 1/100 dilution. DNA was extracted from 12 colonies with visually different morphological traits, 16S rRNA genes were amplified through PCR, and sequenced for identification.

Check Out My Mixed Vape: A Chemical Analysis of E-Cigarette Emissions

Amanda Burns
Sponsor: Tran Nguyen, Ph.D.
Environmental Toxicology

E-cigarettes have become quite popular within the past few years. With little research expressing the potential harmful effects of this new alternative to smoking, consumers could be unknowingly introducing harmful chemicals to their bodies. E-cigarettes are commonly compared to traditional cigarettes in their chemical composition. However, the process for aerozilizing the non-tobacco based vape juice in E-cigarettes is different than the combustion of a tobacco based cigarette. E-cigarette juices contain a solvent composed of propylene glycol and glycerol. Different companies can also add nicotine and flavoring to this base. During aerosolization, these solvents can degrade to numerous carbon-based chemicals that consumers expose themselves to. In result, I am investigating the chemical composition of Blu E-cigarette emissions to identify and quantify potential harmful chemicals produced for future research, consumer, and industry use. Thus far, liquid chromatography-MS (LC-MS) tests have identified and confirmed the findings and concentrations of aldehydes and ketones not initially found in the chemical composition of the E-cigarette juice. Further chemical analyses, such as chemical ionization mass spectrometry (CIMS) for identifying polar gases, are to be introduced to help identify and quantify even more byproducts of E-cigarette emissions.

Conjugation of Chlamydial Immunogen to HEV Nanoparticles Towards Mucosal Vaccine Delivery

Markus Burns
Sponsor: R holland Cheng, Ph.D.
Molecular & Cellular Bio

Chlamydia trachomatis is the most common cause of bacterial sexually transmitted diseases and the leading cause of preventable blindness worldwide. Despite a century of research, there are no effective vaccines against C. trachomatis. Over 60% of the outer membrane protein mass of this bacterium comes from its major outer membrane protein (MOMP), which contains surface exposed variable domains (VD 1-4) capable of triggering an immune response. Here, we used the multivalent arms of the hepatitis E viral nanoparticles (HEVNP) for conjugation of highly immunogenic epitopes of MOMP VD1 and VD4. HEVNP is a non-infectious drug delivery platform that preserves the structural integrity of the native virus and is resistant to gastric pH and enzyme degradation. Such structural attributions of HEVNP makes it an attractive vehicle for mucosal vaccine delivery. We developed an enzyme linked immunosorbent assay to verify the presence of MOMP epitopes conjugated to HEVNP surface, using serum antibodies against VD1 and VD4. In addition, we used cryogenic electron microscopy to characterize the structure of HEVNP-MOMP construct and to evaluate epitope accessibility. Together, the structural characterization of MOMP and assay development for HEVNP-MOMP has served as a crucial step forward towards a chlamydia vaccine design.

Differences in invertebrate composition on invasive algae, *Sargassum muticum,* and native algae in Bodega Bay

Therese Burns
Sponsor: Eric Sanford, Ph.D.
Evolution & Ecology

Introducing a new species can alter existing ecological community structure; in many cases, introduced species compete and displace native species and may adversely affect the communities they support. In intertidal communities, algae play an important role in structuring invertebrate communities by providing refuge from predation and food. We hypothesize that an invasive algae will support lower overall invertebrate abundance and less diverse communities because they have not co-evolved with this algae. We tested this hypothesis in Sargassum muticum, an invasive alga that spread worldwide in the early 1900's. At our field site in Bodega Bay, We compared invertebrate communities of S. muticum with Odonthalia floccosa, a native alga. From ten samples of each algae, we measured invertebrate community composition as well as algal mass, surface area, and complexity. Invertebrate abundance was significantly higher on O. floccosa than S. muticum. There were no significant differences in species richness or diversity. We identified more unique invertebrate species on O. floccosa than S. muticum. We will also investigate a possible explanation that since S. muticum is less structurally complex, it may support fewer species. If S. muticum outcompetes native algae, understanding the cascading community effects will inform our understanding of invasions.

Relationship Between Organic Carbon Availability and Free-Living Nitrogen Fixation in Amazonian Converted Pasture and Primary Forest Soils

Corinne Butler
Sponsor: Jorge Rodrigues, Ph.D.
Land Air & Water Resources

The process of biological nitrogen fixation, in which atmospheric nitrogen gas (N_2) is converted to a biologically active form of ammonia (NH_3), is an energetically expensive process. Due to the large energy expense, bacteria metabolically capable of this process require large amounts of easily-utilized organic carbon for energy production and metabolic function. This is especially limiting to so-called 'free-living' soil nitrogen fixers, as compared to microorganisms that form obligate symbioses with plant roots. Therefore, we may expect a relationship between the amount of available carbon and the rate of fixation. Across a land use gradient in the Amazon region of Brazil, an increase in free-living nitrogen fixation is observed in converted cattle pasture compared to primary forest. To determine if these increased rates in fixation are associated with greater organic carbon availability in Amazonian soils, the POXC (Permanganate-Oxidizable Carbon) content will be measured in each sample, and compared to rates of nitrogen fixation from these soils. It is hypothesized that POXC carbon will be greater in pasture compared to primary forest soils, since rates of fixation are significantly higher in pastures. This research will serve to better understand the drivers of shifts in microbial activity with land use change.

Testing the Effects of *Trichoderma* Containing Products on G. adspersum Growth

Talia Buzel
Sponsor: David Rizzo, Ph.D.
Plant Pathology

Ganoderma adspersum is a recently introduced wood decay fungi that is very destructive to almond trees. In fact, reports have shown that orchards as young as 10 years old have been completely removed after infection. Furthermore, there is currently no known control for G. adspersum. Trichoderma, on the other hand, is a proven biocontrol that can help fight against pathogenic fungi. We tested the effect of five different Trichoderma containing products on the growth of G. adspersum. Two agar plugs from actively growing cultures of G. adspersum were placed 2 cm apart on fresh plates of malt extract agar one week prior to inoculating with Trichoderma products. G. adspersum growth was measured before and after inoculation with Trichoderma. This experiment was repeated three times. Preliminary results suggest that Trichoderma spp. may serve as effective bio-controls for G. adspersum. The most effective Trichoderma strains will be included in 2019 field trials.

Optimizing Cell Synchronization Methods to Identify Zyxin Proximal Proteins during Mitosis

Reca Caballero
Sponsor: Soichiro Yamada, Ph.D.
Biomedical Engineering

Physical forces emerged as a key regulator of tissue regeneration and homeostasis. Zyxin, a focal adhesion protein, is thought to be a molecular force sensor, yet we know very little about zyxin's role in downstream signaling. Interestingly, zyxin interacts with nuclear proteins during mitosis, suggesting a potential role of zyxin in force-activated gene regulation. By using a combination of cell synchronization and proximal biotinylation techniques, our goal is to identify zyxin binding partners in mitosis. To maximize the number of mitotic cells, cells were synchronized with thymidine and R0-33O6 treatment, and mitotic synchrony was verified using live-cell microscopy and western blot analysis. To detect zyxin binding partners, a promiscuous biotin ligase (TurboID) was fused to zyxin and stably introduced into cells. Using synchronized, mitotic cells, proximal proteins of zyxin will be biotinylated by TurboID and these biotinylated proteins will be purified and sequenced by mass spectrometry. Identification of zyxin binding partners in mitosis will be an essential clue for unraveling zyxin's nuclear role and its possible significance in force-activated gene regulation.

Building Lattices: Catalan Recursion on the External Order of Unit Interval Positroids

Jan Tracy Camacho
Sponsor: Jesus De Loera, Ph.D.
Mathematics

The Catalan numbers form a sequence that counts over 200 combinatorial objects. A remarkable property of the Catalan numbers, which extends to these objects, is its recursive definition; that is, we can determine the n^{th} object from previous ones. Matroids are combinatorial objects that generalize the notion of linear independence and have connections with other fields of mathematics. A family of matroids, called unit interval positroids (UIP), are Catalan objects induced by the antiadjacency matrices of unit interval orders. Associated to each UIP is the set of externally ordered bases, which due to Las Vergnas, produces a lattice after adjoining a bottom element. We study these lattices and the implied Catalan-induced recursion on them. Explicitly, we describe an algorithm for constructing the lattices of rank n UIPs from the lattices of lower ranks. Using their inherent combinatorial structure, we also aim to find a simple formula to enumerate the bases for a given UIP. This is joint work with Anastasia Chavez.

Effect of Diabetic Retinopathy microRNA Biomarkers on Vascular Endothelial Tube Formation Assay *in vitro*

Julia Camilleri
Sponsor: Zeljka Mcbride, Ph.D.
MED: Ophthalmology

Neovascularization occurs in the eyes of individuals with proliferative diabetic retinopathy and can lead to impairments in eyesight and eventually blindness. We are investigating the activity of microRNAs, identified as upregulated from ocular fluids of patients with diabetic retinopathy, in regulating neovascularization. We are modeling this process using an in vitro assay of endothelial tube formation by human umbilical vascular endothelial cells (HUVECs). Human adult retinal epithelium (ARPE-19) cells were transfected with microRNA mimics miR-320b and miR-486 at 0nmol, 10nmol, and 25nmol concentrations for periods of 12, 24, and 48 hours. The conditioned media from the ARPE-19 assays was collected and then plated with HUVECs. After 12 hour incubation, cells were labeled with dye and imaged to obtain tube formation images. Total tube formation length was shown to be stimulated by miR-486 at 25nmol after 48 hours when compared to ARPE-0nM ($p<0.05$). No statistically significant effect by miR-320b on total tube length was observed. This data suggests that miR-486 has a stimulatory effect on endothelial tube formation and may be linked to increased VEGF secretion by ARPE-19. Further, this data has implications for future therapies for diabetic retinopathy using microRNAs.

Carbon and Oxygen isotopes from enamel serial samples reconstruct individual mobility patterns in archaic populations in American Samoa

Alexandra Campbell-Grey
Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

Humans in small-scale societies typically change residence for a number of reasons, especially for marriage. This study aims to reconstruct individual mobility patterns in ancient populations in American Samoa, dating between 200 and 1000 years ago, using oxygen and carbon isotope signals in the serial samples from the enamel of third molars. Enamel tissue is synthesized from the water and foods we eat and it therefore reflects an individual's surroundings based on the types of resources available. Furthermore because enamel grows in layers over a number of years, we can track changes in food and water intake over a number of years, which will be related, in part, to changes in place of residence. We compare changes in isotopic signatures of males vs. females to examine differences in mobility patterns by sex. In particular, we aim to test the antiquity of the patrilocal post-marital residence pattern recorded by ethnographers in the 19th century.

Adaptation to Altitude: Reconstructing Diet and Parental Investment in the High Andes 7000 years ago

Lauren Canale
Sponsor: William Haas, Ph.D.
Anthropology

Residentially mobile hunter-gatherers occupied the archaeological site of Soro Mik'aya Patjxa (SMP) between 8000 and 6500 years ago. Research suggests that the inhabitants of SMP were among the first to permanently occupy the high-elevation Andean landscape, which causes hypobaric hypoxic stress. Understanding the cultural and genetic adaptations of these highland populations is an active area of research that is providing insights into human adaptability. We examine stable isotope signatures of carbon and nitrogen in serial samples of permanent first and third molars from six individuals to examine dietary change over the first 22 years of life with a 6-12-month temporal resolution. Teeth grow sequentially in layers and incorporate dietary nitrogen and carbon in the process, which allows us to examine dietary change. Because first molars grow during early childhood it is possible to estimate the age of weaning and the composition of post-weaning foods. Previous research suggests that delayed weaning was a cultural adaptation to physiologically challenging high-elevation environments. These serial samples will allow us to determine when this cultural adaptation began. Third molars record dietary patterns later in life, between 8 and 22 years, and thus allow us to evaluate hypotheses related to late adolescent and early adulthood subsistence adaptations.

FGF Antagonist Peptides As Anti-angiogenic Therapy For Neovascular Age-related Macular Degeneration

Sara Cao
Sponsor: Glenn Yiu, M.D.,Ph.D.
MED: Ophthalmology

Neovascular or "wet" age-related macular degeneration (AMD) is characterized by choroidal neovascularization (CNV) - the development of abnormal, leaky blood vessels that grow under the retina in eyes with AMD. Wet AMD accounts for approximately 90% of severe vision loss among those affected. Current treatments of neovascular AMD involves monthly intraocular injections of drugs such as Avastin and other medications that target vascular endothelial growth factor (VEGF). However, not all patients respond to anti-VEGF therapies so new anti-angiogenic drugs must be developed to treat this condition. In this study, we assessed the anti-angiogenic properties of the fibroblast growth factor (FGF) 1 & 2 antagonist peptides in laser-induced CNV mouse models. Animals received intravitreal injections of FGF-antagonist peptides, the anti-VEGF antibody bevacizumab, or buffered saline. Using fluorescein angiography, optical coherence tomography (OCT), and immunohistochemistry, we quantified the difference in CNV lesion size to evaluate the efficacy of FGF antagonist peptides versus current pharmaceutical treatments.

The Effects of Family Influence on Psychological Distress in Appalachia

Erica Cardinale-Lopez
Sponsor: Patricia Roberson, Ph.D.
Human Ecology

Many rural areas of the U.S. are unable to receive adequate mental health services. Rural populations face difficulties with accessibility, availability, and acceptability of mental health services, which hinders the person's ability to cope with their mental distress. Research has suggested family influence plays a role in health. With this knowledge, the relationship between family influence and psychological distress (anxiety and depression) will be analyzed through a pilot study done at UC Davis. This study surveys individuals who attended the Remote Area Medical clinic in rural regions of Appalachia with limited healthcare access. The findings of this research may provide insight into how the overall culture and beliefs in rural communities may influence the family's impact on the development of anxiety and depression in a family member. Moreover, determining whether there needs to be more mental health interventions in rural areas that focus on the family interactions should be considered to help decrease its influence on psychological distress.

An Examination of the Driving Forces Behind the Rapid Growth of China's Fintech Industry.

Juliana Carmona
Sponsor: Katheryn Russ, Ph.D.
Economics

Financial Technology better known as FinTech, is a financial service industry offering alternative financial solutions to end users through proprietary technology. The aim of this study is to examine the extent of Chinese government involvement in the growth of China's fintech industry.We examine changes in digitalization, demand and the macro-economic landscape in order to better understand industry growth. Our analysis on macro-economics and capital growth suggests that despite a slowing down of China's overall economy, FinTech is on the rise as one of China's most efficient industries. Overall, economic activity and demand for financial products is very strong in China, and the ecosystem of digital mobile users is growing amongst all demographics, making room for future industry growth. Lastly, our evidence suggests that while FinTech in China appears to function autonomously it is in fact heavily shadowed by government involvement in the form of preferential treatment for certain players.

Adult Interaction Strategies for Children with Low Language

Stephanie Carriere
Sponsor: L Harper, Ph.D.
Human Ecology

Children with little or no productive language can be at a disadvantage in social situations, such as among peers in preschool. We used a subset of videotaped observations, each 20 minutes long, from a much larger study to understand the adults' role in their social engagement. Subjects included 11 preschool children (5 female, 6 male) in 94 observations (4-10 observations per child) at a university-associated preschool during free play time. During free play, children can choose where, with what and with whom to play. We coded for adult-initiated interaction, child response, and conclusion of interaction. Our research evaluates the effectiveness of methods adults use to engage children with low language development in an activity or interaction. We hypothesize that talking alone is not enough to grasp a child's attention, and that there is a greater need for the use of touch or modeling of activities to spark interest. Data will be examined to better understand what practices adults can engage in, in order to better serve this population of children and aid their learning and social development.

Urban Desert: Landscape Anxiety in 1930s Los Angeles Literature

Maria Carroll
Sponsor: Matthew Stratton, Ph.D.
English

Los Angeles was a deeply paradoxical place in the 1930s, as it embodied both the fantasy of the American Dream and the cynicism of film noir. Novels written in and about 1930s Los Angeles, such as The Day of the Locust and Ask the Dust, draw a grim, apocalyptic picture, where pursuit of the dream is pursuit of death. They attempt to pull back the curtain on Los Angeles's dreamlike, sunny façade, and determine the source of the violence that pervades their rapidly modernizing urban landscape. Noir struggles with this modernity, and depicts the resultant feelings of loneliness or paranoia in an increasingly alienating society. Los Angeles writers of the 1930s represent the city as empty of meaning, and commonly liken it to a dream, illusion, or mirage, thanks to the city's historical roots in the frontier myth. I address the extent to which anxiety about the emptiness and corruption of Los Angeles is fueled by concerns about the extreme landscape it inhabits. Its literature finds great significance in the Southern California desert, which it connects to mythic, idealized conceptions of a bygone era, whether Middle Eastern, indigenous American, or colonial American.

Institutional Determinants of Local Immigration Policy

Vannalee Cayabyab
Sponsor: Jeannette Money, Ph.D.
Political Science

Cities across the United States have recently passed sanctuary policies to protect unauthorized immigrants from the Trump administration's increased efforts to detain and deport these individuals. However, localities must face the consequences of taking stances that are in conflict with the stances of the federal and state levels of government. These disagreements call into question the power of cities. What pressures and enables cities to pass immigration-enforcement related policies? I theorize that the proportion of unauthorized immigrants in a city and its legal structures affect its government's decision to develop and pass its own legislation or to enter into an agreement with the federal government. California hosts the largest unauthorized immigrant population in the country and grants different types of authority to general law cities and charter cities. I examine the correlation between the existence of sanctuary policies and 287(g) agreements, one pro-immigration policy and one anti-immigration policy, in 482 cities in California and each city's type and immigrant population. This research contributes to existing theories on how cities can protect their unauthorized immigrant population from federal and state forces through policy.

The Effects of Temperature on Flour Beetle Dispersal

Chloe Celniker
Sponsor: Alan Hastings, Ph.D.
Environmental Science & Policy

It is economically important to understand the effects of climate change on agricultural pests. Poikilothermic pests like insects have higher metabolic rates and are more active at higher temperatures, which suggests that pests dispersal may be affected by climate change. Local temperatures are expected to be more extreme during weather events, while global average temperatures are going to increase. Thus, climate change may give individual farmers less time to detect and react to pests. On larger, regional scales, climate change may cause acceleration in the spread of invasive pests. To study these phenomena experimentally, we use Tribolium confusum, also known as the flour beetle. Flour beetles are considered a household pest. We predict that beetles will disperse farther under stressful conditions, such as high and low temperatures. We are testing a range of temperatures between 10°C and 45°C and are comparing results to a control temperature of 31.5°C. Already we are seeing that beetles at 42°C and 20°C disperse 1.5 times farther than the control. This suggests that beetle dispersal distances are temperature-dependent. Knowing if pest dispersal rates are temperature-dependent will help farmers prepare for future climate change.

A Novel Human-Machine Interface Using Entrainment

Priscilla Chan
Sponsor: Daisuke Sato, Ph.D.
MED: Pharmacology

Entrainment is a universal phenomenon that often occurs in and between biological processes. A famous example is the flashing of fireflies. Another example is the beating of pacemaker cells in the heart. Entrainment is effective in synchronizing multiple systems and has many advantages over traditional feedback and feedforward control. One advantage is that a failure point in the network of systems does not impair the overall network. In addition, synchrony can emerge with widely different systems in the network. In our previous research, we demonstrated a novel machine-machine interface using entrainment. In this research, we aim to develop a novel human-machine interface using the entrainment mechanism. This involves a dynamical walking stick that uses Arduino, 3D printing, C/C++ programming, motors, an accelerometer, and the Fitzhugh-Nagumo equations to manipulate the motion of the walking stick, resulting in synchronization of its vertical movement with the human gait rhythm. In this presentation, we show that the entrainment mechanism would result in a novel human-machine interface.

Effects of Video Game Perspective-Taking on Societal Attitudes: How Playing with Different Game Roles Influence Aggressive Cognition, Justified Violence, Feelings of Guilt, and Attitudes about Firearms

Karen Chan
Sponsor: Jorge Pena, Ph.D.
Communication

There has been an increase in gun-related violence in America within the past decade. One key question is whether playing video games that glorify violence can influence individuals' attitudes towards gun rights and control. In our study, we designed a first-person shooter game to explore how individuals gun attitudes change from a baseline after repeated playthroughs. In order to explore "justified violence effects," individuals will be randomly assigned to play the same game as a police officer or a gang member to determine how these roles influenced players' attitudes towards gun rights and control, as mediated through aggressive cognitions. Aggressive cognitions will be measured through fill in the blank tasks. We will also measure players' feelings of guilt after playing either of these roles. Lastly, we will control for factors like game experience, gender, moral foundations, political identity, etc. Since this research is an ongoing project, we will discuss game design implications and directions for future research. The study will illustrate the connection between the individual's roles and individual's attitudes towards guns.

Enrichment of Metal Binding Peptides via Immobilized Metal Affinity Chromatography

Manesh Chand
Sponsor: Marie anne Heffern, Ph.D.
Chemistry

Peptide hormones are an important class of bioactive peptides that act as messengers between cell types to regulate biological processes such as feeding and metabolism. Metal ions have been shown to influence the activity and function of peptide hormones, potentially having significant effects on the delicate homeostasis within a biological system. Despite the importance of peptide-metal interactions, there is a lack of knowledge regarding the exact population of peptides that actively bind metal ions. To this end, we sought to develop a Peptidomics-based method to probe the peptidome for bioactive peptide hormones with propensities to bind metal ions using immobilized metal affinity chromatography. In this work, using copper(II) metal loaded iminodiacetate immobilized metal affinity chromatography resin, we demonstrated a selective enrichment model of copper(II) binding peptides from a cocktail of synthetic peptides. This approach will allow us to probe the peptidome for metal binding species under conditions of hormone stimulation.

Iteration, An interactive Design Process Guide App

Ting-Yu Chang
Sponsor: Thomas Maiorana, M.F.A.
Design Program

When encountering projects, students and designers often have to navigate through uncertainties. The process of figuring out design constraints can be confusing, afflicting and time consuming, which leads to procrastinations, and self-doubt . Eventually, people give up in the middle of their design process. These emotions are all due to the lack of proper guidance in their design process. After reading the book Solving Product Design Exercises by Artiom Dashinsky, we learned that there is a provenly good method for iterating through a project. However, merely suggesting books to designers is far from a good solution due to the linear format of book and lack of accessibility. Therefore we decided to take advantage of the smartphone platform and created Iteration. Iteration is an app that assists designers in building their own design framework by helping them understand the purpose of their project, approaches to the problem, and the execution of their designs. Users can define the value of their designs, go through each design stage systematically, upload photos of their prototypes and ideations during the process, and eventually receive statistics of overall effectiveness in their current project.

Wet-Strength Characteristics of Cellulose-Based Aerogels Formed Through A Slow Freeze-Thawing Process

Chio Chao
Sponsor: You-lo Hsieh, Ph.D.
Textiles & Clothing

Aerogels are unique 3-dimensional structures, noted for their high porosity, low density, and large specific surface area. Silica-, carbon-, and metallic oxide-based aerogels are commonly used in thermal insulations, conductive materials and as chemical catalysts, all of which, use either unsustainable materials or are formed using a costly super-critical CO_2 freeze-drying process. However, there have been increased interest in nanocellulose-based aerogels due to the sustainable and abundant nature of cellulose being derived primarily from the cell walls of plants. In 2014, a new process was purposed for forming nanocellulose-based aerogels using a freeze-dried process, where the self-assembly properties of cellulose nanofibrils are frozen repeatedly and the ice-crystal templating that occurs forms interconnected pores after drying, forming aerogels' unique 3-dimensional structure. The goal of this research was to enhanced the wet-strength of nanocellulose-based aerogels by modifying physical and chemical process of nanocellulose production for use in aerogels. There is many interest in this field due to the amphiphilic properties of cellulose.

The Abundance of Dark Matter Halos Near the Milky Way Galaxy

Sierra Chapman
Sponsor: Andrew Wetzel, Ph.D.
Physics

Dark matter is one of the most essential ingredients in cosmology but remains one of the biggest mysteries in the field. In the standard cosmological model, dark matter collapses under its own gravity into clumps known as halos. While massive halos become the sites of galaxy formation, the lowest-mass halos are expected to be starless and completely dark. Although challenging to detect, the lowest-mass halos could provide valuable information because they are the most sensitive to the nature of dark matter. A promising possibility is to indirectly detect starless halos by finding perturbations they create in stellar streams around the Milky Way. However, cosmological simulations that include gas, stars, and dark matter have found that Milky Way-like galaxies efficiently destroy nearby dark matter halos. In order to provide insight into the likelihood of halo-stream interactions, I have computed the rate of infall and time-averaged number of halos at various distances from Milky Way-like galaxies in cosmological simulations. I find that a small but detectable number of halos survive to reach the distances of stellar streams, suggesting that halo-stream interactions remain a plausible method for detecting starless dark matter halos.

Inexpensive Microfluidics Controller for RNA Sequencing

Valerie Chau
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

RNA-sequencing enables the relatively low-cost transcriptional profiling of biological samples. Heterogeneous samples, like complex tissues or environmental samples, can be sequenced to identify the different patterns of transcriptional activity present within. This type of profiling can be important in the various contexts, from medical diagnostics to environmental sampling. However, the sequencing of mixed samples does not easily allow one to associate specific patterns of gene expression to individual cells. For this single-cell sequencing is required. However, commercial tools for generating single celled sequencing libraries are expensive and therefore not readily accessible. Our project seeks to make single-cell sequencing more accessible by building a less expensive, quick, and reliable microfluidics droplet controller device. The device we are building contains micrometer-sized channels that enable the co-sorting of single cells and DNA barcoded beads into individual aqueous droplets from which uniquely-tagged sequencing libraries can be constructed. Built from inexpensive, commercially available components, this controller is under $550, easy to assemble, and user-friendly. We are in the process of validating the performance of our device using a variety of "simple" microfluidic designs. When finished, we hope that our work will provide greater access to single-celled transcriptomics for researchers both on and off campus.

Creation of a Mammalian Cell-Based Bioassay for the Detection and Quantification of Physiological Stress

Kelly Chau
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

In the field of environmental toxicology, in vitro models are becoming more common in substance toxicity studies. Historically, the gold standard for studying physiological effects of chemicals has been whole animal in vivo studies. However, these studies require substantial time, money, and resources, such as specialized facilities and expertise. Additionally, these studies expose animal to harm, and bioethical considerations require that we minimize animal suffering. Therefore we determined that mammalian cell lines were the appropriate chassis for our biosensor, since these lines are relatively inexpensive but still retain the ability to link the presence of a substance to mammalian stress. With this in mind, we designed a mammalian cell-based bioassay that reports activation of specific stress pathways via fluorescence. When exposed to chemically induced stress, mammalian cells activate complex cellular pathways comprised of many genes. By coupling the expression of enhanced green fluorescent protein to promoters from these stress-response genes, we are able to quantify the activation of these pathways in mammalian cells. Preliminary experiments have shown promising results, with one promoter-reporter construct able to detect the stress induced by one toxin at 10 times lower concentration than the threshold of the cytotoxicological limit defined by the EPA.

At 21: The Formative Research and Implementation of an Inclusive Pelvic Health Campaign

Navya Chauhan
Sponsor: Natalia Deeb Sossa, Ph.D.
Chicano Studies

Disparities exist in knowledge of cervical cancer prevention and uptake of gynecological exams among young adults. The purpose of this formative research was to develop an inclusive, student-centered public health campaign promoting pelvic health for all UC Davis undergraduates who have a cervix. To understand current knowledge around pelvic health and barriers to receiving Pap tests among undergraduates at UC Davis, we conducted two focus groups with cisgender women and sent an anonymous survey to transmasculine students. We also analyzed data from the Spring 2017 National College Health Assessment (NCHA). NCHA data showed that half of all eligible cisgender students and none of eligible transgender students had received a gynecological exam in the last year. In the focus group and survey, cisgender women reported a general lack of knowledge around pelvic health while transmasculine students reported barriers to care that included gender dysphoria and lack of trust in their providers. These data show that cisgender women and transmasculine students each have unique needs when it comes to their pelvic health. These data informed the development of “At 21,” the first -- to our knowledge -- trans-inclusive pelvic health campaign on a college campus.

Investigation Into Two Candidate Genes for Spikelets per Spike Using TILLING Mutant Populations of Tetraploid (*Triticum turgidum ssp.durum)* Wheat

Micah Chavez
Sponsor: Jorge Dubcovsky, Ph.D.
Plant Sciences

Identifying agronomically useful traits in crops as well as their underlying genes, allows for the development of superior varieties with more desirable traits and greater yield. In wheat, the gene responsible for the trait of spikelets per spike (SPS), the number of flowering structures on the rachis, is currently being identified. An increase in expression levels of TraesCS7A01G481500 (Candidate1500) and TraesCS7A01G482000 (Candidate2000) during apical development and a highly conserved amino acid sequence across many dicots, makes these genes possible candidates for the SPS trait. Using a sequenced TILLING (Targeting Induced Local Lesions in Genomes) mutant database, a splice site mutation within candidate 1500 and a premature stop codon within candidate 2000 were identified and populations segregating for each mutation were developed. Using Galaxy Software, PCR primers for dCAPS and KASP assays were designed to identify plants with either of the mutations. T-tests and Analysis of Variance (ANOVA) were used to measure whether the mutations within the candidate genes made a statistical difference in the number of SPS. In the case of both genes, high p-values for SPS suggests that the mutation did not cause a significant difference in SPS and are therefore not likely to influence SPS in tetraploid wheat.

Force-induced Recruitment of LIM Domain Containing Proteins

Joleen Cheah
Sponsor: Soichiro Yamada, Ph.D.
Biomedical Engineering

Physical force emerged as a mechanical cue for regulation of cell migration, division, and differentiation. Yet, we know very little about how physical signals translate into chemical signals that alter cellular processes. Zyxin, a LIM domain containing protein, accumulates along force-bearing actin fibers, and the LIM domains of zyxin are solely responsible for this force-induced relocalization. The LIM domain is found in many proteins with diverse sequences and functions. However, the force-sensitivity of LIM domain containing proteins has not be explored in detail. Here, we screened 18 different LIM proteins across the 14 classes in the protein family using a microneedle to mechanically stimulate cells expressing fluorescently-tagged LIM proteins. Prior to stretch, these LIM proteins localized to the cytoplasm, focal adhesions, nucleus, and actin fibers, though pre-stretch localization was not a predictor of force-sensitivity. When stretched, only the proteins with multiple LIM domains accumulated to actin fibers or focal adhesions or both, suggesting that a single LIM domain is not sufficient for force-sensitivity. Given the diversity of the LIM proteins, understanding the mechanosensory properties of their LIM domains will generate a broader understanding of how physical forces impact cell signaling and cellular responses.

Effects of Natural Disasters on Prices of Agricultural Commodity Futures

Xi Chen
Sponsor: Jeffrey Williams, Ph.D.
Ag & Resource Economics

Natural disasters, such as hurricanes, floods, drought, and extreme temperatures could result in the potential decrease in crop yields and further lead to an economic loss in the agricultural sector. Abnormal weather changes bring risks for the production of agricultural commodities and alter people's expectations on the future productions of the crops. I am interested in the responses reflected on the futures prices of agricultural commodities followed by the climate anomalies. The futures prices of related agricultural commodities, in theory, should react to the potential risks induced by the influential weather changes. Are there some disaster indices which have more significance than others with respect to their effects on the changes in the futures prices? Would factors such as the locations where the disasters happen and crop seasonality result in differences in the change of the futures prices? In order to find answers to these questions, I use the time-series data on spatially comparable climate and weather indices to examine the effects of these variables on the futures prices of corns and soybeans in the United States.

Longitudinal Analysis of Visual Attention Development in Infancy

Zhijun Chen
Sponsor: Lisa Oakes, Ph.D.
Psychology

Visual-spatial attention develops rapidly during infancy. Ross-Sheehy et al. (2015) designed the IOWA task (Infant Orienting With Attention) to assess visual attention development in infants. This task measures the speed and accuracy of eye movements under several conditions: when a target appears where a cue had previously appeared, when a target appears in a different location from where a cue had previously appeared, conditions in which the cue is completely neutral, and no cue control trials. Ross-Sheehy et al. found developmental differences in the effectiveness of the cue conditions on covert attention in infancy. Specifically, they found that older infants were more responsive to the cue than were younger infants. We used an adaptation of the IOWA task in a sample of infants tested longitudinally from 6 to 12 months. Analyzing the data from the 60 infants in our sample will allow us to determine whether we can replicate Ross-Sheehy et al.'s findings on developmental differences. We also will be able to examine stable individual differences in visual attention across the first year.

Simultaneous Heat and Mass Transfer Model to Estimate Drying Time for Wet Cowhide

Elizabeth Chen
Sponsor: Vinod Narayanan, Ph.D.
Mechanical & Aerospace Engr

To reduce heat stress that contributes to production and breeding complications, dairy cows are typically cooled by intermittent water sprays coupled with fan-induced air flow. Though the current industry standard utilises fixed on and off-cycles, efficiency may be improved by matching the sprinkler off-time to the cow drying time corresponding to real-time conditions. As few studies have theoretically investigated simultaneous heat and mass transfer associated with a wet cowhide, a finite-difference MATLAB simulation model is developed in this work to estimate drying time based on parameters such as ambient conditions and fur properties. Utilising heat and mass transfer principles such as convection correlations and the Fourier and Fick diffusion laws, this 1 dimensional transient model monitors spatial and temporal changes in temperature, water vapour concentration, and liquid water content. As an initial validation, parametric analyses indicate faster drying under hot, dry conditions and increased air speed. In addition, calibration of simulated drying times to empirical data yields consistent estimates of fur water content for a range of ambient conditions. Following project completion, this model may be then used in field testing to assess the viability of adaptive spray cycles in a real-world dairy setting.

Continuation of CHARGE - ECHO and Beyond

Alvin Chen
Sponsor: Janine Lasalle, Ph.D.
MED: Medical Microbiology & Imm

There are many factors, like chemical and socioeconomic influences, that can impact a child's health. The ECHO study stands for Environmental influences on Child Health Outcomes and is a national level project that is seeking to understand more of these environmental influences. As a part of the ECHO study, children from the CHARGE (Childhood Autism Risks from Genetics and Environments) study are being reassessed to see if there were any changes to their initial diagnosis. The CHARGE study began in 2003 and enrolled California parents and children to identify chemicals and maternal conditions that can lead to autism and developmental delay. One hypothesis of the CHARGE study is that there is an epigenetic component associated with a child's susceptibility for autism. As part of the process, we are isolating DNA from buccal and saliva samples from this cohort for DNA epigenetic analysis. Specifically, we hope to identify differences in methylation between autistic and control individuals, potentially revealing biomarkers that are associated with autism. Overall, this research could help improve a child's developmental trajectory by providing a way to predict their risk for autism early on, before core symptoms have set it.

Understanding the Plant Glycome Through Its Glycosidic Linkage Composition Using UHPLC-QqQ MS

Ye Chen
Sponsor: Carlito Lebrilla, Ph.D.
Chemistry

Carbohydrates are the most abundant biomolecules in nature and play a significant role in a variety of biological functions, in not only human beings, but also animals. Out of the 391,000 plants in the world, only 20,000 of them are known to be edible. The general focus of plant composition analysis has been primarily placed on only 5 % of the existing plants on earth. Our lab has previously generated a carbohydrate encyclopedia of several types of food and we are now targeting the remaining 95 % plants for their glycosidic linkage composition. For this analysis, 74 plant samples were acquired and homogenized. Samples were permethylated using iodomethane and sodium hydroxide in dimethyl sulfoxide. Permethylated residues were hydrolyzed using trifluoracetic acid and derivatized prior to analysis using UHPLC/QqQ-MS operated in the MRM mode. Our method was capable of monitoring over 80 glycosidic linkages in a 15-minute run. Understanding the linkage composition can allow for the potential deduction of the polysaccharide compositions in plants and establish applications towards creating better dietary fiber supplements, therapeutic products, and prebiotics.

Testing Efficacy of Baits for Fungus Gnat Traps in a Greenhouse Environment

Matthew Chen
Sponsor: Jennifer Mullin, Ph.D.
Biological & Ag Engineering

Fungus gnats (Bradysia species) are small, black flies whose larvae feed on roots and leaves resting on the surface of soil. Gnat-damaged plants may wilt or die from resulting exposure to pathogens. Seedling flats and greenhouses are particularly vulnerable to fungus gnat infestations. Most existing pest management solutions target eggs and larvae. Though adult gnats pose no direct threat to plants, each female can lay 200-300 eggs. Single-use sticky tape, the only major pest management solution targeting adult gnats, produces plastic waste. To address this dearth of solutions, our team utilized rapid prototyping techniques to design reusable, modular testing devices (i.e. traps) targeting adult gnats. Each prototype trap featured a conical lid tapering to a small aperture, a glass body with opaque sides and a transparent base, and a bottom compartment to house electronics. Traps were used to test the efficacy of baits such as apple cider vinegar and short-wavelength light to attract and trap gnats in liquid media. Preliminary field testing demonstrated the importance of environmental conditions on gnat populations, prompting further trials in order to collect statistically significant sample sizes.

Assessing Angiogenic Activity of microRNAs let-7b and miR-92a in Human Umbilical Vascular Endothelial Cells (HUVECS)

Yan Chen
Sponsor: Zeljka Mcbride, Ph.D.
MED: Ophthalmology

Diabetic retinopathy involves neovascularization that causes ocular blood leakage and can lead to blindness. We wanted to test angiogenic activity of candidate microRNAs that we found dysregulated in ocular fluids of diabetic patients. A Matrigel-based tube formation in vitro assay was used to quantify the angiogenic modulatory activity of these microRNAs at different concentrations and time points. Human adult retinal pigment epithelial (ARPE-19) cells were transfected with let-7b or miR-92a at 0nM, 10nM, and 25nM. Conditioned media containing regulatory factors were collected at 12h, 24h, and 48h, then incubated with HUVECS. Tube formations were visualized using Calcein Red-Orange AM staining, ImageXpress Micro high-content screening system, and MetaXpress software. The miR-92a (25nM/24h) showed the strongest statistically significant inhibitory activity ($p<0.01$) compared to 0nM for total tube length (FC=-2.64), total tube area (FC=-3.15), and number of nodes (FC=-2.05). MicroRNA let-7b (25nM/24h) also showed statistically significant ($p<0.05$) inhibition for total tube length (FC=-1.56) and area (FC=-1.61). Generally, miR-92a demonstrated more inhibition than let-7b with the strongest at 24h. Further research of these interactions is crucial for the advancement of anti-angiogenic miRNA therapy for diabetic retinopathy.

HMA: A New Drug for Treating Cancer

Jenny Chen
Sponsor: Kermit Carraway, Ph.D.
MED: Biochem & Molecular Med

Breast cancer is one of the most prevalent forms of cancer in US women. Nearly 30% of women diagnosed with breast cancer eventually develop recurrent disease in metastatic sites. Most primary breast tumors are molecularly and genetically diverse. This makes it very difficult to treat tumors, as each cell responds differently to treatments. Typical chemotherapeutics aim to disrupt the cell cycle by inhibiting mitosis, which causes severe damage to the cell, inducing apoptosis. However, a major challenge in cancer therapy is that some of the cancer cells become apoptosis resistant, leading to therapeutic failure. To help eradicate these apoptosis resistant cells, I present hexamethylene amiloride (HMA) as a promising new anticancer therapeutic. Through initial experiments, we have discovered that HMA does not affect normal breast cells, leaving them at almost 100% viability compared to the breast cancer cell lines, which are reduced to around 40% viability at 40 uM of HMA. Based on our in vitro assays, HMA can slow or reduce the growth of tumors compared to our control mice. If HMA is indeed a viable anticancer therapeutic that can effectively wipe out the apoptosis resistant cancer populations in tumors, we may be able to decrease cancer recurrence.

A Machine Learning Approach to Detect $Ca_V1.2$ channel clusters.

Yu-Shih Chen
Sponsor: Daisuke Sato, Ph.D.
MED: Pharmacology

Voltage-dependent L-type Calcium 1.2 ($Ca_V1.2$) channels play an essential role in heart contraction. During a fight-or-flight response, the advancement of adrenaline triggers the ß-adrenergic receptor (ßAR)/cAMP/PKA which in turn enhances $Ca_V1.2$ channels, resulting in a larger Ca^{2+} influx and thus a stronger heart contraction. Along the series of reactions, the $Ca_V1.2$ channels dynamically form clusters. Thus, accurate detection of the clusters in experiments is crucial for reaching a deeper understanding of the phenomenon. In this study, we developed a novel image processing tool to detect the $Ca_V1.2$ channel clusters. In this study, we use a neural network to detect channel clusters in 2D images. The convolutional neural network (CNN) was trained using experimental image data provided by the Dixon Lab at UC Davis. First, we normalized and extracted the image data for the neural network model by converting the data images to greyscale using the pillow (PIL) and NumPy module in Python. We stored the pixel values (0-255) in a NumPy 2D array in Python. Then, we trained the CNN through TensorFlow, which is a machine learning framework, to detect the $Ca_V1.2$ channel clusters.

Memory Accuracy for Interviews about Childhood Trauma after 20 Years

Tzu-Hsuan Cheng
Sponsor: Gail Goodman, Ph.D.
Psychology

Adults alleging child victimization are often questioned about statements made in childhood interviews. Yet there is little scientific research on the accuracy of adults' memory for maltreatment-related discussions in childhood. We had the special opportunity to investigate this issue in a longitudinal study of memory in child maltreatment victims, based on our detailed documentation of the forensic, medical, and clinical evaluation conducted two decades earlier when the adult participants were children. In this study, we examined predictors of the accuracy of 110 adults' long-term memory for a child maltreatment-related event—a documented clinical/forensic interview to assess maltreatment—experienced in childhood 20 years prior. Memory of the interview was assessed both at Time 1 (1995-97) and Time 2 (2015-17). We hypothesized that first, older age and better memory accuracy at Time 1 would predict memory accuracy 20 years later; second, psychopathology symptoms at Time 2 would predict Time 2 memory accuracy. Regression analyses indicated that Time 1 age, Time 1 free recall units correct, and Time 2 Trauma Symptom Checklist scores were significant unique predictors of memory accuracy about the interview after 20 years. Implications for a scientific understanding of long-term memory and for legal and social policy will be addressed.

Milk Osteopontin Promotes Intestinal Proliferation and Differentiation in Early Life

Tsz Yau Cheng
Sponsor: Bo Lonnerdal, Ph.D.
Nutrition

Osteopontin (OPN) is a phosphorylated glycoprotein with integrin and CD44 binding sites, and is abundantly present in both human and mouse milk. OPN can initiate signaling pathways by binding to integrins or CD44 receptors on the surface of target cells and is important in cellular proliferation, differentiation, and immune function. Since human and bovine milk OPN are resistant to in vitro digestion, we hypothesized that OPN plays important roles in intestinal development during infancy. An established mouse model was used to explore functions of milk OPN in the small intestine. Wild-type (WT) mouse pups were nursed by WT dams (OPN+) or by OPN knock-out (KO) dams (OPN-). Milk OPN is resistant to in vivo digestion shown by immunoblotting using intestinal contents from OPN KO mouse pups (day 12) fed by WT dams. Histological analysis of the villus height/crypt depth ratio showed greater stimulation with milk OPN on proliferation and more BrdU incorporation in the OPN+ than the OPN- group at day 8. Further, pups in the OPN+ group at day 30 showed more developed differentiation by having more goblet cells in duodenal villi shown by histological analysis. Our findings suggest that OPN plays important roles in intestinal proliferation and differentiation.

Altered Metabolism in High Amylose Wheat Mutants Permits Maintenance of Early Growth Under Stress

Phan Chenh
Sponsor: Diane Beckles, Ph.D.
Plant Sciences

Germinating seeds use starch stored in the endosperm for early growth and metabolism. The two different structures of starch, amylose and amylopectin, have varying digestibility. A mutation in the starch branching enzyme (SBE) yields a higher proportion of amylose. High amylose starch is less digestible, and is likely to inhibit plant growth. The purpose of this study was to examine how four different growing conditions (no light, room temperature, cold temperature, and salinity) affected seedling growth and metabolism, especially carbon partitioning, in wild type vs. SBE mutant (abAB) wheat seeds that have been bioengineered to induce a higher amylose-to-amylopectin ratio. Preliminary results show that the environmental stressors have a greater detrimental impact on the growth rate of the mutant genotype than the wild type. However, both genotypes eventually attained the same degree of growth. We therefore conclude that the abAB genotype developed a compensatory metabolic strategy to cope with high levels of amylose.

Effects of Excess Iron on Cognition in a Suckling Rat-Pup Model

Sophia Cheung
Sponsor: Bo Lonnerdal, Ph.D.
Nutrition

There have been several recent reports suggesting excess supplemental iron is detrimental to infant brain development. Little is known about the mechanisms underlying these effects. To learn more, we are investigating the cognitive outcomes of excess postnatal iron supplementation in a suckling rat-pup model, through behavior tests, gene expression, and iron status assessment. Pups were supplemented with ferrous sulfate, an iron chelate (Ferrochel), or sucrose vehicle control beginning postnatal day (PD) 2. Some pups were euthanized at PD 15, while others were supplemented until weaning and underwent behavioral testing at PD 50. By PD 15, hemoglobin and hematocrit increased significantly in the iron-supplemented groups, as well as liver and spleen iron stores. This suggests that iron absorption is under-regulated during the postnatal period. Two cognitive tests were performed: T-Maze spontaneous alternation and Passive Avoidance. Spontaneous alternation results showed no significant difference among groups for males or females. However, males who received Ferrochel had a significant increase in latency compared to those given ferrous sulfate or control, indicating improved cognitive function. Although more studies are needed to explain these results, effects of iron excess are likely form-dependent. These findings are relevant for health professionals giving advice on infant nutrition

Mathematical Modeling of Anomalous Electrical Activity in Networks of TSC1- Mutant Neurons in the Thalamus

Kyle Chickering
Sponsor: Timothy Lewis, Ph.D.
Mathematics

Tuberous sclerosis is a genetic disorder associated with mutations of the TSC gene. These mutations of the TSC gene often lead to autism, epilepsy, and other intellectual disabilities. Scientists can investigate human pathologies by genetically modifying mice to have tuberous sclerosis. Recent electrophysiological experiments in brain slices of TSC1 gene knock-out mice have identified anomalous electrical activity in networks of thalamocortical (TC) cells that could underlie the neurological deficits associated with tuberous sclerosis in human patients. We construct a mathematical model of a network of TC cells and analyze our model using techniques from nonlinear dynamics, including phase plane methods and bifurcation analysis. Our analysis identifies a potential mechanism underlying the anomalous electrical activity that involves the interaction between ionic channels and intracellular electrical coupling between neurons. Based on this mechanism, we suggest pharmacological methods for eliminating this potentially harmful electrical behavior and preventing pathological neurological activity in patients with tuberous sclerosis.

Hyperarticulation in Infant-Directed Speech

Christina Chin
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Research suggests that caregivers fluctuate their speech when directed towards infants versus towards adults (e.g. emphasizing vowels). This is known as infant-directed speech (IDS). The current study explores this by investigating whether parents hyperarticulate, or exaggerate speech sounds more clearly in IDS. Specifically, we are investigating how parents differentiate their production of “t” sounds in speech towards infants versus adults. We are coding emphasized and dulled “t” sounds (e.g. “boddle” for “bottle”) at the middle and ends of words (e.g., hyperarticulated “hat” as “hat-tuh”). We are studying word positioning in sentences (e.g. beginning or ending a sentence with a word) and its influence on hyperarticulation of target words, or items used consistently throughout the experiment. Parents engage in tasks with their infant and with an experimenter. Parents are asked to use target words, in order to encourage repetition of target words with “t” sounds. Sessions are recorded and analyzed for the “t” sound articulation and sentence positioning of target words. We predict hyperarticulation of “t” sounds in IDS because it may function as a language teaching tool. Our preliminary data with seven parents support that parents hyperarticulate more when talking to infants than to adults.

Evaluating the Effects of Early Life Exposure to the Insecticide Chlorpyrifos on Learning and Memory Using a Rat Model

Tianna Ching
Sponsor: Jill Silverman, Ph.D.
MED: Psychiatry & Behav Sci

Prenatal exposure to chlorpyrifos, one of the most widely used insecticides in the U.S., has been linked to early developmental delays such as lower IQ scores, impaired working memory, and attention deficits. The EPA almost banned the pesticide in 2015 but it is still commonly used today and therefore poses a potentially significant risk to human health. This study using rats, modeled the effects of developmental exposure to chlorpyrifos on learning and memory. Sprague-Dawley rat pups were exposed to one of three doses of chlorpyrifos (0.1-1.0 mg/kg) or vehicle on postnatal days 1-4. Juvenile learning and memory was assessed using a fear conditioning assay. Rats were trained to associate a foot shock with a specific environmental context and auditory cue. Twenty four hours later, rats were re-exposed to the context and 48 hours following training, rats were re-exposed to the cue. Time spent freezing during all three sessions was quantified. Brains were collected and analyzed via MRI. Preliminary results suggest that early life exposure to chlorpyrifos does not affect fear memory at these doses, but the neuroanatomical results are still forthcoming. Future investigations will include higher doses and tests of additional types of learning and memory.

Growing Empathy: How Reading Fiction Affects Emotional Intelligence

Shivani Chittaranjan
Sponsor: Greg Glazner, M.F.A.
English

Apart from the conspicuous advantages of reading, implications have been made that reading fiction, in particular, influences our emotional intelligence to a certain degree. 70 undergraduate students aged 17-22 were surveyed to understand the extent to which reading fiction impacts emotional intelligence. The findings of the current study reveal that reading fiction does indeed have a prominent effect on our emotional intelligence as it hones empathy skills, enables us to become more self-aware individuals and increases emotional intelligence by triggering real emotional responses. However, emphasis must be made that individuals who read fiction for more than a moderate amount of time weekly tend to experience a sense of detachment from reality. Furthermore, it is hypothesized that reading fiction might be twice as advantageous as reading non-fiction as it involves both emotional and cognitive stimulation. Moreover, fiction readers, as opposed to non-fiction readers, have an easier time relating to other individuals.

Number Discrimination in 6-month-old Infants

Rebecca Cho
Sponsor: Lisa Oakes, Ph.D.
Psychology

Because infant numerical discrimination is related to the development of later math skills, it is important to understand infants' sensitivity to number. According to core knowledge theorists, infants possess an innate Approximate Number System (ANS) that allows them to discriminate between large numbers (e.g., 6 and 18). We previously conducted a replication of a published study (Libertus & Brannon, 2010), and found - unlike the original paper - that 6-month-old infants were insensitive to the difference between arrays of 6 and 18. However, we discovered a slight discrepancy between the original paper and our replication attempt. Thus, we report a second attempt in which our procedures more closely reflect those of the original paper. If, as suggested by our first replication attempt, infant sensitivity to these differences in number is not robust, we will once again fail to observe that infants prefer the changing stream. However, even if we obtain positive results in this replication, our combined results will suggest that number discrimination in infancy is not robust, but is fragile and depends on how it is tested.

Dance and Documentary Theatre: An Examination and Abstraction of Mental Health and the Body

Tara Choat
Sponsor: David Grenke, Ed.D.
Theatre And Dance

The mind and the body are often thought about and researched in two separate categories, especially with the arts. In this project I am attempting to examine the dependence and relationship of the mind and body through dance and documentary theatre. The project has two main parts. The first involves a small group of subjects making "logs" or entries either every-day, three times a week or once a week for 10 weeks. The logs provide the subject a space in which to express themselves and their mental status through writing, speaking, dancing, drawing etc. The logs are then analyzed in order to find trends, patterns, differences, and changes in mindset from start to end. Using this data, a dance piece will be workshopped which uses aspects of documentary theatre, modern and commercial dance, and speaking. Each subject will not only have to occupy their own mental space, both past and present, but will also attempt to occupy the mental space of others. Through this research and workshopping the piece will demonstrate how powerful mental health can be on the body and how individual experiences can be shared yet unique.

Exploration for Genes Related Salmonella Killing Activity in Neutrophil by CRISPR Interference

Nawang Chokyi
Sponsor: Hirotaka Hiyoshi, Ph.D.
MED: Medical Microbiology & Imm

Salmonella enterica serovar Typhi causes typhoid fever that still continues to be a life-threatening systemic disease in many developing countries. This pathogen propagates in macrophages which allows them to successfully invade systemic organs. Unlike macrophage, some studies have shown the significance of neutrophil in combating and killing Salmonella. Specifically, neutrophil is able to produce a robust amount of reactive oxygen species (ROS) that is considered as lethal response to the Salmonella pathogen. Additionally, many other proteins produced by the neutrophil are suspected to contribute to the effective killing of the bacterium, but the functions of those proteins are still uncertain. To analyze a gene function of neutrophil killing activity, gene knockdown or knockout approach is considerable, but it has been known as difficult to edit genes in neutrophil in vitro. In this study, we evaluated whether a recently established technique CRISPR interference (CRISPRi) can silence targeted genes in a human neutrophil-like cell line PLB-985 that code potential proteins aid in the killing of Salmonella.

Cryopreservation of Santa Cruz Island Horse Fibroblasts for Cloning and Conservation

Anneka Christie
Sponsor: James Murray, Ph.D.
Animal Science

The Santa Cruz Island (SCI) horse breed, thought to be a descendant of Spanish colonial horses, is currently represented by less than fifty horses. Low population size leads to a higher prevalence of inbreeding, which may cause higher frequencies of medical issues such as degenerative suspensory ligament desmitis. In order to preserve the genetics of this small, docile breed of horse, our goal is to establish cell lines isolated from biopsied dermal tissue of all SCI horses followed by cryopreservation of the cells. A comparative study between growth kinetics of cells from older SCI horses and those of younger horses will show the effects of age in genetic preservation. The rationale for establishing a frozen cell bank is to preserve the cells for research and applications, which may include future cloning, maintenance of genetic material, and the potential to differentiate primordial germ cells. Downstream cloning of horses can be performed to increase the population size, which when coupled with selective outcrossing, may improve the genetic health of the SCI horse. Fibroblast cells have been established from two SCI horses and are proliferating quickly. These studies will contribute to the conservation of an endangered and genetically distinct breed of horse.

Effect of Temperature and Cold Stratification on Seed Germination of California Jewelflowers

Siwon Chung
Sponsor: Johanna Schmitt, Ph.D.
Evolution & Ecology

Seeds carefully exploit specialized germination strategies to better ensure their chances of survival in their natural environment. Temperature and other environmental effects, including an initial chilling period (cold stratification), have been previously investigated as factors that can trigger or delay germination. Seeds utilize various life history strategies such as primary and secondary dormancy periods to allow for optimal timing of germination to ultimately increase the probability of seedling viability. We experimentally investigated the effects of temperature and cold stratification on the germination timing of California Jewelflowers Streptanthus and closely related Caulanthus, members of the Streptanthoid complex. We exposed seeds of 12 species from 20 different populations to 6 temperatures and 2 chilling treatments. Preliminary data show that cold stratification suppressed germination in most species with few exceptions in some populations. Seed germination was relatively higher at warmer temperatures, suggesting that the optimal temperature ranged from 20°C to 30°C. We will perform further statistical analysis to determine significant differences in germination response across different species and populations.

Investigating the Genetic Basis of symbiotic compatibility between Cicer and Mesorhizobium

Joanne Chung
Sponsor: Douglas Cook, Ph.D.
Plant Pathology

Chickpea (Cicer arietinum) interacts with Mesorhizobium bacteria to form a novel plant organ: the symbiotic nitrogen (N)-fixing root nodule. Bacteria contained within nodules produce the nitrogenase enzyme, which reduces atmospheric N into ammonia that is assimilated by the plant into organic form. Efficient biological nitrogen fixation in crop legumes could replace synthetic N-fertilizer, which is costly and environmentally damaging. The genetic components of nodulation in agricultural systems are poorly understood. We use a genetic approach to understand compatibility among Cicer and Mesorhizobium. We selected two populations from interspecific crosses of wild (C. echinospermun) and domesticated (C. arietinum) chickpea to determine the genetic basis of compatibility. Parents of these crosses have extreme differences in their response to otherwise effective bacterial symbionts: cultivated has effective symbiosis with either of two bacterial species, while wild performs effectively only with its co- evolved bacterial symbiont species. Several F4 lineages will be grown and inoculated with M. mediterraneum or M. ciceri whose symbiosis phenotypes effectively distinguish the parents. By phenotyping the segregant F4 lines, the phenotypic ratios are expected to reveal the nature of genetic inheritance of the symbiosis trait. Heterozygotes will be selected for molecular marker development and quantitative trait locus mapping.

Septins constrain cortical movement of Atg9-vesicles during autophagy

Ariana Cisneros
Sponsor: Kenneth Kaplan, Ph.D.
Molecular & Cellular Bio

Autophagy is a conserved in eukaryotes that involves the formation of a double membrane autophagosome to transport cellular cargo the vacuoule or lysosome. Atg9 vesicles form at cortical ER exit sites (ERES) and traffic membranes to the autophagosome assembly site (PAS), where they are required for autophagosome maturation. Continual formation of assembly sites and autophagosomes contribute to the constant transport of cargo to the vacuole, a process referred to as “flux”. Flux increases rapidly over 12-24h before being downregulated, however the mechanisms that ensure timely downregulation are unclear. We have found that septins, a class of cytoskeletal filaments that can assemble at the ER-plasma membrane interface, rearrange during autophagy – changing from “rings” assembled at the site of cell division to “bars” arranged in multiple positions around the cell cortex. Moreover, septin mutants fail to downregulate flux from autophagosomes to the vacuole. We hypothesize that septins constrain Atg9 vesicles at ERES limiting interaction with PAS, thus acting as a brake on autophagic flux. To test this hypothesis, we will measure the motility of Atg9 vesicles at the ER cortex in wild type and in septin mutant cells.

Preventing Sexually Transmitted Infections (STIs) in Oaxaca: An Analysis of the Utilization of Condoms by Adolescents and Young Adults

Sara Cisneros
Sponsor: Yvette Flores, Ph.D.
Chicano Studies

High rates of sexually transmitted infections (STIs) in young people in Oaxaca, Mexico has led the government to implement a number of programs making preventative sexual and reproductive health care freely accessible to this demographic. However, are these services truly accessible and does accessibility equal utilization? In Oaxaca 80% of sexually active individuals will contract a STI, and there is a higher burden of death, with young people at highest risk for contracting these diseases. Through reviewing literature, observing clinics, and interviewing primary care physicians the study developed an analysis of the access and utilization of preventative sexual and reproductive health care, in the form of condoms. Condoms were chosen as the area of focus because they are the most accessible, available, and popular contraceptive method used in Oaxaca. Condoms prevent transmission of STIs and thus reduce a myriad of negative health outcomes. The study identified factors such as: age, social stigma, socio-economics, isolation, culture, and gender, that prevent access and utilization of condoms. It recognizes the limitations of condoms in preventing STIs, and concludes with suggestions on ways to increase condom use and fill the gaps of preventative healthcare where condoms fail at preventing STIs.

Adaptive Smartphone-based Sensor Fusion for Estimating Competitive Rowing Kinematic Metrics

Bryn Cloud
Sponsor: Jason Moore, Ph.D.
Mechanical & Aerospace Engr

Competitive rowing highly values boat position and velocity data for real-time feedback during training, racing and post-training analysis. The ubiquity of smartphones with embedded position and motion sensors motivates their possible use in these tasks. We investigated the use of two real-time digital filters to achieve highly accurate, reasonably priced measurements of boat speed and distance traveled. Both filters combine acceleration and location data to estimate boat distance and speed; the first using a complementary frequency response-based filter technique, the second with a Kalman filter that includes adaptive, real-time estimates of effective accelerometer bias. The estimates from both filters were validated with a 10Hz differential GPS system with better than 1cm precision, in experiments using an experienced club-level rower and an elite rower in two different boats on a 300m course. Compared with single channel (smartphone GPS only) measures of distance and speed, the complementary filter improved accuracy and precision of boat speed, boat distance traveled, and distance per stroke by 44%, 42%, and 73%, respectively, while the Kalman filter improved boat speed and distance per stroke by 51% and 72%, respectively. Both filters demonstrate promise to substantially improve estimates of important rowing metrics.

Respiratory Sinus Arrhythmia of Parent-Child Pairs in Happy-Sad Task

Danielle Clark
Sponsor: Daniel Choe, Ph.D.
Human Ecology

Self-regulation is a process of guiding one's own thoughts, feelings, and behaviors. Happy-Sad is a Stroop-like task measuring self-regulation and executive function that is more sensitive in detecting age differences in performance than other Stroop-like tasks. Respiratory sinus arrhythmia (RSA) is a measure of heart rate regulation through parasympathetic control, and is considered a physiological marker of self-regulation. Decreases in heart rate and increases in RSA are expected when participants engage with non-threatening environmental stimuli or relax in safe environments. Increases in the parent's and child's RSA values during Happy-Sad correlating with their higher task performance would suggest that self-regulation can be monitored physiologically. This present study compares RSA values of a preliminary sample of 10 preschoolers (Mean age = 50.7 months, SD = 5.3) and their parents while they complete Happy-Sad in separate rooms (compared to their RSA values at rest when they are alone) to see whether physiological control and self-regulation are related within the individual and across dyadic pairs. This ongoing study uses parent–child pairs to determine how self-regulation development is influenced by parents and psychophysiology to better understand how children adapt to different situations.

Individual Variation in Ewe Maternal Attentiveness in Response to Stressful Management Events

Patrick Cogo
Sponsor: Kristina Horback, Ph.D.
Animal Science

The early postpartum period in sheep is understood to be a critical point for bond development between the ewe-lamb pair and important for nutrient uptake in the lamb. The ewe's attentiveness at this time has direct consequences for augmentation and maintenance of the bond and is therefore critical for the lamb's future health, welfare, and performance outcome. The aim of this study is to evaluate the impact of human intervention on maternal attentiveness in ewes. In this study, trained observers will monitor 30 ewes and their offspring to record behavioral measurements pre- and post-processing in order to assess individual variation among ewes. The study will utilize a human approach test to analyze reactivity of the ewe pre-processing, and latency to interact with the lamb post-processing will be used to analyze maternal attentiveness. We expect there to be individual variation in the ewe's response to this management procedure, and anticipate a correlation between the level of reactivity pre-processing and attention oriented towards the lamb post-processing. By profiling individual behavioral responses in ewes surrounding stressful management events, this study may guide the producer to make decisions on flock selection that allow for the improvement of maternal traits and lamb survivability.

Estrogen and Prolactin Cooperatively Activate STAT5 in the Mammary Epithelium of Pigs

Julia Cohen
Sponsor: Russell Hovey, Ph.D.
Animal Science

Milk production by epithelial cells within the mammary gland (MG) is essential for the reproductive success of mammals. Hormones from the ovaries (estrogen, E; progesterone, P) and the pituitary gland (prolactin, PRL) play important roles in MG development and also cooperatively regulate milk production and the onset of breast cancer. Following a study in which we demonstrated increased proliferation of MG epithelial cells in pigs when E + PRL were administered in combination, I hypothesized that this treatment would also increase phosphorylation of the transcription factor Signal Transducer and Activator of Transcription 5 (pSTAT5). Tissue sections from the MG of n=12 peripubertal gilts treated with saline, E, PRL, or E + PRL (n=3 per treatment) were analyzed by immunohistochemistry. The proportion of epithelial nuclei containing pSTAT5 was significantly ($p<0.0001$) greater in the MG of pigs treated with E + PRL (79.5%) versus saline (2.2%) or E (0.8%). There was no effect of PRL treatment (39.8%). Understanding the cooperative actions of E and PRL improves our understanding of offspring development supported by lactation, as well as the regulation of breast cancer risk in women.

Investigating the Role of the *Caenorhabditis elegans* Structure-Specific Endonuclease MUS-81-EME-1 Complex in Meiotic Crossovers

Kelly Colbert
Sponsor: Joanne Engebrecht, Ph.D.
Molecular & Cellular Bio

During meiosis, crossovers between homologous chromosomes are essential for the first reductional division reducing the ploidy of germ cells. Double strand breaks are intentionally induced, initiating meiotic recombination, and select breaks are repaired by crossover recombination. Structure-specific endonucleases are important for resolution of double Holliday junctions for formation of crossovers. Two nucleases, MUS81 and EME1, form a complex that has Holliday junction resolvase activity and may be critical for resolution of class II crossovers. Class II crossovers have distinct properties from canonical crossovers, including lack of interference. Unlike the well-studied MUS-81, little is known about the function of EME-1 in C. elegans, as no mutant alleles are available. To address this deficiency, I am generating a mutant eme-1 worm using CRISPR/Cas-9 genome editing. I will characterize the phenotype of a null mutant for EME-1 through various indicators of reproductive success. The eme-1 mutation will also be introduced in strains with GFP tagged COSA-1, a marker of crossover progression, as well as under conditions where class II crossovers are induced. Elucidating the role of MUS-81-EME-1 complex will contribute to a greater understanding of the mechanisms of crossover recombination.

Investigating microbial isolates from *Rana sierrae* and their interactions with the virulent chytrid fungus, Batrachochytrium dendrobatidis

Jacqueline Colin
Sponsor: Jonathan Eisen, Ph.D.
Evolution & Ecology

The pathogenic aquatic chytrid fungus, Batrachochytrium dendrobatidis (Bd), has caused the decline or extinction of hundreds of amphibian species worldwide. In the California Sierra Nevada mountains, Rana sierrae (the Sierra Nevada yellow-legged frog), has experienced particularly severe Bd-driven declines with >90% of populations going extinct over the last several decades. Skin-associated bacteria provide the first line of defense for skin pathogens like Bd, either by altering the hosts' innate immune response or through direct competition with or inhibition of the chytrid. For example, one bacterium that is associated with Rana sierrae, Janthinobacterium lividum, has previously been shown to effectively inhibit Bd on other species of amphibians. By studying bacterial symbionts of Rana sierrae, I hope to identify and analyze various modes of Bd inhibition. First, I will identify 117 isolates obtained from two field work seasons using phylogenic analysis. Second, I will test each isolate's ability to limit Bd growth by conducting inhibition assays. Last, I plan to assemble and annotate genomes of the most inhibitory isolates to determine pathways of inhibition employed by the frog-associated bacteria. These inhibitory isolates and their anti-fungal gene pathways may be used as criteria for selecting bacteria for future Bd disease therapies.

Investigating the Genetic Basis of symbiotic compatibility between Cicer and Mesorhizobium

Celeste Contreras
Sponsor: Douglas Cook, Ph.D.
Plant Pathology

Chickpea (Cicer arietinum) interacts with Mesorhizobium bacteria to form a novel plant organ: the symbiotic nitrogen (N)-fixing root nodule. Bacteria contained within nodules produce the nitrogenase enzyme, which reduces atmospheric N into ammonia that is assimilated by the plant into organic form. Efficient biological nitrogen fixation in crop legumes could replace synthetic N-fertilizer, which is costly and environmentally damaging. The genetic components of nodulation in agricultural systems are poorly understood. We use a genetic approach to understand compatibility among Cicer and Mesorhizobium. We selected two populations from interspecific crosses of wild (C. echinospermun) and domesticated (C. arietinum) chickpea to determine the genetic basis of compatibility. Parents of these crosses have extreme differences in their response to otherwise effective bacterial symbionts: cultivated has effective symbiosis with either of two bacterial species, while wild performs effectively only with its co- evolved bacterial symbiont species. Several F4 lineages will be grown and inoculated with M. mediterraneum or M. ciceri whose symbiosis phenotypes effectively distinguish the parents. By phenotyping the segregant F4 lines, the phenotypic ratios are expected to reveal the nature of genetic inheritance of the symbiosis trait. Heterozygotes will be selected for molecular marker development and quantitative trait locus mapping.

Optimization and Analysis of PCB Magnetorquer Coils for CubeSats

Kylie Cooper
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The Remote Experimentation and Analysis of LEO Phenomena (REALOPs) is a 2U CubeSat development project focused on data acquisition for use in STEM education. The objective of the Attitude Determination and Control System (ADCS) is to develop low-cost solutions that meet mission orientation and stability requirements of the small satellite. Magnetorquer coils provide active magnetic attitude control; they are responsible for detumbling maneuvers and preventing saturation of reaction wheels. This presentation discusses the embedded magnetorquer coil design of the ADCS. Embedded coils provide a similar magnetic moment but higher heat dissipation and easier integrability than air coils; they also provide more reliable control than torquerrods. The inexpensive embedded coils are produced by CNC milling PCBs. Trend analysis of magnetic and thermal behavior is conducted to ensure accurate modeling and prediction of board properties and to optimize designs for low volume interference, low energy consumption, and high heat dissipation. The REALOP mission aims to demonstrate the utility of embedded coils and their synergy with reaction wheels for effective attitude controls.

Evaluating the Molecular Determinants of Kv2-dependent Induction of Neuronal Endoplasmic Reticulum-Plasma Membrane Junctions

Karen Cornejo
Sponsor: James Trimmer, Ph.D.
Neuro Physio & Behavior

Kv2.1 and Kv2.2 are voltage-gated potassium channels highly expressed in brain neurons, where they regulate neuronal electrical activity. Kv2 channels are also plasma membrane (PM) components of junctions between the endoplasmic reticulum and the PM, or EPJs. The localization of Kv2 channels to EPJs requires a Kv2-specific motif, known as the proximal restriction and clustering (PRC) domain. The PRC domain recruits the ER to the PM via a phosphorylation-dependent interaction with ER-localized VAP proteins. Furthermore, the PRC domain also restricts Kv2. localization to the soma, proximal dendrites, and axon initial segment. This property has led to the utilization of the PRC domain in optogenetic tools to restrict their subcellular localization. Our objective was to evaluate whether PRC domain-containing optogenetic tools, such as ChROME-ST, induce EPJ formation through recruitment of VAPs. We also investigated the impact of ChROME-ST on Kv2 channel distribution. We assessed this using immunocytochemistry assays, Apotome optical sectioning, and TIRF microscopy in HEK293T cells, COS1 cells, and cultured neurons. Our preliminary results suggest that phosphorylation-dependent clustering of ChROME-ST induces EPJs through an interaction with VAPs. These findings indicate that proteins fused with the PRC domain require further investigation to evaluate their impact on neuronal function.

Organizations Supporting Formerly Incarcerated Students in Higher Education

Julienne Alexis Correa
Sponsor: Christina Smith, Ph.D.
Sociology

Formerly incarcerated individuals face collateral consequence due to their stigmatized identity as former felons. These consequences include, housing, employment, and educational discrimination. As they navigate these barriers in society, it is necessary to implement support systems that will guide them through these institutions. This study examines the websites and the search results of California higher education institutions and whether they mention or offer support groups for formerly incarcerated students. Findings showed that 34.1% of California higher education institutions mentioned formerly incarcerated students with 6.4% offering a student group and 17.7% offering a funded group. Of all non-profit private colleges in California only one institution mentioned formerly incarcerated and had no data on student or funded organizations; where California State Universities had 13 mentions and 9 funded organizations out of the 23 universities. This study contributes to our understanding of the availability of resources within higher education for formerly incarcerated students with important directions for future research.

Effects of Financial Stress on Latinx Students

David Correa
Sponsor: Francisco Martorell, Ph.D.
Education

Previous research has concluded that financially stressed students are more likely to drop out of university, reduce their course load, and interrupt their academic progress. Hispanic Serving Institutions (HSI) have a total enrollment of at least 25% Hispanic students and should be more effective at serving Latinx undergraduates by limiting the aforementioned issues. The University of California at Davis (UCD) has recently become HSI eligible, therefore, it is imperative to examine problems associated with financial stress among Latinx undergraduates. An online survey was distributed via Qualtrics to learn more about the prevalence of financial stress and academic outcomes among Latinx undergraduates. Financial stress was characterized by students' access to affordable and quality food, housing, and transportation. Academic outcomes are characterized by grade point average at UCD and academic status. Additionally, the survey asked about strategies Latinx student use to cope with financial hardships. Survey responses will provide a better understanding of the financial factors that impact Latinx students at UCD, and how these factors can impact their academic performance. Findings from this analysis can help university administration understand the needs of financially stressed and Latinx students to inform policies that foster improved academic outcomes.

Interactions During Shared Book Reading: Spanish-English Bilingual Children and their Parents

Mayra Covarrubias
Sponsor: Yuuko Tonkovich, Ph.D.
Education

Past studies with preschoolers and younger, have shown that bilingual parents tend to read to their children in the language that is most spoken at home. Also, bilingual parents read in the language they are most comfortable reading in. Parents engaged their preschooler by pointing to illustrations that might relate to the child, providing yes/no questions, giving more descriptions, and providing positive feedback (Rodriguez, Hines,& Montiel 2009). The goal of this study is to understand how Spanish-speaking parents interact with older children, specifically with a kindergarten child while reading a bilingual book. The research questions are (1) What languages do Spanish-speaking parents use with their Spanish-English bilingual children when reading bilingual books? (2) What are some strategies Spanish-speaking parents engage in when reading to their children? A total of 12 Spanish-speaking parent-child dyads were asked to read a Spanish-English bilingual book, Radio Man by Arthur Dorros together. Preliminary results show that parents tended to read mostly in Spanish. When the parent engaged, they would ask questions about the text and point to the illustrations. Results suggest that bilingual books provide opportunities for parents and children to read in a language that they feel most comfortable in.

The Artwork of Kristin Cox

Kristin Cox
Sponsor: Robin Hill, M.F.A.
Art

Kristin Cox is a senior at UC Davis studying Art Studio and Art History, planning to graduate in September 2019. She loves painting and drawing and has been practicing art for 6 years. Kristin is drawn to Impressionism and how light and color play and interact together. She is fascinated by works from Monet, Degas, Rodin, Klimt, Wayne Thiebaud and Jenny Saville and how they utilize light and shadow, pattern and repetition, and contrasting colors throughout their embodiment of works. Her favorite subjects to draw or paint include portraits, figures, and organic forms, such as landscapes or nature. Kristin loves working in large scale and is currently experimenting with abstracted figures and bolder color palettes than her usual preferred pastels. After graduating, Kristin will be taking a gap year before pursuing a graduate degree in Art Therapy and Counseling. Kristin hopes to combine her love for art studio with her passion for helping people, and is excited to pursue that endeavor.

Did You Think About Studying: Metacognitive Survey Analysis Findings Across Two Cohorts

Elizabeth Cox
Sponsor: Julia Chamberlain, Ph.D.
Chemistry

Students from two different quarters of large lower-division general chemistry classes were given metacognitive surveys a week prior to each course examination, along with a survey at the onset of the quarter. These surveys asked students to think about their learning in terms of exam preparedness and a selection of learning resources. The study focuses on student reported data based on what learning resources students said they had used leading up to the week before an exam, and what resources they plan to use during the week leading up to the exam. Results from the first quarter of data show overall trends of student optimism with lower reported use and planned usage of most resources and study practices as the quarter continued. With the addition of a second quarter of data, we hope to determine either a correlation with the previous data collected, and examine any observed differences that may result between the two cohorts.

Student Farm Market Garden Production & Teaching Facility

Cassidy Craford
Sponsor: David de laPena, Ph.D.
Landscape Architecture and Sustainable Environmental Design

The Student Farm Market Garden at the University of California Davis runs a Community Supported Agriculture (CSA) program, donates to campus organizations, sells to the Dining Commons/Coho, and provides experiential learning opportunities to students, but lacks a physical building space to support the growth and improvement of these initiatives. In order to increase production, efficiency, and learning in the Student Farm Market Garden, our team partnered with the Student Farm community to design a Production and Teaching Facility. This facility would (1) provide space and equipment to wash, package, and store produce, (2) act as a student gathering area, and (3) support community engagement and youth education programs. The design reflects the inclusive, creative, and productive Student Farm community and aims to provide a sustainable solution to the community's needs. In this presentation, we will present our design deliverables including documents, drawings, and models of the facility intended to inspire private funding.

To Feel or Not to Feel: Testing Guilt Response to Artificial Actors in the Milgram Paradigm

Matthew Craig
Sponsor: Jorge Pena, Ph.D.
Communication

Stanley Milgram's studies revealed that seemingly normal individuals obeyed the commands of an authority figure that tasked them with administering increasing or even lethal electric shocks to a partner that failed to provide correct answers in a learner-student task. This effect has been seen when people interact with synthetic agents and video game characters. Our project aims at recreating Milgram's experiment but with a twist. First, does becoming a moral, immoral, or amoral game character (i.e., hero, villain, antihero) through avatar customization affect the likelihood of participants completing the study via social priming mechanisms? Second, how do participants behave when they are under the assumption that they are shocking a potentially sentient (i.e., a non-player character that has feelings and can create memories)? For our experiment, we modified the game Fallout 4 to meet our needs. We discuss how researchers can leverage commercial video games to test hypotheses in the social sciences and also how we will measure participants reactions to the situation described above. We plan to measure the level of shock administered and participants guilt response. We also discuss how priming, players' moral foundations, and perceived synthetic agent anthropomorphism may influence participants' willingness to harm a synthetic agent.

"In God We Trust": Religious Opposition to the Vietnam War and the Birth of the Bay Area Sanctuary Movement, 1971-1972

Julianne Cravotto
Sponsor: Kathryn Olmsted, Ph.D.
History

In 2017, the Washington Times reported that five hundred American cities adopted sanctuary laws. Yet in 1971, Berkeley became the first city following demands for sanctuary from soldiers of the Vietnam War and local clergymen. Thus, the modern sanctuary movement began as eighteen parishes in the Bay Area formed the Sanctuary Caucus, providing legal counsel to soldiers who wished to obtain conscientious objector status. Consequently, these parishes united with the secular Left, the counterculture, and students to demonstrate their solidarity with draft resisters and to oppose federal law. In forming a united front, these parishes raised questions concerning the role of religion in politics and civil disobedience. By analyzing conscientious objector laws, Gallup data on religious groups' political views, and the archives of prominent figures such as Robert McAfee Brown and Gustav Schultz, this research aims to understand the factors behind religious opposition to the Vietnam War in the Bay Area, examining the local and national conditions which made it the testing ground for sanctuary law. Moreover, this study depicts the Vietnam crisis as the prototype for the recent sanctuary movement involving Latin American refugees and undocumented immigrants, challenging the common association of American religion with political conservatism.

Identifying Pain in Dairy Calves: Effects of Hot-Iron Disbudding on Behavior

Danielle Cruz
Sponsor: Cassandra Tucker, Ph.D.
Animal Science

Hot-iron disbudding is a common practice of preventing horn-producing tissue from growing via cauterization in young calves. It is well established that the procedure itself is painful; however, less is known about what calves experience in the days or weeks afterwards. To evaluate if pain was still present around the time the initial scab loosens, we tested whether pain-related spontaneous behaviors were reduced in dairy calves receiving a local anesthetic 11 days after disbudding. Disbudded female Holstein and Jersey calves (n=24) were randomly assigned to an experimental or control group, receiving an injection of local anesthetic or saline, respectively, near each disbudding wound. They were then filmed for 75 minutes, and these videos were analyzed for pain-related behaviors such as head-shaking, ear-flicking, and tail-flicking. We hypothesized that pain would persist 11 days-post-procedure, and calves with anesthetized disbudding wounds would display less pain-related spontaneous behaviors than calves that received saline.

The Role of PTIP/PIS-1 in Repair Choice During Meiosis in *Caenorhabditis elegans*

Lorena Cruz-Gutierrez
Sponsor: Joanne Engebrecht, Ph.D.
Molecular & Cellular Bio

Eukaryotic cells repair DNA double-stranded breaks (DSBs) by one of two major repair pathways: non-homologous end-joining (NHEJ) and homologous recombination (HR). The repair pathway for DSBs is critical for genome maintenance, particularly during meiosis, where DSBs are intentionally induced for crossover formation. In somatic cells, a DNA binding protein, 53BP1 (C. elegans HSR-9) interacts with two other proteins, RIF-1 and PTIP (PIS-1), in a complex by localizing to the site of DNA damage and protecting it from resection to favor NHEJ; however, its role in meiosis is unknown. I hypothesize that PTIP functions with 53BP1 to promote NHEJ during meiosis in C. elegans. 53BP1 mutant male and hermaphrodite worms displayed elevated levels of RAD51, a recA recombinase that plays a major role in HR, compared to wild-type worms consistent with a role for the 53BP1 complex in repair of meiotic DSBs through NHEJ. I am currently examining whether pis-1 has a similar phenotype, by generating a degron allele to selectively target PIS-1 degradation during meiosis. These studies will determine whether 53BP1 and PTIP function together in a complex to promote NHEJ during meiosis.

The Effects of Computers in the Classroom

Kristen Cui
Sponsor: Giovanni Peri, Ph.D.
Economics

Studies have linked college attendance as well as major and college choice to greater intergenerational mobility in America. In particular, STEM majors, compared to other majors earn the highest salary initially and over the course of their careers but historically there has been an under-representation of women and non-Asian racial minorities in STEM degree attainment. My research focuses on analyzing computers in the classroom as a possible factor for choosing a STEM major and attending college. This focus is unique because it focuses on computers' effects on learning outcomes such as major choice and college attendance rather than its effects on test scores and academic performance. Using individual data from the NCES Educational Longitudinal Study of 2002, I use regression analysis to study computer placement in the classroom as well as in school facilities such as in libraries or computer labs and its impact on major choice or college attendance on two groups of students: those who have computers at home and those who do not. Identifying computers within the classroom as a possible effect on learning outcomes could help shape education policy moving forward.

Small-Scale Bioprinter Used in Production and Purification of Protein-Based Pharmaceuticals

Israel Curry
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

Existing technologies for the production and purification of protein-based pharmaceuticals, such as bioreactors, centrifuges, and filtration systems are large and not considered suitable by NASA for use in early outposts on the Moon or Mars. This project addresses whether small-scale bioprinting can be a component of space exploration and support production of protein-based drugs. To test this concept we modified a Monoprice MP Select Mini 3D Printer and designed a syringe extruder attachment that prints hydrogel instead of plastic. We have made changes to the hardware code using Arduino IDE, which lets us program settings for the 3D Printer. The bioprinter will eject hydrogel with transgenic rice cells that have been engineered to produce enzyme butyrylcholinesterase (BChE). BChE has detoxifying properties for organophosphate nerve agents, pesticides and the metabolism of cocaine, heroin and aspirin. We have demonstrated that rice cells can live immobilized in hydrogel for over 30 days after being extruded from the bioprinter and maintained in growth media. We are working on formulating hydrogel of optimal pore size that both suspends cells and maximizes enzyme secretion from the gel.

Uncovering the Structural Basis of TORC1 and TORC2 Specificity and Assembly

Andrew Cuyegkeng
Sponsor: Edmund Powers, Ph.D.
Molecular & Cellular Bio

Cells undergo regulated growth and proliferation. When the mechanisms that control growth are disturbed, diseases such as cancer may arise. Tor is a protein kinase that regulates cell growth and functions by assembling into two protein complexes, TORC1 and TORC2. These complexes control processes essential for growth, including protein synthesis and gene expression. In the model eukaryote, budding yeast, two Tor kinases exist, where Tor1 assembles exclusively into TORC1 and Tor2 assembles preferentially into TORC2. The structural reasons for these preferences are not well understood, but this bifurcation in yeast provides a system to explore the structural elements within Tor1 and Tor2 that determine complex specificity. Through the interactive visualization software UCSF Chimera, we identified the presence of a potential minimal assembly domain: a small region in the Tor kinases that we hypothesize is capable of conferring TORC1/2 specificity. By constructing chimeras that include specific Tor1 and Tor2 sequences, we are testing whether this minimal assembly domain confers TORC1/2 specificity using both genetic and biochemical approaches. The specific mechanisms for Tor complex assembly have eluded researchers for many years, but this project may yield further insight into complex specificity.

The Risk of *Fusarium Oxysporum* f.sp. Fragariae Colonization of Raspberry Crop Residue

Leah Dajani
Sponsor: Thomas Gordon, Ph.D.
Plant Pathology

Fusarium oxysporum f. sp. fragariae (Fof) is a fungal pathogen of strawberries, resulting in the collapse and death of the plant. Fof is able to survive in soil and crop rotation is used to reduce the soil population. This strategy will only be effective if the pathogen does not colonize living tissue of rotation crops or residue incorporated into soil. Because raspberry may be grown in rotation with strawberry, it is of interest to know if Fof is capable of colonizing raspberry tissue. To make this determination, leaf disks of raspberry were buried in soil infested with a hygromycin resistant strain of Fof. An experiment included four pots of soil, each with ten disks of raspberry, for a total of forty disks. After five days in moist soil, disks were removed and placed on a selective growth medium. Colonies emerging from leaf disks were tested for hygromycin resistance to determine if they were Fof. The results showed that most raspberry disks were colonized by Fof, indicating it is competitive with other fungi commonly found in soil. For this reason, raspberry may allow Fof to increase in soil, increasing the risk of damage to a subsequent strawberry crop.

SUMO Modification of Msh4 Regulates Meiotic Crossing Over

Brian Dang
Sponsor: Neil Hunter, Ph.D.
Microbiology & Molec Genetics

Meiosis produces haploid gametes (sperms and eggs) from diploid precursor cells through two successive rounds of chromosome segregation. Accurate segregation of homologous chromosomes at the first meiotic division requires chromosome pairing, synapsis and crossing over. Defects in meiosis are a leading cause of infertility, pregnancy loss and congenital disease in humans. SUMOylation is a post-translational modification involved in the regulation of many aspects of nuclear dynamics and chromosome metabolism. Recent studies have demonstrated a critical role of SUMOylation in the regulation of meiosis. Our long-term goals are to discover specific targets of SUMOylation during meiosis and understand how SUMO regulates their function. The Msh4 and Msh5 proteins form a heterodimer that facilitates meiotic crossing over by stabilizing the DNA joint-molecule intermediates. In this study, we identify budding yeast Msh4 as a SUMO target and show that SUMOylation is important for the crossover function of the Msh4/5 complex. Insights into how SUMOylation modulates the function of Msh4 will also be presented.

***Carrot mottle virus* as a Viral Vector to Express GFP in Plants**

Stephen Darodda
Sponsor: Bryce Falk, Ph.D.
Plant Pathology

An important part of maintaining healthy crops is protecting them from insects that transmit pathogens. While transgenic plants can be made that are harmful to insects such, as Bt Corn, that solution is not always desirable. An alternative to creating transgenic plants is using a virus as a vector to express proteins and peptides, which are selectively toxic to specific insects, in plants. This project is concerned with creating an infectious, transgenic clone of Carrot mottle virus (CMoV) that is capable of expressing proteins of interest in plants. CMoV is a positive sense single stranded RNA (+ssRNA) virus in the family Tombusviridae and can be found in California. In order to have the proteins of interest expressed in plants, the corresponding genes must first be inserted into the genome of CMoV. However, because CMoV has not been used as vector before, the method of successfully inserting genes must be determined. Green fluorescent protein (GFP) is an ideal protein to test for possible insertion sites and strategies because of its ease of detection as a marker. Repeatable systemic infection of the transgenic CMoV with GFP expression throughout the plant is indicative that CMoV has successfully been converted into a viral vector.

Asking for Help: The Influence of Hints on Children's Memory Decisions

Jacqueline Davila
Sponsor: Simona Ghetti, Ph.D.
Psychology

Metamemory, or the ability to evaluate and self-regulate one's memory, develops throughout middle childhood and is recognized as a critical skill in effective learners (Donker et al., 2014). Metamemory can benefit children's memory performance by helping children determine when they are uncertain and need help. In the current study, we investigated whether encouraging children to actively ask for recommendations would improve children's metamemory ability. Children ages 5-, 7- and 9-years-old (Current N=143, Projected N= 156) completed a recognition memory task during which reliable cues (75% valid, 25% invalid) were available. Participants were either always provided with cues (given condition) or chose which trials they wanted to use the cues (ask condition). Metamemory was measured using confidence ratings which were provided after each memory decision. We predict that children in the ask condition will have better metamemory and benefit more from the recommendations relative to the given condition, because choosing when to ask for help may encourage children to engage in greater self-reflection compared to a situation in which help is given independent of children's requests. This study provides insight into the development of metamemory strategies and children's ability to regulate their learning.

Presence, diversity, and abundance of neotropical migrant and resident birds at the Desert Studies Center.

Francine De Castro
Sponsor: Rebecca Hernandez, Ph.D.
Land Air & Water Resources

The Desert Studies Center (DSC) just south of Baker, California is an oasis on the western side of the Mojave National Preserve. Home to the endangered Mojave Tui Chub, the DSC's two man-made ponds, including the tamarisk and mesquite that grow around them, provide important habitat for both resident and neotropical migratory birds. Since these efforts began in 2015, 22 different species of birds have been banded at the DSC using USGS BBL bands. Banding has occurred every year since 2015, for a period of 2-5 days during the end of May, from sunrise to 90 deg F and in the evenings from <90 deg F to 8PM. A total of 131.5 net hours over the last four years yielded a total of 100 captured and banded birds- a combination of 15 neotropical migrant species, and 7 Mojave residents species. Morphometrics and evaluations were recorded for each bird per USGS BBL standards, and the vast majority of birds were determined to be AHY. This poster will highlight the diversity and abundance of the resident and neotropical migrant birds at the DSC per the data collected over our study period.

War of the Spirits: A Psychological Analysis of Modern Demonic Deliverance Prayers

Francesca De Las Alas
Sponsor: Naomi Janowitz, Ph.D.
Religious Studies

Demonic beings and evil spirits have existed since antiquity. New Testament literature depicts the grand tales of Jesus and his disciples "casting out" demons and healing those burdened by its emotional, mental, and physical manifestations. Whether it be one, legions, or Satan himself, the demonic beings afflicting the early church evidently demonstrate to the modern Charismatic church that the reality of evil spirits exists beyond the pages of the New Testament. This present study aims to understand the community's interaction with evil spirits and works to propose the psychological functions of identifying demons by means of psychodynamic language. By focusing on Bethel Church in Redding California, this study will analyze how the "spirit of fear" and its colleagues ("spirit of grief", "spirit of depression", etc.) operate to preserve ego orientation as part of individual identity and function as a boundary maintenance mechanism as part of communal identity. With the support of the self-discrepancy theory and corresponding boundary maintenance theories, the discussion of Bethel's demonic deliverance prayers will provide a more holistic understanding to the role of evil spirits in the modern Charismatic faith.

Physiological and molecular assessment of thermal tolerance of *Lytechinus pictus*

Erin de Leon Sanchez
Sponsor: Lynne Arcangel, M.A.
Graduate Division

Ocean temperatures are rising due to climate change, testing many marine organisms' physiological thermal tolerances. Marine organisms with planktonic larval stages are especially vulnerable since they experience large variations in environmental parameters. Lytechinus pictus, the painted sea urchin, has a range that spans from central California to Ecuador. Little is known about L. pictus's thermal tolerance limits and extent for plasticity. We investigated thermal tolerance and heat shock protein expression of L. pictus larvae in the pluteus life stage. Urchins were collected in the Santa Barbara Channel, spawned and reared at 17°C or 20°C. Larvae were then subjected to temperatures ranging from 22°C to 35°C to examine high-temperature induced mortality rates. Separate larvae were heat shocked at 25°C, 28°C, 30°C, and 31°C for gene expression analysis via qPCR. Thermal tolerance data shows 100% mortality at 31°C, indicating the upper threshold of L. pictus's thermal limits. Gene expression analysis reveal increases in hsp70 and actin expression between 25°C and 28°C, regardless of rearing temperature, suggesting there is no plasticity in thermal tolerance abilities based on previous larval thermal experiences. These results shed light on how L. pictus responds to thermal stress and its ability to live in our future oceans.

Mechanistic Characterization of Tomato DDB1-DDA1 Ubiquitin Ligase Complex

Samuel Deck
Sponsor: Nitzan Shabek, Ph.D.
Plant Biology

Cellular levels of proteins are determined by rates of synthesis and degradation. The central events in the protein degradation process is the recognition and attachment of ubiquitin molecule to the target protein by a family of enzymes called Ubiquitin Ligases. A group of Ubiquitin Ligases contains the protein DDB1 that serves as a module to recruit targeted proteins for destruction. Interestingly, DDA1 has been shown to be a core component of DDB1 protein complex and its mutant has been implicated in multiple diseases. Yet the exact function of human DDA1 in the DDB1 complex remains unexplored. Plant DDB1 mutants are characterized by exaggerated light responsiveness. Here, we provide a structural analysis of DDB1-DDA1 and demonstrate that tomato DDB1 mutant displays a mutation at the same interface human DDA1 binds. This raises the hypothesis that like the human complex, plant DDB1-DDA1 may share a similar structural interface with yet unknown function. Here we use molecular and biochemical tools to produce tomato DDA1 and DDB1 proteins to decipher the role of DDA1 in Ubiquitin Ligase activity of DDB1 complex. This work will establish DDB1-DDA1 structural interrogation studies and will potentially uncover the function of DDA1 in human DDB1 complex.

Wood Decay Growth Variation in *Ganoderma* Species

Caleb Dedmore
Sponsor: David Rizzo, Ph.D.
Plant Pathology

Ganoderma is a genus of wood decay fungi that is a common cause of rot in trees, including butt rot in almonds. 80% of the world's almonds are produced in California, and Ganoderma adspersum, an especially aggressive species recently introduced from Europe, presents a threat to the industry in the near future. It has already been identified in many orchards, and surveys are underway to monitor its rate of spread in California. However, identification of Ganoderma to the species level can be difficult, as the different fruiting bodies amongst them, if even present at all, are very similar. In culture, growth patterns of Ganoderma vary depending on the growth media used. The purpose of this study is to observe the effect of different nutrient medias on the growth pattern of different Ganoderma species and to specifically identify and describe these differences.This experiment will better enable diagnostic labs to positively identify Ganoderma cultures to the species level, which will in turn help in finding ways to prevent the fungi from negatively impacting agricultural practices and food production.

The Mechanism of Recombination-Associated DNA Synthesis During Meiosis

Saum Dehleh Hossein Zadeh
Sponsor: Neil Hunter, Ph.D.
Microbiology & Molec Genetics

Meiosis is a cell division whereby haploid gametes are formed from diploid cells. During meiosis, homologous recombination mediates chromosome pairing and crossing over to connect homologous chromosomes and ensure accurate segregation. Failure to form crossovers and uniformly segregate chromosomes can cause aneuploid gametes, resulting in infertility, miscarriage and birth defects. Although the mechanism of meiotic recombination has been extensively studied, the intermediate steps that require DNA synthesis remain poorly understood. Recombination-associated DNA synthesis (RADS) is difficult to study in vivo because DNA replication factors are essential for cell viability, and because it is difficult to disentangle DNA synthesis associated with recombination from that of meiotic chromosome replication. We are using novel molecular tools in budding yeast to inactivate RADS within synchronized meiotic cultures. Using these tools, we found that DNA synthesis is required for chromosome synapsis and formation of double Holliday junction recombination intermediates, both of which are required for crossing over. I aim to determine whether DNA synthesis is necessary to stabilize recombination intermediates following initial DNA strand invasion to prevent them from becoming vulnerable to unwinding by DNA helicases and/or degradation by exonucleases. These studies provide the first glimpses of the molecular mechanism of meiotic RADS in vivo.

Characterizing ERMES Subunit Function and Architecture in Mitochondria

Martha Delaney
Sponsor: Jodi Nunnari, Ph.D.
Molecular & Cellular Bio

Organelle contact sites between mitochondria and another major endomembrane, the endoplasmic reticulum (ER) have emerged as central players in mitochondrial function, including ER-associated mitochondrial division (ERMD), ion and lipid homeostasis, and mtDNA distribution. A well-characterized ER-Mito membrane contact site found in budding yeast is the ER-Mitochondrial Encounter Structure (ERMES). ERMES is implicated in both ERMD and mtDNA distribution within yeast cells and is thought to transport lipids in vivo by forming a physical linkage between the ER and mitochondria. An ancillary component tightly associated with the ERMES complex, Gem1 regulates ER-mitochondrial contact sites via ERMES assembly and/or facilitates mitochondrial motility that follows ERMD. To determine the mechanistic role of ERMES and Gem1 in ERMD, we took a structure-function approach in budding yeast. Specifically, we constructed wildtype and mutant GFP-tagged versions of all ERMES subunits and examined localization compared to the ER and mitochondria by live cell confocal and super resolution microscopy. Our data may suggest a model in which ERMES is assembled in vivo de novo or in a templated manner and determine if/how Gem1 regulates ERMES complex formation and potentially ERMD.

Competiton Between *Ganoderma* Species

Emma Delp
Sponsor: David Rizzo, Ph.D.
Plant Pathology

Almond growers in the Madera, Tulare, Kings, Fresno and Kern Counties of California have had to remove thousands of acres of orchards due to a recently introduced wood decay fungus, Ganoderma adspersum. This fungus decays the butt of almond trees and causes them to be blown down in their prime production years. However, there are other endemic California Ganoderma species including G. polychromum, G. brownii, and G. applanatum that have not posed problems to almond orchards although their geographic range overlaps. It is unknown what happens when different species infect the same tree. To explore this, four Ganoderma species were paired to create all possible combinations including with themselves. Two agar plugs of actively growing Ganoderma cultures were placed 2 cm apart on malt extract agar and incubated at room temperature for 1 month. Observations of growth and interactions were recorded weekly. We expect to find differences in their growth patterns and interactions when the fungi cultures compete with each other.

Phenotypic Traits of *Plantago lanceolata* as Related to Population Structure and Herbivory

Sabrina Denton
Sponsor: Jennifer Gremer, Ph.D.
Evolution & Ecology

This project is a continuation of a study on the globally-distributed perennial plant Plantago lanceolata that has been conducted annually since 2015. This study uses the protocol of Plant Pop Net, an international project, which aims to understand the factors driving the spatial dynamics of plant populations in response to climate change using data from P. lanceolata populations around the world. At our site in Davis, CA, we measured abundance and phenotypic traits of P. lanceolata for three years. Trait data included floral characteristics, phenology, morphology, and signs of herbivory. Using these data, we will compare density and herbivory experienced by different plants within our transect, as well as how how the population structure has changed over time. The results of this study can be used to further understand how plants respond to herbivory and competition, and a continuation of this study will allow us to ask questions in the future about the factors influencing these traits, including disease and climate change.

Understanding how Deepfake Videos Deceive People: An Exploratory Study.

Michael Diabali
Sponsor: Cuihua Shen, Ph.D.
Communication

Deepfake technology has the potential to drive disinformation at an exponential rate and is considered to be the greatest modern threat to any society. More advanced than any combination of "Fake news" and Photoshop; Deepfake is a form of unsupervised deep learning (General Adversarial Network) which uses Artificial Intelligence to modify both video and audio in order to deceive its audience • One of the greatest challenges to reducing the harmful effects of Deepfake is its resilience against detection by adapting to correct its errors, a unique characteristic of unsupervised machine learning. Therefore, our work will focus on a cognitive-based approach. Our aim is to first understand the strength of deception by presenting currently available Deepfake videos to participants and recording their response. We suggest this as a starting point from which we can then identify alternative solutions to capturing Deepfake videos before they can spread across a population or society • Equally threatening is the growing ability for new actors to gain the understanding, skills and software necessary to develop their own Deepfake videos. Considering this, along with the speed at which the internet distributes information, a peak in disinformation can lead to irreversible social effects.

Effects of solar energy development on the biosphere: An overview of *Wild Energy Initiative* research projects in the Mojave Desert

Suellen Dias
Sponsor: Steven Grodsky, Ph.D.
Land, Air and Water Resources

Solar energy contributes to global decarbonization and mitigates climate change by reducing greenhouse gas emissions. However, its development is an anthropogenic driver of land-use and land-cover change, especially in desert ecosystems of the Desert Southwest. To address urgent sustainability issues, undergraduate researchers are assisting the Wild Energy Initiative to better understand effects of solar energy development on wildlife in the Mojave Desert, using the Ivanpah Solar Electric Generating System (ISEGS)—one of the world's largest concentrating solar power plants—as a case study. We are investigating the response of desert kit foxes (Vulpes macrotis arsipus) to an altered thermal landscape and habitat modification using a combination of camera trapping and geospatial analyses. We are using environmental sensors, camera trap arrays, field measurements, molecular analyses, and remote sensing to study effects of the habitat alteration on a trophic system involving soils, Mojave milkweed (Asclepias nyctaginifolia), queen and monarch butterflies (genus Danaus), avian predators, and parasitoids/parasites to elucidate species-species and species-process interactions that inform on ecosystem responses to solar energy development. Additionally, we are studying effects of human-modified habitats at ISEGS on pollinator populations. Here, we present an overview of these current projects, along with preliminary findings and future research directions.

The Effect of Milk from Lactoferrin Trangenic Cows on the Fecal Microbiota of Young Pigs

Yulissa Diaz
Sponsor: Elizabeth Maga, Ph.D.
Animal Science

Despite numerous advances, the problem of malnutrition continues to be a risk factor in children of many underdeveloped countries. Malnutrition, can negatively impact the intestinal epithelium by decreasing nutrient absorption, and making it more susceptible to diarrheal illnesses caused by pathogens. An attempt to combat these affects is through the use of milk containing human lactoferrin (hLF). Lactoferrin is a glycoprotein present in human milk that has antimicrobial properties that have been thought to promote a healthy epithelium. Using a pig model of malnutrition, as they closely resemble the digestive tract of humans, feces were collected from the experimental malnourished pigs after three weeks and again after five weeks. These groups consisted of full fed (controls), malnourished (no milk), cow milk group, and hLF milk group. These samples will then be run under a polymerase chain reaction to amplify the DNA. The samples will then be barcoded and sorted into bacterial groups based on taxonomy. The overall goal of this project is to determine if the lactoferrin protein positively influenced the microbial populations in the gut compared to cow milk in attempts to recover the state of a healthy epithelium.

Kelvin Waves on a Superfluid Vortex Core

Andrew Diggs
Sponsor: Rena Zieve, Ph.D.
Physics

Near 2 Kelvin helium undergoes a phase transition to a unique state known as superfluid. One the particularly interesting characteristic of superfluid are the quantized vortices that arise from angular momentum imparted on the system. We study the behavior of a superfluid vortex stretched between a wire and the wall of a cylindrical container. The wire is used to both excite and measure the vortex. Excitations of the wire result in oscillations of the vortex core know as Kelvin waves. Measurements of the amplitude and frequency of these waves are used to determine how mechanical energy introduced to the superfluid system is transferred to the Kelvin waves. Variations in the frequency and amplitude of the wire excitation, result in the excitation of different modes of the vortex core and in some cases give evidence of a transition to non-linearity. The study of this behavior could help us to better understand quantum turbulence in condensates.

Sulfated Alginate Hydrogels

Daphne Diloretto
Sponsor: Jonathan Leach, Ph.D.
Biomedical Engineering

Alginate hydrogels have been successfully implemented in wound healing, drug delivery, and cell culturing due to their customizable mechanical, chemical, and physiological properties. However, alginate exhibits low growth factor retention rates, leading researchers to covalently modify various functional groups to improve the sustained delivery of cytokines. Sulfating the alginate allows for the hydrogel to sequester these secretions within the gel for longer, benefiting the cells cultured within. However, the significant negative charge on the sulfate group interferes with the hydrogel's crosslinking chemistry. We propose to mix sulfated and non-sulfated alginate to reduce the crosslinking interference. Ionically and covalently cross-linked methods will be investigated for gel stability as well. We hope to produce a platform in which we can modulate the modulus independently of sulfation, allowing us to investigate the interaction between growth factor retention and mechanical properties. Preliminary experiments show that higher percentages of sulfate in alginate correlate with a higher modulus and higher retention rates of cell secretion. Sulfated alginate hydrogels can improve the therapeutic effects of stem cell therapies by entrapping their beneficial secretions, allowing for sustained cytokine signaling to invading cells. Increasing growth factor retention can ultimately improve the regeneration of various types of tissues.

Identifying the Molecular Machinery of Cell Fusion in Epithelial Cells

Alena Dinh
Sponsor: Soichiro Yamada, Ph.D.
Biomedical Engineering

In multicellular organisms, cell-to-cell fusion is tightly regulated and restricted to specialized cells such as zygotes, muscles, and bone. Interestingly, some cancer cells have been shown to fuse with normal cells and are thought to result in a more invasive phenotype. However, the molecular machinery behind this cell fusion is unknown. My goal is to identify these proteins using p14FAST, a small, viral transmembrane protein that induces cell-to-cell fusion. My hypothesis is that p14FAST may be recruiting host proteins to induce plasma membrane fusion. To capture these protein interactions, cell fusion was synchronized by regulating cell-to-cell adhesion using calcium. The binding partners of p14FAST were then detected by "proximal biotin identification" that tags any protein in the vicinity of p14FAST with biotin. Based on immuno-fluorescence analysis, biotinylated proteins indeed co-localized with the p14FAST proteins expressed in epithelial cells. The next step is to isolate and analyze the proteins with mass spectrometry to determine their identity. The discovery of novel fusion proteins in epithelial cells holds promising implications for preventing the progression of fusion-induced cancer cell metastasis.

Effects of Radiation on Carbon Materials for High Luminosity Upgrade of CMS Silicon Tracking Detector

Jeske Dioquino
Sponsor: Maxwell Chertok, Ph.D.
Physics

Future collider detectors, such as silicon tracking detectors for the High-Luminosity Large Hadron Collider (LHC) upgrade, will need materials of low mass, as well as sufficient mechanical strength, thermal conductivity, and radiation tolerance. These properties are essential for the detector, as the experiments study the interactions of particles of extremely high energies. These energies are increasing with the LHC luminosity, and so the detectors along the accelerator must be upgraded in such a way as to be able to handle these higher energies and rates of events. In this particular study we look at the thermal properties and tensile strength of small samples meant to model potential structures for the Compact Muon Solenoid (CMS) detector's silicon tracker. The samples are squares of carbon foam bonded on both sides to carbon fiber sheets using thermal epoxy. We look at how the thermal properties and tensile strength of the samples are different before and after exposure to radiation.

Replication stress-induced nucleophagy is induced through parallel pathways involving the intra-S phase checkpoint and Tor kinase regulation of autophagy

Jonathan Do
Sponsor: Kenneth Kaplan, Ph.D.
Molecular & Cellular Bio

Mitosis is highly regulated such that each daughter cell receives identical genomes. Genome stability requires constant coordination of chromosome replication and segregation elements. The final steps in this process include the resolution of sister chromatids and completion of DNA replication. To ensure stability, nuclear envelope formation is suppressed until segregated sisters have been properly resolved. The premature packaging of chromatids into a nucleus gives rise to micronuclei and subsequent genomic instability. The mechanisms that suppress micronuclei are unclear, though it has been proposed that nucleophagy, a type of autophagy, may play a role. Consistent with this idea, we have seen that DNA replication stress activates nucleophagy in budding yeast and that this pathway requires the intra-S-phase checkpoint kinases. We hypothesize that nucleophagy induced by replication stress involves the activation of two parallel pathways such as the intra-S-phase checkpoint kinases and Tor-regulated autophagy program. We predict that each pathway will control discrete steps in the replication stress-induced nucleophagy response. To test this, I will use cell-based assays developed in the Kaplan lab and test how mutations in these pathways impact nucleophagy. I predict that mutations in both pathways will compromise nucleophagy and lead to genomic instability after replication stress.

An Autoradiographic Analysis of Cannabinoid Receptor Distribution in Microtus: Implications for Social Organization and Sex Differences

Brooke Dreyer
Sponsor: Karen Bales, Ph.D.
Psychology

The endogenous cannabinoid system includes the cannabinoid receptors (CB1 and CB2), their ligands, and the enzymes that metabolize them. In humans, CB1 receptors are the most abundant GPCR in the central nervous system. Previously, variations in CB1 activity, density and distribution have been seen in a number of neurodevelopmental disorders such as autism spectrum disorder (ASD). This study focuses on how variations in CB1 receptor density and distribution within the cerebral cortex affects the development and maintenance in social-attachments, similar to those present in ASD. To study this effect, we used two closely related species that varied only in their social behavior: monogamous, pair-bonding prairie voles and promiscuous meadow voles. Adult brains were sectioned and receptors were visualized with autoradiography using a [3H] CP-55,940 ligand. CB1 density will be quantified and compared between sexes within species, and between sexes across species. We expect to find CB1 expression differences within limbic regions of the brain, particularly in the hippocampus and lateral septum where sociospatial information is integrated. The results will help us better understand how CB1 receptors contribute to social behavior, and if they can be targeted as a potential therapy for ASD.

Organic Fertilizers Lead to Greater Ecological Stability for Soil Bacterial Communities as Compared to Inorganic Fertilizers

Evan Dumas
Sponsor: Kate Scow, Ph.D.
Land Air & Water Resources

Soil structure, which enhances agriculturally important soil properties like water retention and topsoil preservation, is maintained in part by the glue-like secretions of soil microbes; nevertheless, these microbes rely on the availability of organic compounds in the soil to generate these secretions. Organic fertilizers, like manure and compost, provide a mixture of organic compounds and have been shown to improve soil structure, while inorganic fertilizers, which contain specific macronutrients necessary for plant growth such as nitrogen or phosphorus, lack these organic compounds and can lead to soil structure degradation. Due to their difference in organic matter content, inorganic and organic fertilizers have varying impacts on the composition of microbial communities in the soil; however, research is lacking on the effect of these fertilizers on the ability of microbial communities to resist compositional change. This attribute of microbial communities, referred to as resistance, serves as an indicator of ecological health. We sought to determine how different fertilization regimes affect the ability of soil bacterial communities to resist changes in response to plant growth and cultivation. Our results suggest that organic fertilizers foster a bacterial community with greater resistance to seasonal changes than inorganic fertilizers.

Effects of Increased Polyphenol Oxidase Activity on Infection by *Pratylenchus vulnus* in Walnut Roots

Tia Dunbar
Sponsor: Abhaya Dandekar, Ph.D.
Plant Sciences

Nematodes are among the most abundant animals on Earth. Consequently, pathogenic soil nematodes play a serious role in the destruction of crops due to their sheer numbers. The root-lesion nematode Pratylenchus vulnus is a prolific soil pathogen that parasitises over half of California's top agricultural crops, including walnuts. P. vulnus feeds on the intracellular contents of plant roots and kills its host after inflicting sufficient damage. Nematicides that have been used in the past can eliminate soil-borne nematodes but are often environmentally unfriendly, economically unfeasible, and harmful to beneficial soil organisms. This project aims to contribute to more practical approaches to protecting walnut crops from P. vulnus by enhancing the plant's natural immune response. Two genes of interest, jrPPO1 and jrPPO2, are known to promote activity of polyphenolic compounds in walnuts. Polyphenol oxidases (PPOs) are enzymes that function in many plant species as a wound response and inhibit bacterial infection. We have engineered walnuts to constitutively express jrPPO1 and jrPPO2 in an effort to increase resistance to root-lesion nematodes. Our experiment monitors the effects of jrPPO1 and jrPPO2 upregulation on walnut root infection by P. vulnus.

Effect of Vehicular Emissions on Lung Gene Expression

Charleen Duong
Sponsor: Laura Van Winkle, Ph.D.
VM: Anat Physio & Cell Biology

Exposure to traffic-related air pollution (TRAP) has been associated with respiratory diseases and diminished lung function. These health effects can be exacerbated when exposure occurs early in life. The objective of this study is to determine if genes within the lungs were changed in response to TRAP exposure. Rats were continuously exposed to real-time TRAP prenatally until five-weeks of age or filtered air (FA). We examined genes involved in cell proliferation (PCNA), epithelial differentiation (SCGB1A1 and MUC5AC), inflammation (MIP) and lung anti-oxidant responses (CGLC, NQO-1, HOX-1, CAT, GSTP) in five-week old rats. HPRT1 gene was utilized as the housekeeping gene in qRT-PCR analysis. Lungs were collected using RNAlater and then microdissected into lung regions: proximal and distal airways and parenchyma. The tissue was extracted for RNA using RNEasy minikits. Quantification of RNA was performed using a NanoDrop spectrophotometer. cDNA was then synthesized and gene expression analyzed using TaqMan Assays. There were significant differences in gene expression by lung region for SGB1A1, HOX1 and NQO-1. Although there were some small shifts in expression with exposure, there were no significant treatment specific changes in the lungs of rats exposed to TRAP for PCNA, MIP and CAT. Funded by: P30 ES023513 and R21 ES025570

Lipid Oxidation in Meat from Boilers Feed Organic Diets with Cowpeas and Sunflower Meal

Elyn Dushane
Sponsor: Annie King, Ph.D.
Animal Science

The objective of this study was to compare lipid oxidation rates in variously processed thigh meat from broilers (meat-type chicken) fed organic cowpeas (no added methionine) in place of traditional corn and soy with added synthetic methionine. All broilers, raised to 6 weeks of age, were provided diets specialized for their growth level. Treatment included a control corn/soybean meal, Basal formulation (D1); Basal + 20% Sunflower Meal (D2); Basal + 20% unheated Cowpeas (D3); Basal + 20% Sunflower Meal; Basal + 20% unheated Cowpeas with no added methionine (D4); and Basal + 20% Sunflower Meal and 20% heated Cowpeas with no added methionine (D5). At processing, thigh samples from birds fed each diet were collected and frozen in liquid nitrogen before being stored in a -80°C freezer. Samples were processed into 6 conditions of raw; raw in the refrigerator for 3 days; raw in the freezer for 2 weeks; cooked; cooked, stored in the refrigerator for 3 days; and cooked, stored in the freezer for 2 weeks. Lipid oxidation was determined with the thiobarbituric acid assay. We hypothesized that D4 and D5, diets with no synthetically added methionine, would show higher oxidation rates in the raw and cooked samples.

Region-Dependent Bone Loss in the Lumbar Spine Following Femoral Fracture in Mice

Erica Ely
Sponsor: Blaine Christiansen, Ph.D.
MED: Orthopedic Surgery

A bone fracture leads to systemic loss of bone mass, increasing future fracture risk at all skeletal sites. A previous study from our lab showed that femur fracture in mice led to a loss of whole-body bone mineral density (BMD) within 2 weeks post-fracture; trabecular bone of the lumbar spine was particularly affected by this bone loss. The specific location of resorbed trabecular bone can strongly affect the mechanical properties of vertebral bodies. Therefore, we sought to determine if trabecular bone loss in the lumbar spine of mice following femur fracture is region-specific. 32 mice were subjected to transverse femoral fracture or acted as unfractured controls; L5 vertebrae were analyzed using micro-computed tomography (μCT) 2 weeks post-fracture. Three regions (cranial, central, caudal) were analyzed to determine trabecular bone volume fraction and trabecular thickness. Following μCT, histological sections were stained for tartrate-resistant acid phosphatase (TRAP) to determine osteoclast activity. MicroCT analysis and TRAP staining revealed greater decreases in trabecular bone fraction in the cranial and caudal regions compared to the center region. Trabecular bone loss from these regions of the vertebral body following fracture may subsequently increase the risk of future vertebral fractures.

Social Networks and Association Rates Between Black-Handed Spider Monkeys (*Ateles geoffroyi)* on Barro Colorado Island, Panama

Ellen Dyer
Sponsor: Margaret Crofoot, Ph.D.
Anthropology

Sociality, the degree to which individuals in a population associate and form cooperative societies, is thought to have evolved as a strategy for animals to cope with environmental pressures. Fission-fusion societies, characterized by periodic splitting and re-aggregation of subgroups, pose an interesting challenge for interacting members of social groups, as composition of parties change constantly; how do individuals choose who to associate with in subgroups? The black-handed spider monkey (Ateles geoffroyi) provides an opportunity to study how social interactions in fission-fusion societies can predict association patterns between individuals. In this 6-month long study, we use behavioral sampling, focal follows, and group demographic surveys to document and quantify social interactions within a group of 52 spider monkeys on Barro Colorado Island, Panama. Social interactions are classified into three levels of sociality: passive (individuals in close spatial proximity to others); affiliative (grooming, embracing, and sexual behaviors); and aggression (conflict, displacement, or threats). Using social network analyses, we create group social networks by enumerating the frequency of social events within subgroups. With this data, we compare social behaviors between individuals and association frequency in the same subgroups, making it possible to explore the link between social bonds and association patterns within fission-fusion societies.

The Effects of Irradiation on Circulating Lymphocytes in Dogs Receiving Fractionated Radiotherapy

Shaheen Emami
Sponsor: Michael Kent, D.V.M.
VM: Surg/Rad Science

Radiotherapy comes with a variety of side effects, immunosuppression. Several studies have noted changes in Complete Blood Count (CBC) parameters including decreases in the absolute lymphocyte count (ALC) and increases in the neutrophil:lymphocyte ratio (NLR). These changes could reflect immunosuppression and may contribute to decreased efficacy of immunotherapies used to treat cancer. We hypothesized that dogs would have a decrease in the ALC during a course of radiotherapy. A retrospective study was done on dogs receiving curative-intent radiotherapy at UC Davis between 2013-2018. 203 dogs were included. Demographic information, CBC values from prior to the start of and half way through the course of radiotherapy as well as details of the radiotherapy protocol were collected. The ALC decreased by a mean of 380.15 cells/mL ($p<0.0001$) This decrease was not correlated with the volume irradiated ($p=0.27$), yet was correlated with the dogs volume:weight ratio ($p=.03$) and the anatomic area irradiated ($p=0.03$). The NLR increased by a mean of 0.93 ($p=0.02$). Although severe lymphopenia was rare, these decreases, especially if sustained, could affect adjuvant therapy for their cancer. Future work will include evaluation of the subsets of lymphocytes affected and determining the duration of these lymphocyte changes after treatment with radiotherapy.

Designing an Enriched Enclosure for Zoo-Housed Giraffes (*Giraffa camelopardalis*)

Ariel Escalante
Sponsor: Kristina Horback, Ph.D.
Animal Science

In captivity, giraffes may develop abnormal or stereotypic behaviors, such as repetitive surface-licking, if their environment is not meeting their behavioral needs. Although the baseline for captive giraffe care has not yet been established, recent research suggests the importance of enrichment in the zoo enclosure to enhance the animals' mental and physical well-being. The goal of this project is to design and construct a 3D model of an enriched giraffe enclosure that provides opportunities for the giraffes to express species-specific behavior and complies with current Association of Zoos & Aquariums (AZA) standards. The model is alterable to accommodate differing demographics and climates among wildlife facilities. This was done by visiting five local AZA facilities and recording enclosure dimensions, cost, enrichment, demographics, food, and guest interaction using photography and employee interviews. Additional information about giraffe care was gathered from various published works. Preliminary results indicate that feeding enrichment (i.e. feeders that encourage manipulation with the giraffe's tongue) is instrumental in maximizing well-being, as well as other forms of sensory enrichment. These aspects, therefore, play a major part in the model. This project may be beneficial to facilities in the future who are looking to update or build a giraffe enclosure.

Centrifugation Speed and Its Effect on Enzyme Activity Using White Sturgeon

Jessica Escamilla
Sponsor: Anne Todgham, Ph.D.
Animal Science

Measuring tissue enzymatic activity provides insight into important metabolic processes in organisms, and is a frequently used "tool" in environmental physiology. Recently, several researchers in the lab have found that our previous protocol centrifuge speed of 1,000 rcf was insufficient to pellet cellular debris in the tissue homogenate, leading to inaccurate enzyme measurements. From the literature, we also know that centrifuging too fast leads to mitochondrial pelleting and loss of mitochondrial-located enzymes like citrate synthase, although the exact speeds where this happens is unclear. The goal of this project was to optimize the protocols for measuring enzyme activity of citrate synthase (CS) and lactate dehydrogenase(LDH) enzymes in fish tissues, using white sturgeon liver. These enzymes are important cellular measures of aerobic (CS) and anaerobic (LDH) capacity. In this project I varied centrifugation speeds from 0 to 15000 rcf. Surprisingly, there was no significant difference in LDH activity of liver tissues centrifuged at different speeds. I am currently conducting similar research on the effect of centrifuge speed on CS activity.

Small Unmanned Aerial System (sUAS) for Remote Air Quality Monitoring

Russell Evangelista
Sponsor: Zhaodan Kong, Ph.D.
Mechanical & Aerospace Engr

The development of inversion layers restrict the vertical dissipation of air pollution and trap poor air quality just over the surface of the earth. This could have negative health effects on humans that could lead to cardiovascular issues in the future. While stationary air quality monitoring could provide useful information, it is restricted to monitoring only a specific region while air quality varies with altitude. This project presents the idea of using a small unmanned aerial system (sUAS) to perform remote air quality monitoring, with a flight time of at least one hour. Test flights have been performed on board a DJI S100+, proving the detection of inversion layers in the early morning. Trends regarding particulate matter (PM) with altitude and temperature have also been observed that agree with current science. This project can pave the way for the implementation of robust and affordable air quality monitoring system in applications such as refinery monitoring and ship emission monitoring.

The Effect of Temperature on the Growth of Ganoderma Species

Emily Evans
Sponsor: David Rizzo, Ph.D.
Plant Pathology

Ganoderma adspersum is an aggressive species of wood decay fungus that is having devastating effects on almond orchards in the San Joaquin Valley of California. Although wood decay fungi were previously considered a concern of old and diseased trees, G. adspersum is causing the loss of young, healthy trees in some parts of the almond growing region. Exactly what contributes to its limited distribution remains unclear, but temperature could be an important factor. The goal of this study was to determine if there is a correlation between temperature and the growth rate of different Ganoderma species. A growth rate experiment was conducted with four species of Ganoderma, grown at four different temperatures (5, 15, 25 and 35° C). Agar plugs of actively growing Ganoderma cultures were plated on malt extract agar and placed in incubators. Culture diameter was recorded weekly for 6 weeks. The growth rate should vary between the four species and different temperatures. Understanding the optimum temperature for growth of different Ganoderma species may help to explain the differences in distribution we find with the Ganoderma species in California almonds.

UC Davis REALOPs Satellite Mission

Vamsi Krishna Eyunni
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The Remote Experimentation and Analysis of LEO Phenomena (REALOPs) is a 2U CubeSat development project focused on data acquisition for use in STEM education. This project presents the idea of developing a thermal model, based on flight data, to predict thermal properties of a nanosatellite with respect to its onboard hardware and its orientation in orbit. There will be a secondary payload onboard (micro dosimeter) that will be used to collect data on the low Earth orbit (LEO) radiation environment as well. The resulting models and raw data collected during the life span of the satellite will be used to introduce students of all levels and disciplines to data analysis with regards to the development of scientific conclusions. Additionally, the developed models will be compared to existing software that has thermal analysis capabilities such as SolidWorks and NASTRAN/PATRAN for validation. Lessons learned from the development lifecycle of this mission will be used to create a robust and reliable base bus that can be modified to perform a multitude of future space missions.

Understanding the Molecular Mechanisms of Fragile-X Associated Tremor/Ataxia Syndrome

Alexandria Falcon
Sponsor: Paul Hagerman, M.D.,Ph.D.
MED: Biochem & Molecular Med

Fragile-X associated tremor/ataxia syndrome (FXTAS) is a fatal late-onset neurodegenerative disorder characterized by intention tremor, cognitive decline, and psychological disorders, among other features. FXTAS affects carriers of premutation expansions (55-200 repeats) of a 5' non-coding CGG trinucleotide within the Fragile-X Mental Retardation 1 (FMR1) gene; globally, 1:150 women and 1:400 men are premutation carriers. Larger expansions (>200 repeats) give rise to Fragile-X Syndrome, the leading heritable form of cognitive impairment and autism. There is currently no cure or effective treatment for FXTAS and its pathogenic mechanism remains unknown, although it is recognized that transcriptional activity is necessary for pathogenesis. In the Hagerman Lab, I aim to identify protein interactions within the 5'UTR FMR1 mRNA relevant to the disorder. Previous studies have identified protein-RNA interactions at the CGG-repeat itself; however, ours is the first study that involves the entire 5' non-coding region encompassing the CGG-repeat. I am currently constructing bacterial expression plasmids of different CGG-repeat sizes and will expose them to brain tissue of FXTAS individuals. We hope that the identification, through mass spectrometry, of proteins preferentially interacting with the CGG-repeat in its 5'UTR context will reveal the nature of the coupling between the expanded CGG-repeat mRNA and FXTAS development.

Mapping Metaphyton at Lake Tahoe Using Small Unmanned Aerial System and Color Digital Camera

Yao Fang
Sponsor: Yufang Jin, Ph.D.
Land Air & Water Resources

Metaphyton is a form of filamentous algae that has been proliferating near the shore of Lake Tahoe. It forms green patches during summer months and drifts toward the shore by physical processes such as waves and currents. When it washed ashore onto the beaches, it decomposes and produces unpleasant smell and visual impact, which is bad for Lake Tahoe water quality as well as tourism. UC Davis Tahoe Environmental Research Center (TERC) is developing a sustainable way to map and monitor the distribution and the growth of metaphyton. During summer 2018, we collected thousands of RGB photos at Regan Beach in South Lake Tahoe using a small Unmanned Aerial System. Using Pix4D and ENVI, we processed and mosaicked these georeferenced photos into an image covering the beach for June, August, and September. We also developed a method to classify metaphyton on the mosaicked images. This method will be applied to color images collected with a helicopter for the entire shore of Lake Tahoe. The product of this project will help researchers to examine the correlation between metaphyton growth and Asian clam population occurrence and to monitor future algae bloom in Lake Tahoe.

The Potential of Interactions Through Temporary Biosensing Pigments

Yasameen Farahvash
Sponsor: Katia Canepa Vega, Ph.D.
Design Program

The exterior surface of the body provides a platform to obtain information about the inner, biological functions. Wearable technology has enhanced the use of non-invasive devices on the skin for electrochemical tracking of biological processes through data output. Similar research reveals a novel approach to permanent pigments, similar to tattoos, that can interact within the skin. This project investigates the potential of a temporary tattoo molecule, such as lawsone, to be implemented as a natural dye biosensor to reveal information about the body through interactions within the epidermis. Lawsone, also known as henna, is used as a paste that binds to the keratin proteins in the outermost layer of skin and is faded over time as the skin sheds and interacts with the environment. In the lab, experiments using an ex vivo model (pig skin) were conducted by modifying the appearance of the lawsone molecule with different substances, such as acidic manipulations for alterations in color. This project proposes the possibility of extending the functionality of henna from a traditional pigment to a chemical sensor in order to create an interactive display within the skin.

Early Loss of Vision Induces Cross-Modal Volumetric Changes in Thalamic Sensory Nuclei

Samaan Faridjoo
Sponsor: Leah Krubitzer, Ph.D.
Psychology

Changes to early sensory input has profound effects on the structure and function of the neocortex. Previous work from the Krubitzer laboratory has demonstrated that altering sensory inputs though bilateral enucleation in short-tailed opossums (Monodelphis domestica) prior to the onset of spontaneous retinal activity, causes drastic changes to areas of the neocortex responsible for processing both the lost and spared senses. In this study, we investigated if these changes extend to thalamic nuclei involved in processing somatosensory information. It has been shown that early enucleation induces changes in the size of thalamic visual areas (LGN) and in primary visual cortex (V1). We demonstrated that in early blind opossums, the LGN decreases in volume proportionally to the decrease in area of V1. Furthermore, the somatosensory area of the thalamus (VPN) is larger in early blind opossums; this increase in volume is proportional to the observed increase in area of primary somatosensory cortex (S1). Our data shows that changes in sensory input early in development can induce cross-modal changes within the thalamus that mirror changes within the cortex, strengthening the argument that the size of primary sensory nuclei in the thalamus and primary sensory areas in the cortex scale predictably.

Implications of Sound Variability Surrounding Wildlife Crossing Structures

Parisa Farman
Sponsor: Fraser Shilling, Ph.D.
Environmental Science & Policy

With an expansive network of roadways connecting regions of our world, we are severely fragmenting the habitat of wildlife species. Habitat fragmentation can have a wide array of negative impacts on wildlife populations, such as disrupting gene flow. Fortunately, wildlife crossing structures can connect fragmented habitats. Based on data taken by the Davis Road Ecology Center, we know that many wildlife species use wildlife crossing structures to move about their home range. However, much of the efficacy of these structures is not known, in addition to how animals are affected by traffic. Since sound travels past its point of origin, it is highly likely that wildlife is affected by noise from passing traffic before they reach the crossing structure. I plan to investigate how sound varies on terrain surrounding wildlife crossing structures and use data collected from sound meters to develop a modeled "soundscape". My data will be collected at structures located along California roadways, using sound meters to record traffic volume for a set period of time. I will arrange the meters in transects moving away from the structure. I anticipate finding variation in the soundscape around the structures, with diminishing sound with distance from the roadway.

Age- and Language-Related Positivity Effect in Episodic Memory

Caitlyn Rose Fastenau
Sponsor: Beth Ober, Ph.D.
Human Ecology

Memory for positive items (e.g., parrot) is generally better than memory for negative items (e.g., snake), the positivity bias. We investigated potential differences in positivity bias, based on age (younger vs. older adults) or language (young native English speakers vs. non-native); a significant difference in positivity bias between two groups is a positivity effect. The age-related positivity effect is the finding that older adults remember a greater quantity of positive versus negative stimuli compared to younger adults. The language-related positivity effect is the finding that non-native speakers show a larger memory advantage for positive versus negative stimuli compared to native speakers. Our prior memory study for lists of positive and negative words, from several semantic categories (e.g., animals) was conducted with young adult native English speakers vs. non-native. Results showed a significant interaction of Group by Emotion, a language-related positivity effect. Our current study is designed to replicate the language-related positivity effect, while determining whether an age-related positivity effect will be present with our list-memory paradigm. Preliminary results show a robust language-related positivity effect. However, the positivity bias for the (combined) younger and older native English speakers only approaches significance, and there is no indication of an age-related positivity effect.

Characterization of Mucosa-Associated Invariant T-Cells (MAIT) in Chronic HIV Infection

Emily Fehrman
Sponsor: Barbara Shacklett, Ph.D.
MED: Medical Microbiology & Imm

Mucosa-associated invariant T cells (MAIT cells) are a recently discovered subset of T cells which bridge the gap between innate and adaptive immunity. MAIT cells recognize bacteria and fungi derived antigens presented by major histocompatibility complex (MHC) related molecule (MR1), which is highly evolutionarily conserved. We hypothesize that in Human Immunodeficiency Virus (HIV-1) infection, these specialized T cells play an important role in maintenance of mucosal barrier integrity, as well as in host defense against opportunistic pathogens. During HIV infection, MAIT cell numbers are significantly reduced in peripheral blood even after successful Highly Active Antiretroviral Therapy (HAART). The mechanism driving this loss is currently unclear, and could involve cell death and/or redistribution of MAIT cells to mucosal tissues. In this study, we used flow cytometry to characterize the frequency and phenotype of CD8+ MAIT cells in peripheral blood and rectal mucosa of seronegative and HIV+ HAART suppressed participants. By looking at markers of gut trafficking and tissue residency (CD103 and CD69), memory (CD45RO), innate cell properties (CD56), and cytotoxic capability (perforin and granzyme B), we can gain a better understanding of the role of mucosal MAIT cells in HIV immunopathogenesis.

Optical Pedobarograph System Redesign for Quantifying Foot Pressure

Ningshen Feng
Sponsor: David Hawkins, Ph.D.
Neuro Physio & Behavior

A Pedobarograph is a device that measures foot pressure distribution. It is useful for diagnosing foot disorders and studying basic biomechanics of gait and posture. There are two types of pedobarograph: electronic and optical. An optical pedobarograph consists of a reflective surface that a person stands on, a light source that exposes the surface to light, a camera that captures pictures of the light reflected from the surface in response to the pressure created by the foot contact, and a computer and software that create a pressure map based on the light patterns. The purpose of this project was to upgrade and operationalize a non-functional optical pedobarograph acquired from the UC Davis Orthopedic Department. The existing camera system and computer were removed and replaced with a cell phone and laptop. Calibration procedures were developed to relate camera image pixel intensity and pressure. Matlab script was created to convert the raw images to pressure maps based on the pixel intensity and calibration information. The pedobarograph is operational and an instruction manual was written to facilitate its use. The measurement error of the pressure map was determined to be 4.1% to 14.4% The standard coefficient of variation (CV) was 4.7%.

Secretion and Delivery *in vitro* of Bremia lactucae Effectors

Qian Feng
Sponsor: Richard Michelmore, Ph.D.
Plant Sciences

Bremia lactucae is a devastating plant pathogen that causes lettuce downy mildew. B. lactucae secrets effector proteins into plant cells to interfere with the host's immunity and this secretion process relies on N-terminal signal peptides (SP). Some candidate effectors from B. lactucae were found to not have a predicted signal peptide, which was unexpected. Protoplasts are plant cells lacking the cell wall and are used in plant molecular biology to study gene function in vitro. Here I use protoplasts to investigate the secretion of effectors in order to see whether these proteins contain a signal peptide that is not recognized by the SignalP prediction algorithm. I cloned 13 effector candidates (9 with predicted SP, 3 without) into a vector for plant expression, which contains a C-terminal YFP marker for visual detection of the protein. I will transfect lettuce protoplasts with these cloned effectors and observe whether there is transient expression as visualized by YFP. I will put transfected and untransfected protoplasts together to see if the effectors can be delivered to the untransfected ones. Such translocation will indicate whether there is a signal peptide and can potentially become a novel transfection method with lower cell death rate than traditional methods.

An Attempt at Efficient Generation of "Hairy" Sheep via CRISPR/Cas9 Electroporation Into "Woolly" Sheep Oocytes.

Devon Fitzpatrick
Sponsor: Pablo Ross, D.V.M.,Ph.D.
Animal Science

Hair sheep have rapidly become a major sector of the American sheep industry and research to identify the genes underlying their unique fleece characteristics has revealed a single retrogene associated with differentiating modern "woolly" sheep from ancestral "hairy" sheep. As of yet, it is unknown whether or not the deletion of this retrogene in woolly sheep would induce the growth of "hair". The objective of this project is to discover if oocyte electroporation of the CRISPR/Cas9 system targeting the retrogene will induce the "hairy" phenotype in "woolly" sheep. The retrogene originated from the insertion of an antisense EIF2S2 retrogene into the 3' UTR of the IRF2BP2 gene leading to an abnormal IRF2BP2 transcript. This mutation causes the abnormal IRF2BP2 transcript to hybridize with the original EIF2S2 transcript and create dsRNA that reduces expression of both genes. Initial results from PCR of genomic DNA from "hairy" and "woolly" sheep ovaries confirms that "woolly" sheep contain an insertion not present in "hairy" sheep and sequencing results have revealed that it was the EIF2S2 retrogene.

Investigating the Maturation Potential of Virgin Beta Cells Within Mouse Pancreatic Islets

Marcus Flisher
Sponsor: Mark Huising, Ph.D.
Neuro Physio & Behavior

Type 1 diabetes (T1D) is an autoimmune disease that results in the destruction of insulin-secreting beta cells. Although T1D can be managed by daily administration of exogenous insulin, significant research is aimed towards restoring beta cell mass for endogenous insulin secretion in diabetic patients. Our lab discovered a novel population of functionally immature beta cells, named "virgin" beta cells, which derive from non-beta progenitors at a neogenic niche near the islet periphery. Little is known about the ability of virgin beta cells to mature over time. Therefore, we seek to examine the potential for virgin beta cells to differentiate into functionally mature beta cells. We hypothesize that virgin beta cells develop into functionally mature beta cells. To test our hypothesis, we used bi-transgenic mice that allowed inducible expression of a fluorescent reporter to selectively lineage-label all beta cells. We then followed the fate of these cells over time. By counting changes in the number of lineage-labeled virgin and mature beta cells, we can determine if virgin beta cells mature over time. The outcome of our experiment will inform on the maturation capacity of virgin beta cells, which could potentially be targeted for beta cell regeneration as a treatment for T1D.

The relationship between crystalline structure and fracture morphology of frozen bone

Sarah Foley
Sponsor: Teresa Steele, Ph.D.
Anthropology

Bone is widely recognized to fracture in distinct ways, reflecting if the bone is fresh or dry (degraded) upon breakage. It has been suggested that bone frozen for prolonged periods of time produce fracture patterns similar to those of dry bones. Therefore, any pre-breakage processes bone undergoes, including freezing or caching, affects the degradation and subsequent fracture morphology. This research investigates the fracture patterns of fresh and frozen bones using the Freshness Fracture Index (FFI), a visual analysis based on shape, length, and angle of cortical bone fracture. Complementary to FFI analysis is the splitting factor (SF), a metric evaluating the crystallinity of bone as measured by Fourier Transformed Infrared Spectroscopy (FTIR), which will further our understanding of the effects of freezing on the internal structure of bone. This project investigates patterning of SF and FFI to determine if breakage patterns may be predicted by changes in bone crystallinity. Implications from this study include a firmer understanding how the treatment of bone used for archaeological experiments may bias results. Additionally, broader implications exist for the interpretation of the use of bone for food and fuel by hunter-gatherers including Neanderthals and modern humans who lived in harsh glacial environments.

Expression of Caseins in *Kluyveromyces lactis* Towards the Synthesis of a Sustainable, Animal-free Cheese

Ashley Fong
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

In recent years, products accommodating vegan and vegetarian diets have come to market as consumers are increasingly concerned about the ethical drawbacks of food production, primarily the environmental impact of animal products and the cruelty sometimes prevalent in the meat and dairy industry. Attempts to find alternatives to animal-derived proteins have resulted in products that do not always taste, smell, and feel like the traditional product. We are exploring whether some or all of these problems can be solved by using microorganisms to synthesize the proteins integral to traditional animal products. In this study, we are creating transgenic strains of Kluyveromyces lactis, an FDA-listed generally regarded as safe (GRAS) yeast used to produce food-associated products, to express the major proteins in bovine cheese: alpha-s1, alpha-s2, beta, and kappa caseins. Currently, we are cloning these genes into several expression vectors, developing an economic assessment pertaining to cost of production, and plan to explore various purification strategies. If successful, we propose that a cheese made from lab-produced proteins would be more environmentally sustainable, free of pathogens, and would also satisfy public interest in cruelty-free products that taste nearly identical to the traditional version.

Edna Woolman Chase: A Microhistory

Elizabeth Ford
Sponsor: Lisa Materson, Ph.D.
History

Born and raised in a small Quaker village in New Jersey, Edna Woolman Chase moved to New York City and began working at Vogue when she was eighteen. Despite her gender and working class background, Chase went on to have an extremely successful and groundbreaking career as Editor-in-chief of Vogue from 1914 to 1952, at a time when very few career women existed. Yet, despite these achievements, no analysis or written history of her life exists. Through archival research at the Fashion Group International and the Ilka Chase Archive, as well as in-depth analysis of Chase's own autobiography and the autobiographies of her daughter and proteges, this research provides the first microhistory of Chase's life, atypical for the period, highlighting her class ascension and how she navigated gender norms of the period throughout her career. Placed into historical context, this microhistory provides a new lens through which to examine American society during the first half of the twentieth century, especially in terms of class and gender; the retraction of women's rights and backlash post World War II; and the erasure of women throughout American history.

Do Low-Income Energy Efficiency Programs Reduce Energy Burdens for Beneficiaries and Surrounding Communities?

Natalie Fortman
Sponsor: Alan Meier, Ph.D.
Environmental Science & Policy

Low-income households spend a disproportionately high percentage of income on energy bills compared to the average household, leaving less money for necessities like food. To help combat this issue, California implemented the Low-Income Weatherization Program for Multi-Family Properties (LIWP-MF), a program that provides energy efficiency and renewable energy upgrades to low income housing properties. This paper seeks to identify a reduction in energy burden for low-income residents as a result of LIWP-MF upgrades. To determine this, estimated household energy expenditures are calculated for residents of 22 low-income housing properties that recieved LIWP-MF upgrades and their surrounding communities. All of the selected properties fall within PG&E territory and comprise only a miniscule fraction of all households within their community. With a scope limited to a few dozen properties around the state, this program does not reduce energy expenses for entire low-income communities. Calculations for individual properties reveal that spending on energy services does decrease as a result of the upgrades, however, the value of the energy savings is not enough to have widespread effects at the community level.

The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Jewish" in the New York Times (1900-1909)

Jazzmin Fragiacomo
Sponsor: Suad Joseph, Ph.D.
Anthropology

My research is situated within the context of the New York Times from 1900 to 1909. The broad scope of the research project is to examine how the representation of the Middle East, Islam, Muslims, and Arabs appear in what is considered to be the leading liberal newspaper in the United States. I employed the method of database research through the ProQuest advanced search engine and proceeded to search the term "Jewish*." The search revealed an array of representations of Judaism, Jewish people, and their interests. One notable representation that has come up is of Zionism—the movement that seeks to reestablish the Jewish nation and to restore Israel—as linked to colonialism. Embedded in this representation is rhetoric of justice, inheritance, and return to the Holy Land that is employed as justification for a colonial project. Additionally, institutional acts of Anti-Semitism, particularly in the case of Roumanian Jews, are central to claims of justification. The displacement of Roumanian Jews is tied to a broad spectrum of Zionist rhetoric to justify colonization of Palestine.

Communication of Droplet Printed, Artificial Cell Mimics

Katelyn France
Sponsor: Cheemeng Tan, Ph.D.
Biomedical Engineering

Artificial cells have emerged as an important tool in the field of synthetic biology because they provide a simplified model of natural cells in a more controlled environment. They have the capability to replicate many important biological functions, including the transcription and translations of proteins, membrane signaling pathways, and division. However, communication between artificial cells thus far has been limited compared to the range of communication present in natural cells. Our work combines the ability of artificial cells to sense extracellular chemicals and a microfluidics droplet printer to create fluorescing patterns from a 2-dimensional array of artificial cells. The gene network in these cells regulates the release and detection of chemical inducers between artificial cells, which controls the fluorescent patterns. Droplet printing these artificial cells provides a fast, consistent cell distribution method. Together, these methods provide a high throughput means of artificial cell communication to induce gene expression. Our work opens the door to more complex gene networks with the potential to create a variety of chemical-sensing biological assays that may be applied in clinical or portable diagnostics.

The Role of Rad21l1 in Zebrafish Sex Reversal

Michelle Frees
Sponsor: Sean Burgess, Ph.D.
Molecular & Cellular Bio

Meiosis produces haploid gametes through one round of DNA replication and two divisions that will give rise to the next diploid generation in sexually-reproducing organisms. Errors during either division result in aneuploidy which can lead to miscarriages or birth defects in humans. During meiosis I, cohesins form a ring-like structure that holds sister chromatids together. We have previously knocked out rad21l1, a meiotic-specific cohesin subunit, in zebrafish and observed that nearly the entire population is comprised of fertile males. We hypothesize that rad21l1-/- juvenile female fish are unable to maintain necessary levels of oocytes to sustain a female phenotype. Instead, their ovaries undergo tp53-mediated apoptosis, and sperm-producing testes develop. The detection of both oocytes and spermatocytes in whole-mount gonads of late-reverting fish support this hypothesis. To elucidate the rad21l1-/- phenotype in female zebrafish, we introduced a tp53 mutation to interrupt the reversion to male. These double mutant females are fertile, but release poor-quality eggs that cause elevated embryonic mortality when crossed to wild-type males. These inquiries attempt to clarify the role of rad21l1 in meiosis.

Differences in invertebrate composition on invasive algae, *Sargassum muticum,* and native algae in Bodega Bay

Madeline Frey
Sponsor: Eric Sanford, Ph.D.
Evolution & Ecology

Introducing a new species can alter existing ecological community structure; in many cases, introduced species compete and displace native species and may adversely affect the communities they support. In intertidal communities, algae play an important role in structuring invertebrate communities by providing refuge from predation and food. We hypothesize that an invasive algae will support lower overall invertebrate abundance and less diverse communities because they have not co-evolved with this algae. We tested this hypothesis in Sargassum muticum, an invasive alga that spread worldwide in the early 1900's. At our field site in Bodega Bay, We compared invertebrate communities of S. muticum with Odonthalia floccosa, a native alga. From ten samples of each algae, we measured invertebrate community composition as well as algal mass, surface area, and complexity. Invertebrate abundance was significantly higher on O. floccosa than S. muticum. There were no significant differences in species richness or diversity. We identified more unique invertebrate species on O. floccosa than S. muticum. We will also investigate a possible explanation that since S. muticum is less structurally complex, it may support fewer species. If S. muticum outcompetes native algae, understanding the cascading community effects will inform our understanding of invasions.

Effect of Aging on the Neuroinflammatory Response to Acute Photoreceptor Degeneration

Sonia Frick
Sponsor: Marie Burns, Ph.D.
MED: Ophthalmology

Microglia are innate immune cells in the central nervous system (CNS) that rapidly respond to injury, infection, or degeneration by phagocytosing debris and constrain cytotoxic diffusion. In the retina, microglia dysfunction is associated with age-related diseases like glaucoma and age-related macular degeneration. A mouse model of inducible photoreceptor degeneration (Arrestin-1$^{-/-}$) provides the opportunity to study how microglia function changes during aging. In mice lacking Arrestin-1, light triggers rapid retinal degeneration and microglia activation, as well as, monocyte infiltration from retinal vessels. To test whether this neuroinflammatory response to photoreceptor degeneration is affected by aging, microglia and monocyte populations of young adult (2-3 months) and aged Arr1$^{-/-}$ mice (18 months) were compared using both immunohistochemistry and flow cytometry. Surprisingly, immunohistochemistry revealed that aged Arr1$^{-/-}$ mice showed a loss of Iba1^{+} microglia cells during photoreceptor degeneration suggesting that microglia activation in aged mouse retinas results in overall loss of microglial cells. Furthermore, the number of infiltrating monocytes appeared to be unaffected. Ongoing studies will investigate how these age-related differences in neuroinflammation impact the progression of degeneration in the Arr1$^{-/-}$ model.

Examining the Intersection of Buddhist Non-Attachment and Attachment Security in Experienced Meditators

Tracy Frost
Sponsor: Clifford Saron, Ph.D.
Center For Mind & Brain

Close relationships are core to the human experience, and questions of how best to be in relationship with the self and others are found across cultures. Western psychological attachment theory and the Buddhist concept of non-attachment both grapple with these core questions.. Attachment theory posits that secure attachment is developed through experiences with early caregivers, with consequences for relationships in adulthood; whereas non-attachment holds that security is not attained relationally, but through cultivating one's mind. Using self-report scales, we examined the relationship between these two constructs in experienced meditators (n=61). We found negative correlations between both dimensions of Western attachment insecurity (avoidance and anxiety) and Buddhist non-attachment, suggesting that greater non-attachment is related to more secure attachment profiles. We then examined correlations among retreat-related changes in these scales following a month-long meditation retreat attended by half of the original participants (n=29). Here we found that increases in non-attachment were related to decreases in attachment anxiety, but not attachment avoidance. These findings suggest that these constructs are related, but may not be equivalent. They further suggest that both may be influenced by meditation training. We will also test whether these findings replicate in a second retreat cohort.

Kinetics of Texture Change of Almond Particles During Simulated Gastric Digestion

Zhe Fu
Sponsor: Gail Bornhorst, Ph.D.
Biological & Ag Engineering

Texture change in solid foods during digestion has implications for gastric emptying and satiety. The objective was to quantify texture changes in almond particles during simulated gastric digestion. Almonds particles of size 2-4 mm were mixed with simulated gastric juice and incubated in a shaking water bath at 37°C for 1, 5, 15, 30 and 180 min as well as 0 min (control). Maximum force and compression work of particles were quantified using uniaxial compression to 90% strain. °Brix of liquid digesta was quantified using a refractometer. Maximum force and compression work were significantly lower for almonds digested for 1 min (max force =194.4N) than for undigested (0 min) almonds (max force =106.2N) ($p<0.01$). However, there were no statistically significant differences between these parameters at any time points 1-180 min during digestion ($p>0.05$). °Brix significantly increased during digestion ($p<0.01$), from 1.9 at 1 min to 4.3 at 180 min. Results suggest that the texture of almond particles changes rapidly during digestion, based on the lower maximum force and compression work of almonds digested for one minute compared to undigested particles. These results could help future researchers understand the kinetics of texture changes of almond particles that occur during gastric digestion.

Reconstruction of Paleo-Diets in Pre-Contact San Francisco: Stable Isotope studies at SFR-191

Abigail Fuchs
Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

Stable carbon and nitrogen isotopes from a set of human burials at CA-SFR-191 reveal the paleodiets of individuals living on the San Francisco peninsula between 1500 and 800 years ago. Inhabitants of the site had immediate access to San Francisco Bay and the peninsula interior, while the Pacific Coast is an easy 2-hour walk away. Carbon isotopes trace the importance of marine foods versus terrestrial foods in the diet, while nitrogen isotopes provide information on the trophic level of the consumer. The study compares diets of males, females, adults, and juveniles, focusing on the role of marine foods within and between these demographic categories. Based on previous studies, and expectations from the division of labor in hunter-gatherer societies, we expect females to show greater consumption of lower trophic level terrestrial foods compared to males. The study also examines the diet of one high status individual male buried with large numbers of unusual and exotic grave goods, marking him as a potential leader and/or shaman.

Regulation of Spastin's Interaction with Microtubules by the Alzheimer's Disease Protein Tau

Jana Gagacheva
Sponsor: Richard Mckenney, Ph.D.
Molecular & Cellular Bio

Mutations in the Microtubule Associated Protein (MAP) Spastin are responsible for 40% of the incidents of autosomal dominant hereditary spastic paraplegia (HSP). Spastin hydrolyzes ATP to remove tubulin subunits from the microtubule lattice, leading to microtubule severing and turnover. Dysregulation of microtubule turnover by spastin is hypothesized to affect neuronal death in both HSP and Alzheimer's disease. Tau is a non-enzymatic MAP that is the primary constituent of neurofibrillary tangles found in Alzheimer's disease brains. Previous data has suggested that tau could regulate spastin's ability to sever microtubules, but a molecular mechanism for tau's effects was unknown. We have found that tau forms high-density 'condensates', regions of high tau density surrounded by areas of tau at lower density, on the surface of microtubules. Using in vitro reconstitution, we have observed that tau condensates exclude truncated spastin protein from binding to the underlying microtubule lattice, protecting it from spastin-mediated severing. These results provide a molecular mechanism for how tau can spatially regulate spastin's microtubule severing activity and provide new insight into spastin misregulation in Alzheimer's disease, where tau is mis-localized into neurofibrillary tangles. We are currently generating new reagents to extend these findings using biochemistry and single molecule imaging.

Major Nutrients in Complementary Foods and Their Possible Implication on Infants

Tian Gan
Sponsor: Carolyn Slupsky, Ph.D.
Nutrition

It is suggested that infants start consuming complementary foods at 6 months since beyond 6 months, human milk cannot provide sufficient nutrients for infant growth. Many parents of developing infants tend to choose complementary foods based on the availability and affordability. To better understand infant meals, we reviewed commercial complementary foods on the market in the US and China to determine the most popular food ingredients. The most common ingredients for complementary foods were classified into five categories: fruits, vegetables, grains, meat and dairy. Through searching published literature and the USDA food composition databases, we further reviewed the nutritional profile of these frequently used food ingredients to determine nutrient composition, energy density, digestibility, taste and salt level. There is a substantial difference in the complementary foods available in the two different countries. This work will help us better understand the landscape of complementary foods available to parents of developing infants.

The Art of Harm Reduction

Siddhi Ganesh
Sponsor: Adele Seelke, Ph.D.
Psychology

This project is a series of three watercolor paintings that embody the lived experiences of persons who use drugs. Having served at a clinic in Sacramento that provides free, non-judgmental, and accessible care to persons who use drugs, the community, and anyone who walks through our doors, this project pays homage to those most vulnerable to structural violence. Having had the privilege of serving at this clinic in my highest capacity, manifesting my community's narratives through art is to commemorate those who have lost their lives in the war on drugs, which is, in reality, a war on people. The project aims to raise the consciousness around psychosocial factors and the stigma that accompanies drug use by addressing Substance Use Disorder using the philosophy of harm reduction. Harm reduction is meeting people where they are and helping them get to where they want to be. It is about not letting people die by fighting paternalistic solutions and mobilizing resources to support the underserved and overlooked. It is about shifting the narrative to the radical concept of love so that every human being can make choices for themselves with dignity and a firm sense of agency over their lives.

Polymerase-gamma Manipulation to Induce Mitochondrial Deficient Cells

Nicholas Garaffo
Sponsor: Nicholas Marsh-Armstrong, Ph.D.
MED: Ophthalmology

To determine whether there is a deficiency in getting rid of damaged mitochondria in glaucoma, the Marsh-Armstrong lab is creating various genetic tools to damage mitochondria under controlled conditions. One approach is based on polymerase-gamma (polg), which encodes for a catalytic subunit of the mitochondria DNA polymerase which assists in mitochondrial DNA (mtDNA) repair and stability. Our research is geared towards the creation of Xenopus laevis with a complete knock-out of polg, or, alternatively, expressing a tetracycline inducible dominant-negative form of polg. The complete knock-out will be created using CRISPR Cas9 technology, whereby DNA insertion-deletions are expected to result in a frameshift mutation. The dominant negative will be created in a human cDNA, and will introduce a single amino acid change, D1135A, which has shown to produce a dominant negative version of polg. Making an inducible dominant negative will allow us to activate or deactivate the gene mutation, thus we should be able to study polg deficiency and activation. If expression of the dominant negative or the loss of polg leads to loss of mitochondria in retinal ganglion cells, as predicted, we will be using these animals to test vitamin B3, to determine the molecular mechanism by which B3 acts.

Is Victimization by Same- or Different-Ethnicity Peers Related to Adolescent Adjustment?

Jackelyne Garcia
Sponsor: Adrienne Nishina, Ph.D.
Human Ecology

Given the high frequency of peer victimization, or bullying, experienced during middle school years, it is essential to consider what factors are associated with adolescent adjustment. This study examines whether being victimized by peer(s) who have a similar or different background will result in higher depressive symptoms, social anxiety, and poorer physical health. Sixth grade students from ethnically diverse middle schools (N = 587, 43.6% male, 28.4% Latino(a)/Hispanic, 24.1% Caucasian/White, 23.4% Multiethnic/other, 12% African/African American, 11.5% Asian/Pacific Islander) completed daily surveys where they reported whether they had been bullied and whether their aggressor(s) had the same or different ethnic background. Our results indicate that there are no differences in adjustment indicators based on whether students were picked on by a same or different-ethnicity peer. However, students who experienced any form of peer victimization, regardless of same- or cross-ethnic, reported significantly higher depressive symptoms, social anxiety, and more physical health symptoms compared to students who had not experienced victimization. Although the current study extends our understanding of peer victimization and adolescent adjustment, it is also crucial to investigate whether other school contexts (e.g., less diverse schools) would yield different results.

Phylogeny and Evolution of the Big-eyed Tree Ant Genus *Tetraponera* from Comparative Morphological Data (Hymenoptera: Formicidae)

Lohitashwa Garikipati
Sponsor: Philip Ward, M.D.,Ph.D.
Entomology/Nematology

The Pseudomyrmecinae are a diverse group of tropicopolitan ants commonly referred to as the “big-eyed tree ants”. Our focal group, the genus Tetraponera, contains over 100 species and shows impressive variation in morphology. Recently, the phylogeny of this group was established with molecular data, but integration of morphology will provide insight into the evolutionary history of these ants. Therefore, we scored informative traits for the clypeus and mesosoma of 17 species of Tetraponera, as well as for outgroups, which included two species of Pseudomyrmex and one species of Myrcidris. We estimated a dated molecular phylogeny using MrBayes and benchmarked the morphological topology against it. This phylogeny was also used as input for the ace function of the R package ape to reconstruct the ancestral morphology of the clypeus. The resulting ancestral estimations will be used to interpret the pattern of character state change in an evolutionary context. The tree generated with mesosomal characters will reveal synapomorphies that will underlie future work with males in Pseudomyrmecinae. Combining evolutionary and phylogenetic approaches will create a more robust hypothesis of the morphological evolution for the genus Tetraponera.

Verification of Electret Microphone Data to Predict Stall in a NACA0012 Airfoil

Shannon Geary
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The phenomenon of stall presents one of the most important aerodynamic limitations on aircraft. Potential loss of lift and control due to stall on aircraft wings can cause fatal accidents. In order to mitigate stall, which is hard to predict in-flight, most commercial airplanes use permanent vortex generators (VGs) to encourage flow attachment over the wings. These are effective, but incur a constant drag penalty. The main investigation in this research focuses on creating a reliable metric for active stall-detection using frequency readings from electret microphones embedded in the wing surface. Ultimately, this will lead to the exploration of autonomously activated VGs to avoid stall while eliminating the extra drag. In support of this research, this study will visually analyze tufts on the wing section. Classically, tuft behavior on the wing surface provides a simple and reliable indication for stall behavior. In this case, digital post-processing of tuft pictures and recordings will provide more detailed information on stall behavior of the NACA0012 airfoil at different airspeeds and angles of attack. The results of this study will serve as a direct comparison for the microphone data from the main research.

Applications of Probabilistic Risk Assessment in Space Systems Design

Cory George
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

For space systems, even a minor unexpected equipment or structural failure can result in multi-billion dollar financial losses or even loss of life. Probabilistic Risk Assessment (PRA) is used to inform system design. The goal is to understand sources of risk and mitigate them as much as possible to improve the probability of mission success. This study will outline the methods of PRA as applied to a CubeSat used to inspect the hull of the International Space Station (ISS). The purpose of such a mission is to reduce hazard to human life by eliminating the need for a spacewalk, performed by a crewmember, to investigate hull damage or other issues. Understanding the risk balance of any mission involving one spacecraft in close proximity to the ISS is essential as a collision between the spacecraft and the ISS could result in a loss of mission or loss of crew scenario. Risk analysis of space systems introduces other unique sources of risk and potential failure modes. These stem from the use of new systems and technologies that have had little to no operational history. In these cases, understanding the probability of system failure and how it might occur becomes much more difficult.

Ab initio Modeling of Solvent-Exposed Variable Loops of Chlamydia Major Outer Membrane Protein

Bardia Ghayoumi
Sponsor: R holland Cheng, Ph.D.
Molecular & Cellular Bio

The major outer membrane protein (MOMP) of Chlamydia trachomatis is a prime candidate for subunit vaccination against Chlamydial infection and has been shown to elicit cross-serovar protection. Making up over 60% of Chlamydia's outer membrane mass, MOMP is comprised of solvent-exposed immunogenic regions, identified as variable domains (VDs) 1-4. Despite multiple attempts towards characterization of MOMP's structure, little progress has been made. While a model of the transmembrane beta-barrel region of MOMP has been generated using comparative homology modeling of gram-negative bacterial porins, there's no compelling evidence to validate the integrity of the quaternary structure. Here, we utilized an ab initio modeling method in conjugation with cryo-electron microscopy single particle analysis to generate models of the surface exposed antigenic regions of MOMP, as well as its quaternary assembly. Using the Rosetta software package, we modeled both the VDs on the beta barrel, as well as a simplified conformational epitope using linker regions to simulate the transmembrane region. Establishing a model for these immunogenic, yet highly labile regions of MOMP VDs, along with an experimental structure would benefit the development of a Chlamydia vaccine that targets these VDs.

Comparing the Differential Effects of Colonization Resistance and Immunotherapy in Reducing *Salmonella* Invasion

Austin Ghera
Sponsor: David Mills, Ph.D.
Food Science & Technology

Salmonellosis is the leading cause of diarrhea disease in children aged under 5, with over 20,000 cases in the US annually with limited prevention strategies. The secretory IgA antibody Sal4 can prevent Salmonella enterica serovar Typhimurium (ST) infection endogenously in mice but has had limited success as an oral prophylactic treatment. Probiotics have been regarded as beneficial to the host by competitive exclusion of pathogens for colonization sites in the gut environment. This project compares colonization resistance from probiotic administration of Bifidobacterium longum spp. infantis (BI) with Sal4-targeted immunotherapy to prevent invasion of ST in colonocytes. To investigate this, a gentamycin protection assay with a Caco-2 colonocyte culture was performed to determine total invasion of ST strain JS107. Treatment with Sal4 or BI showed a 11-fold and 8-fold decrease, respectively, in total invaded bacteria. In addition, BI treatment reduced IL-8 expression for neutrophil recruitment by 3.75-fold in Caco-2 cells. These data present slight differences in the efficacy of immunotherapy and probiotic administration at reducing ST infection, providing support for diverse prophylactic options.

Verification of Electret Microphone Data to Predict Stall in a NACA 0012 Airfoil

Kilian Ginnell
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The phenomenon of stall presents one of the most important aerodynamic limitations on aircraft. Potential loss of lift and control due to stall on aircraft wings can cause fatal accidents. In order to mitigate stall, which is hard to predict in-flight, most commercial airplanes use permanent vortex generators (VGs) to encourage flow attachment over the wings. These are effective, but incur a constant drag penalty. The main investigation in this research focuses on creating a reliable metric for active stall-detection using frequency readings from electret microphones embedded in the wing surface. Ultimately, this will lead to the exploration of autonomously activated VGs to avoid stall while eliminating the extra drag. In support of this research, this study will visually analyze tufts on the wing section. Classically, tuft behavior on the wing surface provides a simple and reliable indication for stall behavior. In this case, digital post-processing of tuft pictures and recordings will provide more detailed information on stall behavior of the NACA0012 airfoil at different airspeeds and angles of attack. The results of this study will serve as a direct comparison for the microphone data from the main research.

First Steps Towards Optimizing Plastic Biodegradation Pathways via PETase Enzymes

Isabella Glenn
Sponsor: Nitzan Shabek, Ph.D.
Plant Biology

Plastic persistence in our environment has resulted in a vastly deleterious effect on both terrestrial and marine ecosystems. Every year about 300 million metric tons of plastic are produced. This synthetic material is disposed of via recycling, landfilling, or incineration. While recycling has been a partial solution by repurposing plastic, a more permanent solution awaits to be discovered. In the past decade, scientists have been exploring the possibility of plastic biodegradation by breaking down plastic polymers into organic compounds. A plausible solution was found with the recent discovery of plastic-degrading-bacteria, Ideonella sakaiensis, that utilizes a catalytic enzyme called PETase. Although PETase effectively metabolizes polyethylene terephthalate (PET, one of the most common plastic polymer) to generate organic molecules, the hydrolysis reaction rate is extremely slow. The main goal of this study is to design a molecular and biochemical platform to optimize and accelerate the catalytic function of PETase. Here, we present the isolation and molecular cloning of PETase enzyme in bacteria. Moreover, we were able to produce PETase protein and will attempt to study its function in vitro. This study aims to provide the foundation for large-scale mutant analysis towards the optimization of plastic eating bacteria.

Hypothalamic ß-klotho Controls Energy and Glucose Homeostasis in Mice

Nadejda Godoroja
Sponsor: Karen Ryan, Ph.D.
Neuro Physio & Behavior

Obesity is a worldwide health problem that requires major attention in many countries. Fibroblast growth factor 21 (FGF21) is a hormone known to improve glucose homeostasis and decrease body weight when administered to obese mice. FGF21 crosses the blood–brain barrier and its action on the brain has been shown necessary for the hormone's weight loss effects. The precise brain region/s where FGF21 acts is unknown; however, previous research suggests that the paraventricular nucleus (PVN) of the hypothalamus plays an essential role in controlling energy and glucose homeostasis. To test whether the PVN is necessary for the observed FGF21 metabolic effects, ß-klotho, an obligate co-receptor for FGF21, was silenced specifically in the PVN using AAV-mediated viral knockdown. The resulting metabolic effects were analyzed using glucose tolerance tests, body composition analysis, and feed intake during two phases: chow and high-fat diet (HFD) consumption. Reducing ß-klotho in the PVN resulted in weight gain and poor glucose homeostasis, supporting a role for endogenous FGF21 signaling in the PVN to control systemic metabolism. These findings identify the PVN as a potential target for treating obesity and diabetis. Future studies will determine the role of PVN ß-klotho to mediate the effects of pharmacological FGF21 treatment.

The Rise Of The Far-Right, Far-Left And Populists In 21st Century American And Western European Politics: How Income And Wealth Inequality Leads To Political Instability.

Dante Golden
Sponsor: Adrienne Hosek, Ph.D.
Political Science

Income inequality has continued to rise to levels not seen since the 20th century Gilded Age, however exploration into the effects income and wealth inequality has on political stability is a new field being researched in political economy academia. Rising income and wealth inequality has correlated with large scale political instability in the United States and Western European countries with the rise of far right and populist movements as examples. I will be using economic research from international political economist Mark Blyth's recent work, Rise of Global Trumpism, to confirm income inequality directly correlates with political volatility. Designs of public policies are most often a response from events that went awry in the past, my research will also be examining historic international and domestic governmental policies from the 20th century to modern 21st century as well. Thus far, conclusions suggest that income inequality, by fueling social discontent, increases socio-political instability. These are the preliminary results from conducted research.

Hard Disk Drive Reaction Wheels for CubeSats

Ricardo Gonzalez
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The Remote Experimentation and Analysis of LEO Phenomena (REALOPs) is a 2U CubeSat development project focused on data acquisition for use in STEM education. The objective of the Attitude Determination and Control System (ADCS) is to develop low-cost solutions that meet mission orientation and stability requirements of the small satellite. Reaction wheels are necessary in addition to magnetorquer coils to provide full control and for precision attitude control and pointing maneuvers. This presentation discusses the hard disk drive reaction wheels of the ADCS. Commercial CubeSat reaction wheels cost on the order of 10^4 to 10^5 USD. REALOP will repurpose 30 USD hard disk drives, typically found in laptops and iPods, by utilizing them as reaction wheels. Hard disk drives have yet to be used for attitude control in space but are capable of meeting and exceeding the performance requirements of small satellite reaction wheels. In addition to being far less expensive than commercial options, hard disk drives are more reliable than in-house reaction wheels as they are mass-manufactured with high precision standards. The REALOP mission aims to be a technological demonstration of hard disk drive reaction wheels and prove its capabilities and potential for future small satellites.

Evaluation of Three *In Vitro* Platforms to Study Animal Gastrointestinal Function

Maria Gonzalez
Sponsor: Matthias Hess, Ph.D.
Animal Science

Microbial communities are an essential component of the gastrointestinal tract and have been identified as key factors for host health and performance. Diet can alter the assemblage of microbial communities and their function, explaining the increased interest in understanding how various diets may affect or improve performance. Studying these effects in vivo is complex due to economic and ethical limitations. Artificial methods that allow for cost effective, reproducible, controlled experimentation can address these obstacles. Numerous in vitro systems that mimic the gut ecosystem have been developed. These systems vary in complexity, ease of operation, maintenance and reliability of the generated data. This study aimed to compare various in vitro gut models to determine which can be used to most reliably depict in vivo microbial community function. We ran baseline trials comparing the volatile fatty acid, gas, and microbial community profiles of different in vitro systems to profiles observed in the natural gut ecosystem. This provided insight into the strengths and limitations of each in vitro system emulating natural gut microbiome function, and allowed us to evaluate which in vitro model might be most suitable to study and predict the in vivo effects of novel compounds on gastrointestinal health.

Can California Transition to 100 Percent Renewable Energy by 2045?

Costanza Gonzalo
Sponsor: Bagher Modjtahedi, Ph.D.
Economics

The transition to renewable energy is a controversial and politically charged topic partly because of its uncertain social costs and benefits and partly because, like any other major economic policy, it involves winners and losers. But this isn't anything new, this naturally occurs in the economic world as a result from technological progress and changes in the environment. In September of 2018, former Governor Jerry Brown signed the Senate Bill 100, which sets the goal of providing Californian end-use customers with 100 percent renewable energy by the end of 2045. However, energy use is continuously increasing every year—particularly in the residential sector. Therefore, the focus of this study is to find an optimal, sustainable quantity of demanded energy that allows California to be fossil fuel independent. Using available data and existing literature, I will consider predicted costs, population growth, and realistic renewable energy projects to estimate an equilibrium point between energy demanded and renewable energy supplied.

Optimizing Electrosynthesis of Superconducting $Ba_{1-x}K_xBiO_3$ Single Crystals

Kai Goodman
Sponsor: Valentin Taufour, Ph.D.
Physics

Electrosynthesis of single crystal superconductors is a promising technique to efficiently synthesize new compounds. Fermi surfaces of non-cuprate, high T_c superconductors are difficult to measure with Angle-resolved photoemission spectroscopy (ARPES) because few exist that can be grown with facets large enough for cleaving. We investigate and optimize the electrochemical growth-cell parameters of temperature, flux composition, electrode potential, configuration, electrical current, and oxygen content of superconducting $Ba_{1-x}K_xBiO_3$ crystals to produce large-faceted crystals with compositional homogeneity and high critical temperatures. Once large single crystals (2-4 mm) can be grown consistently, the critical temperatures are increased and sharpened by increasing oxygen saturation through annealing the crystals in oxygen. The optimization and development of this technique will not only enable ARPES measurements of BKBO's Fermi surface but also opens the window to the electrosynthesis of new compounds. Although electrosynthesis is more complex than other single-crystal growth methods, with more variables to optimize, it enables greater crystallization control.

Exploring Changes in Students' Attitudes Toward Science and Career Aspirations Through Integration of Socio-scientific Issues into the General Chemistry Curriculum

Kaanan Goradia
Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Due to its inherent complexities, students perceive chemistry as a high-level and perplexing subject. Many students fear just hearing the word, "chemistry". Increasing motivation and making chemistry relevant to students' life are important goals in chemistry education and are meant to alleviate this stress. In this project, the goal is to explore the influence of socio-scientific issues such as Nanotechnology and Alternative Energies on changes in students' career aspirations and attitudes towards the relevancy of science. Two different learning environments on these topics were prepared by using Prezi. The study was completed in three steps. First, students were asked to take pre-intervention surveys and explore the learning environments. During the discussion session, they debated on these topics by assuming real world careers, like economists, scientists and health safety experts. In the last step, they completed post-intervention surveys and highlighted discussion points. In addition to analyzing students' comments, a t-test will be performed to see if there are statistically significant differences between data collected in the pre- and post- survey results, which will help to see if such interventions are effective to influence students' attitudes and career aspirations.

Designing The Academy: Shields Library in the Digital Age

Victoria Gost
Sponsor: Mark Kessler, M.A.
Design Program

Shields Library is one of UC Davis' largest and most iconic buildings. Its recognizability and centralized location make it one of the most frequently visited structures on campus. Yet, the majority of users barely scratch the surface of the Library's resources. Undergraduates make up the library's largest user base, but of that group of 30,000 students less than 20% have ever checked out a book, let alone met a librarian. Constructed in four phases from 1930-1990, the most recent phase of construction was completed over twenty-five years ago. It is no wonder that the library today is utterly unequipped to handle the diverse needs of a growing student body in an increasingly digital age. Solutions are possible, but the question of how can only be answered through the lenses of architecture and design. Design thinking can revolutionize the way that the Davis student body utilizes Shields Library and its myriad resources by encouraging interdisciplinary research and altering the language of institutional architecture to be more welcoming.

Identifying Regulatory Genes of Mitochondrial DNA Maintenance in Budding Yeast

Kaitlynn Gov
Sponsor: Jodi Nunnari, Ph.D.
Molecular & Cellular Bio

Mitochondria are semi-autonomous organelles that contain their own genetic material. Mitochondrial genomes, or mtDNA, are packaged into protein-DNA structures termed nucleoids and encode for essential proteins required for energy production via oxidative phosphorylation. As a result, mutations in mtDNA and an altered copy number of mitochondrial genomes are linked to human diseases, including metabolic disorders. To investigate how mtDNA and copy number are maintained in cells, we conducted a genome-wide high-throughput high-content imaging screen in budding yeast. We generated a custom library of approximately 6,000 yeast deletion mutants expressing bright and functional fluorescent markers for the cytosol, mitochondria, and mtDNA using Yme2 as a nucleoid marker. We are performing image analysis using CellProfiler and machine learning to classify mutant phenotypes by their deviation from the wildtype. For each mutant, we will quantify: number of foci, fluorescence intensity, focus size, and texture. Ultimately, we aim to identify candidate regulatory proteins to elucidate the mechanisms of mtDNA maintenance in cells.

Exploring the Relationship Between Childhood Trauma and Psychotic Disorders: Associations with Symptom Severity and Age of Onset of Psychosis.

Jaxon Grandchamp
Sponsor: Cameron Carter, M.D.
MED: Psychiatry & Behav Sci

The relationship between childhood trauma (CT) and psychotic symptoms is well supported. Particularly, higher positive symptoms are typically reported. We hypothesized that the presence and age of onset of CT would be associated with 1. earlier onset of psychosis and 2. more severe symptoms, when compared to individuals with no reported CT. A retrospective chart review examined clinical interviews for individuals with first-episode psychosis (FEP; n=251) and reported or suspected CT (n=28) recruited through EDAPT and SacEDAPT clinics at the University of California, Davis. Clinical interviews were completed by clinicians and research assistants under the direct supervision of doctorate-level researchers. Preliminary results indicated that individuals with CT demonstrated a trend for higher disorganization symptoms at baseline intake (p=.06). We did not see a relationship between CT and other symptoms, age of onset of psychosis, or severity. Consequently, a history of CT is associated with subtly higher attentional/disorganization symptoms when an individual presents with psychosis as an adolescent or young adult. The lack of relationship between CT and age of onset of psychosis, may be due to the small sample size. Additional data collection and analysis is ongoing and will be included in the final poster.

Unveiling the Social Determinants of Opioid Use

Grace Grant
Sponsor: Patricia Roberson, Ph.D.
Human Ecology

In 2017, the United States declared the opioid epidemic to be a national public health emergency. Research has shown that the greatest threat remains concentrated in rural, low-income areas of the United States. Thus, it is important to research other potential social determinants that influence opioid use. The research question to be investigated is: Does socioeconomic status (SES) influence whether individuals use opioids? In order to address this research problem, data from a pilot study conducted by the University of California, Davis was used. The study surveys patients who have attended Remote Area Medical Clinic in rural Appalachia with limited health access and asks patients about their opioid use. Results from this study will suggest how a low socioeconomic status (measured by insurance coverage, geographical setting, income, and education level) influences participant opioid use. The results of this study will emphasize the importance of creating and implementing educational programs that target individuals who may be at a higher risk of opioid abuse before they become users. Additionally, the results will provide evidence supporting the need for addiction programs and treatment interventions that target uninsured populations with limited health access.

Physico-chemical Analysis of Starch Granules from Genetically Modified Wheat (*Triticum aestivum* L.)

Grace Gravley
Sponsor: Diane Beckles, Ph.D.
Plant Sciences

Wheat starch is one of the most important caloric sources for the human diet. The gene TaGW2 is associated with smaller grain size and lower thousand-grain weight in wheat by modulating cellular division in the husk and grain. Knockouts of the TaGW2 gene were performed on multiple wheat varietals via CRISPR/Cas9 biotechnology. With the decreased presence of functional alleles of TaGW2, overall grain size and thousand grain weight increased. A similar mutation in an orthologous rice gene resulted in an increase in grain size but also in chalky grain starch, an incredibly undesirable trait. In this study, the effect of loss of TaGW2 on wheat the physico-chemical properties of wheat starch quality was determined. The biomolecular construction of starch, composed of branched glucan polymers known as amylose and amylopectin, dictates starch property and thus its usefulness as a food. We sought to characterize the proportion of amylose to amylopectin and starch granule size and morphology, important quality parameters of wheat to elucidate the usefulness of the transgenic wheat line in various downstream food applications. We utilized a high throughput methodology that could be adopted in future experimentation for the analysis of starch granule composition.

Ectopic Expression of Orthologous *CBF1* Genes on Chilling Tolerance in Transgenic Solanum lycopersicum L.

Jonas Grove
Sponsor: Diane Beckles, Ph.D.
Plant Sciences

Subtropical species like tomato experience Postharvest Chilling Injury (PCI) when transfered to room temperature after being refrigerated (0-12.5°C). PCI accelerates fruit spoilage leading to post-harvest waste. CBF1 is a transcription factor that has been shown in previous studies to increase chilling tolerance when overexpressed in transgenic tomato plants. No studies have been conducted on fruit post-harvest, thus leading to our hypothesis that CBF1 upregulation in chilled fruit could reduce PCI. This was tested in transgenic tomato lines engineered with cold or chemical-inducible regulatory systems of native and orthologous CBF1 genes. Transgenic fruit were harvested, cold-stored, and PCI development was monitored based on phenotypic characteristics such as objective color and surface pitting. CBF1 transgenic expression was confirmed by qRT-PCR. Results revealed an amplification of PCI symptoms and accelerated senescence of transgenic fruit. If CBF provides an advantage to plants under cold stress, it is possible that the fruit phenotype may be advantageous to plant fitness. Therefore, the physiological effect of CBF1 overexpression on seed germination and seedling growth was assessed under chilling and control temperatures. This study allowed for more insight into understanding the regulatory mechanisms of fruit cold response.

Testing Efficacy of Baits for Fungus Gnat Traps in a Greenhouse Environment

Alyssa Gu
Sponsor: Jennifer Mullin, Ph.D.
Biological & Ag Engineering

Fungus gnats (Bradysia species) are small, black flies whose larvae feed on roots and leaves resting on the surface of soil. Gnat-damaged plants may wilt or die from resulting exposure to pathogens. Seedling flats and greenhouses are particularly vulnerable to fungus gnat infestations. Most existing pest management solutions target eggs and larvae. Though adult gnats pose no direct threat to plants, each female can lay 200-300 eggs. Single-use sticky tape, the only major pest management solution targeting adult gnats, produces plastic waste. To address this dearth of solutions, our team utilized rapid prototyping techniques to design reusable, modular testing devices (i.e. traps) targeting adult gnats. Each prototype trap featured a conical lid tapering to a small aperture, a glass body with opaque sides and a transparent base, and a bottom compartment to house electronics. Traps were used to test the efficacy of baits such as apple cider vinegar and short-wavelength light to attract and trap gnats in liquid media. Preliminary field testing demonstrated the importance of environmental conditions on gnat populations, prompting further trials in order to collect statistically significant sample sizes.

Development of a T7-Based Tetracycline Inducible Gene Expression System in *Giardia lamblia*

Yinghao Gu
Sponsor: Scott Dawson, Ph.D.
Microbiology & Molec Genetics

Giardia lamblia is a widespread, yet understudied unicellular eukaryotic parasite. Giardia is one of the global causes of severe parasitic infections in human, especially in areas with poor water system sanitation. Upon the ingestion of Giardia cysts, the trophozoites attach and colonize the small intestine. Pathogenesis is less understood. Despite a completed genome, molecular genetics in Giardia cell biology are limited by few methods of genetic manipulation. We recently developed methods for constituitive CRISPRi knockdowns in Giardia, yet we still lack methods to regulate expression of endogenous or exogenous genes. Thus, we are developing an inducible gene expression system using the bacteriophage T7 RNA polymerase with T7 promoters to drive exogenous gene expression in Giardia. We have shown that exogenous luciferase genes are expressed using various T7 promoters. Now I am optimizing the tetracycline-inducible system by including a upstream tetracycline operator (tetO) and by expression the repressor (TetR) to inducibly express Nanoluc luciferase or mNeonGreen. We are currently evaluating the levels of induction and penetrance of both constructs using live imaging and bioluminescence assays. Overall, this inducible T7-based system reliably expresses exogenous genes in Giardia, and we are currently evaluating protocols for maximal induction of gene expression.

Impacts of Human Presence at Wildlife Culverts

Mia Guarnieri
Sponsor: Fraser Shilling, Ph.D.
Environmental Science & Policy

As the world becomes more developed, fragmentation of wild habitats by roads is an increasingly large problem. Roads create barriers to wildlife movement, leading to smaller, less diverse, isolated populations, and are often a site of high mortality as animals try to cross them. Wildlife crossing structures under major roadways are an innovative way to combat habitat fragmentation by allowing animals to safely cross roads, but to be beneficial, these structures must be used by the animals. Human presence may negatively impact wildlife use of crossing structures, rendering them less effective. In this project, I will examine the impacts of human activity at crossing structures using data from seventeen cameras at eleven underpasses along California highways, observing the number of humans per day, the number of species present, and the time between animal and human occurrences. I will then perform a regression to determine if number of humans per day is negatively correlated with number of species present at the culvert, and generate a chi square test to determine if animals are taking significantly longer to return to the culvert after a human occurrence, thereby altering their typical patterns as a result of human presence.

Pancreatic Delta Cells Form Heterogeneous Subpopulations

Jaresley Guillen
Sponsor: Mark Huising, Ph.D.
Neuro Physio & Behavior

Pancreatic beta and delta cells work together to maintain normoglycemia in healthy individuals. Loss or dysfunction of beta cells results in hyperglycemia, a key characteristic of diabetes. The role of delta cells is increasingly appreciated and we now know of several hormones that activate delta cells to modulate insulin release. The goal of my project is to identify how delta cells respond to different stimuli with the underlying hypothesis that individual delta cells display heterogeneity in their responses within pancreatic islets. Identifying this heterogeneity and elucidating how somatostatin secretion is regulated is fundamental for understanding how the islet works in a coordinated fashion to accurately regulate blood-glucose. To test my hypothesis, I used transgenic mice that expressed GCaMP6 selectively in delta cells. This allowed me to view the calcium response of delta cells within live islets using confocal microscopy. I perfused different stimuli known to activate delta cells, followed by depolarization with KCl to confirm the viability and responsiveness of the cells throughout the experiment. I then quantified delta cell responses over time using imaging analysis software. My data thus far support my hypothesis of heterogeneity among delta cells, both in their pulsatile patterns and their response to various stimuli.

Interactions During Shared Book Reading: Spanish-English Bilingual Children and their Parents

Paola Gutierrez
Sponsor: Yuuko Tonkovich, Ed.D.
Education

Past studies with preschoolers and younger, have shown that bilingual parents tend to read to their children in the language that is most spoken at home. Also, bilingual parents read in the language they are most comfortable reading in. Parents engaged their preschooler by pointing to illustrations that might relate to the child, providing yes/no questions, giving more descriptions, and providing positive feedback (Rodriguez, Hines,& Montiel 2009). The goal of this study is to understand how Spanish-speaking parents interact with older children, specifically with a kindergarten child while reading a bilingual book. The research question are (1) What languages do Spanish-speaking parents use with their Spanish-English bilingual children when reading bilingual books? (2) What are some strategies Spanish-speaking parents engage in when reading to their children? A total of 12 Spanish-speaking parent-child dyads were asked to read a Spanish-English bilingual book, Radio Man by Arthur Dorros together. Preliminary results show that parents tended to read mostly in Spanish. When the parent engaged, they would ask questions about the text and point to the illustrations. Results suggest that bilingual books provide opportunities for parents and children to read in a language that they feel most comfortable in.

Digitization of Process Parameters in Manual Grinding

Shivam Gupta
Sponsor: Barbara Linke, Ph.D.
Mechanical & Aerospace Engr

Constant increase in demand for production services in the modern world emphasizes the need for sustainable manufacturing practices. The primary design principles of smart manufacturing aim at attaining cognitive process monitoring for cyber-physical systems. This monitoring can provide significant insight into manufacturing processes in real-time scenarios. Manual Grinding is used to repair or customize products through a hand-held power tool and depends heavily on the operator's skills. Aggregating and comprehensively visualizing the process parameters data such as manual feed and tool orientation and evaluating the operator profile promises to improve the efficiency of the process. This project utilizes a 6-axis Inertial Measurement Unit (IMU) to measure the acceleration and position of the operator's wrist holding the power tool during the grinding process. In order to process the data in real-time, the IMU is programmed to use a cloud interface to analyze and extract useful process-related information such as manual feed rate and wrist orientation, which can be used as a measure of consistency in the operator's hand movement. Validation of data is carried out by moving the IMU through a test space and comparing the results obtained with mathematically known values.

Functional Analysis of LET-99, a Protein Needed for Asymmetric Cell Division

Camelia Hacein-Bey
Sponsor: Lesilee Rose, Ph.D.
Molecular & Cellular Bio

Asymmetric divisions produce daughter cells with distinct contents, which results in different fates. Such divisions are important for development in many organisms and are controlled by conserved polarity proteins. Previous work has shown that in the C. elegans embryo, LET-99 is a regulator of asymmetric division and is asymmetrically localized at the cell membrane in response to polarity proteins. There, LET-99 plays a role in the orientation and timing of embryonic division. The purpose of this study is to determine which parts of the LET-99 protein are essential for its function. To do this, versions of the LET-99 protein with specific domains deleted were introduced into C. elegans as extra copies (transgenes). We then generated C. elegans strains containing these transgenes in combination with a complete loss of the normal let-99 gene. We are examining the localization of LET-99 in embryos expressing these transgenes, compared to wild type, to determine which domains are important for asymmetry or membrane targeting. We will also determine if a given domain is required for normal orientation or timing of division. Through the analysis of these lines, we will gain a better understanding of the LET-99 protein in asymmetric cell division.

Analyzing the United Nations Population Projections and Estimates

Lily Hallmark
Sponsor: Emily Merchant, Ph.D.
Science & Technology Studies

This project aims to understand how knowledge of the world's population has changed over the last 60 years through quantitative analysis of United Nations population projections from 1957 up until 2017. Since its establishment in 1945, the United Nations has been instrumental in promoting the collection of population data in countries all over the world. In 1957, the United Nation Population Division began publishing World Population Prospects on a semi-regular basis, they now publish revisions approximately every two years. At each publication date, World Population Prospects summarizes what is known about the world population in the form of estimates of the past population size and projections for the future population size for each continent and for the region as a whole. This project will utilize data from the full run of World Population Prospects to examine the history of knowledge regarding the size of the past and future world's population.

An investigation of cross-kingdom pathogen interactions and their part in disease development

Natalie Hamada
Sponsor: Richard Michelmore, Ph.D.
Plant Sciences

Plant pathogens utilize various strategies to successfully infect their hosts. Bremia lactucae, the oomycete causal agent of lettuce downy mildew, is a biotrophic pathogen that utilizes RNA silencing suppressors to inhibit lettuce siRNA -- an important element of the plant immune system. RXLR3 effector proteins are B. lactucae silencing suppressors, and I aim to better characterize their role in plant disease development. Although RXLR3 has been shown to be a silencing suppressor, the mechanism by which it functions and its level of specificity for siRNA have yet to be characterized. Plants possess multiple "tiers" of immunity, ranging from pathogen-specific ETI (effector triggered immunity) to broader MTI (microbial-associated-molecular-patterns-triggered immunity). If RXLR3 inhibits siRNAs significant to plant basal immunity, it may result in the host plant becoming more vulnerable to infection by other pathogens, such as bacteria and fungi. To determine if there is a correlation between RXLR3 expression and increased virulence of non-oomycete pathogens, I am developing qPCR and colony-counting assays to quantify growth of the bacterial lettuce pathogen Xanthomonas campestris pv. vitians (Xcv). These assays will be utilized to compare Xcv growth in the presence and absence of RXLR3.

Hard Disk Drive Reaction Wheels for CubeSats

Rafic Hamade
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The Remote Experimentation and Analysis of LEO Phenomena (REALOPs) is a 2U CubeSat development project focused on data acquisition for use in STEM education. The objective of the Attitude Determination and Control System (ADCS) is to develop low-cost solutions that meet mission orientation and stability requirements of the small satellite. Reaction wheels are necessary in addition to magnetorquer coils to provide full control and for precision attitude control and pointing maneuvers. This presentation discusses the hard disk drive reaction wheels of the ADCS. Commercial CubeSat reaction wheels cost on the order of 10^4 to 10^5 USD. REALOP will repurpose 30 USD hard disk drives, typically found in laptops and iPods, by utilizing them as reaction wheels. Hard disk drives have yet to be used for attitude control in space but are capable of meeting and exceeding the performance requirements of small satellite reaction wheels. In addition to being far less expensive than commercial options, hard disk drives are more reliable than in-house reaction wheels as they are mass-manufactured with high precision standards. The REALOP mission aims to be a technological demonstration of hard disk drive reaction wheels and prove its capabilities and potential for future small satellites.

University Honors Program Mental Health Initiative

Nina Han
Sponsor: Eva Schepeler, Ph.D.
Psychology

The state of mental health among college students is an issue that has been thoroughly studied in recent years after increased public awareness. What is lacking, however, is research specifically on honors students' mental health which we suspect is uniquely at risk because of the high expectations to succeed placed on them by themselves and others. This study aims to shed light on this issue by administering a survey to students in the University Honors Program (UHP) at UC Davis asking students about their UHP experiences, their mental state, and their knowledge of campus mental health resources. The preliminary results of this investigation suggest that honors students are stressed about honors classes, lack of support from UHP staff, and program requirements (i.e. GPA). The ultimate results of this survey will be used to produce a series of mental health workshops for honors students and will provide insight to UHP staff on how to best support students in UHP. Overall, these results will serve as a starting point for shifting the culture surrounding mental health in honors students, so that future UHP students will be better prepared to manage their stress and consistently prioritize their mental health.

Title: Fusarium oxysporum f. sp. fragariae as a Saprobic Competitor

Teska Hapig-Ward
Sponsor: Thomas Gordon, Ph.D.
Plant Pathology

Fusarium oxysporum f. sp. fragariae (Fof), a soil borne fungus, causes Fusarium wilt of strawberry,posing a long-term threat to the strawberry industry in California and elsewhere in the world. Symptoms of this disease include stunting, reduced productivity, wilting, crown discoloration, and death. The fungus can survive in soil for over a year by producing spores that remain dormant until a suitable host is present. Therefore, the most common management strategy is crop rotation, allowing enough time between susceptible crops for inoculum levels to decline below the density necessary for disease. However, pathogen colonization of organic matter from non-susceptible crops could allow for persistence of the pathogen in the soil. The present study evaluates the competitive saprobic ability of the pathogen in comparison to other strains of Fusarium commonly found in soil. Leaf samples from lettuce and strawberry plants were placed in infested soil, and, after five days, were removed to assay for colonization by Fof and other Fusarium species. Preliminary results show Fof to be the predominant colonizer of both strawberry and lettuce tissue, indicating that the pathogen is a competitive saprobe in the soil. Experiments are in progress to confirm these findings.

Gentle Ventilation and Neurocentric Management of Persistent Pulmonary Hypertension of the Newborn

Morgan Hardie
Sponsor: Satyanarayana Lakshminrusimha, M.D.
MED: General Pediatrics

Persistent pulmonary hypertension of the newborn (PPHN) can be a life-threatening condition, and survivors are at an increased risk of neurodevelopmental impairment. Hypocapnia leads to cerebral vasoconstriction and can exacerbate neurologic outcomes. We hypothesized that maintaining higher CO_2 values in a lamb model of PPHN results in improved cerebral blood flow and oxygenation without compromising pulmonary blood flow (Qp). 25 fetal lambs were intubated, and flow probes were placed around the left carotid and left pulmonary arteries. PPHN was induced by umbilical cord occlusion and meconium aspiration. Lambs were randomized to high (14-17 mg/dL) or low (10-13 mg/dL) hemoglobin and high (50-70 mmHg) or low (30-45 mmHg) CO_2. Carotid and pulmonary flows were continuously measured, and arterial blood gases were collected every 15 minutes. Left carotid blood flow (Qca) was significantly higher in the high CO_2 group (29.3 ml/kg/min) compared to the low CO_2 group (17.5 ml/kg/min) at both high and low hemoglobin, while Qp remained similar across the groups. Additionally, carotid oxygen delivery was greatest in the high CO_2, high hemoglobin group. In a lamb model of PPHN, maintaining higher CO_2 improves Qca and oxygen delivery without compromising Qp.

Effects of the *3etv* Genes on the Left/Right Asymmetry in Zebrafish

Neta Hart
Sponsor: Bruce Draper, Ph.D.
Molecular & Cellular Bio

Left/right (L/R) differentiation is important for correct organs alignment and the health of the organism, whether it is a fish or a human. During early embryonic development, asymmetry must distinguish the left side from the right, so cells can develop correctly. Thus, studying how asymmetry is established is important for understanding health issues regarding incorrect organ development. Polycystic kidney disease 2 (pkd2) is known to affect L/R asymmetry in zebrafish. The three ETS translocation variant genes (3etv), currently not known if they affect L/R asymmetry, shows similar mutated phenotype to pkd2 zebrafish mutants. The similarities in the two phenotypes lead to the investigation of the 3etv genes' effects on asymmetry. My hypothesis is that because 3etv mutants show similar phenotypes to pkd2 mutants, 3Etv transcription factors function in the pathway as pkd2 and regulate L/R asymmetry. To test this, I will use RNA in situ hybridization which compares asymmetry markers in normal and mutated 3etv fish. If hypothesis is correct, I expect to see L/R pattern defects in the mutated embryos but not in the wild-type embryos. If 3etv genes affect asymmetry, Kupffer's vesicle – starting point of L/R asymmetry – will be better understood and organs' alignment implications can be studied.

Comparing Nutrient Types in the Hydroponic Production of Bok Choy

Eleanor Haworth
Sponsor: Jason Gross, Ph.D.
Animal Science

Hydroponic food production systems in California are increasingly popular for commercial agriculture with a focus on tomatoes, herbs, and leafy greens. Hydroponic, also known as soilless growing traditionally uses mineral nutrient solutions. Another potential source of nutrients high in limiting nutrients including nitrogen and phosphorus is waste water and solids from aquaculture. Aquaculture waste can be costly to dispose of and by incorporating these nutrients into hydroponics, farming can increase water conservation as well as reuse and recycle wastes. Hydroponic growing is also a viable option for drought prone areas as lettuce grown hydroponically will use 90% less water than conventional farming techniques. the purpose of this study is to explore the utility of aquaculture derived nutrients compared to commercial hydroponic nutrients on Chinese cabbage specifically bok choy. Bok choy is a California specialty crop high in vitamins C and A as well as economically valuable compared to regular cabbage. six species of bok choy were grown in a controlled greenhouse using the nutrient film technique (NFT) and deep-water culture (DFW) technique. Endpoints compare root mass, growth rate, and seed performance of each species and potentially. open up new markets for farmers as well as increase yield and profits.

The Benefits of Physical Therapy Following Fetal Repair of Myelomeningocele in an Ovine Model

Kalie Haynes
Sponsor: Diana Farmer, M.D.
MED: Surgery

Myelomeningocele (MMC) is one of the most severe forms of spina bifida that can affect up to 1 in 4,000 babies annually. This debilitating birth defect is caused by the failure of spinal cord development, leading to full or partial paraplegia. Our preceding research using the fetal ovine model of myelomeningocele, discovered that fetal treatment with placenta-derived mesenchymal stromal cells (PMSCs) leads to significant improvements in the motor function of the lambs. However, because the ovine model is limited by the surgically created spinal instability, we are now testing the improvement of motor function with daily physical therapy. Our therapy includes once to twice daily sessions, five days a week, in which one lamb, treated with PMCSs, performs our ten current exercises for core and hind limb strength. One lamb currently undergoing therapy has lived for 77 days and continues to progress. Our two previous lambs that did not receive physical therapy only survived 29 and 65 days. Both were euthanized for the inability to walk and nurse, which resulted from muscle atrophy. This study explores the importance of physical therapy on recovering MMC lambs, how it may impede the process of muscle atrophy, and shows initial promising results.

Analytical Research of Carbon Nanotube Presence from Novel Synthesis Method

Malia Helms
Sponsor: Bryan Jenkins, Ph.D.
Biological & Ag Engineering

Water quality and water scarcity are of great global concern especially as the global population continues to grow. Various technologies have been developed to combat these issues but still need major improvements. Carbon nanotubes (CNTs) display remarkable properties which have captured the interest of many research studies attempting to develop improved water filtration technologies. CNTs have shown remarkable applications in water filtration technologies like membranes in desalination and waste water treatment, and as biosensors for the detection of pathogens and organic pollutants. Current synthesis methods of CNTs are extremely expensive and problematic due to the lack of size uniformity and reproducibility of the CNTs. Current CNT studies also focus on solving these issues as CNTs are one of the most relevant nanomaterials in research, and a cost-effective production method is imperative to their application in a wide variety of technologies. In this study, the investigators research the presence of CNTs in a sample from a novel CNT production method using analytical methods like SEM and Raman Spectroscopy.

Origin and Laminar Distribution of Newborn Granule Cells in Adult Hippocampal Neurogenesis

Bryan Heng
Sponsor: Hwai-jong Cheng, M.D.,Ph.D.
Neuro Physio & Behavior

Adult hippocampal neurogenesis (AHN) is a form of neural plasticity where new neurons are integrated into pre-existing brain circuits. Current research on AHN has focused on young adult ages – few studies have examined older adult ages. This project examined the origin and migratory pattern of adult-born neurons in the hippocampus by looking at AHN throughout the lifespan of mice. We hypothesized that the pattern of adult-born granule cell distribution would recapitulate their distribution during neonatal development. We predicted that this recapitulation would result in the distribution of granule cells throughout the granule cell layer of the dentate gyrus. This project utilized the CreER recombinase / tdTomato system to determine the number and localization of granule cells in aged animals at different timepoints after their birth. Contrary to our hypothesis, we found that adult-born granule cells were primarily localized within the inner region of the granule cell layer. Our analysis also revealed that the number of adult-born granule cells peaked between three and six months of age. These results suggest that AHN impacts a specific subset of granule cells localized in the inner core of the dentate gyrus and that these adult-born granule cells are generated from a specific neurogenic niche.

The Production of Phospholipase A_2 (PLA_2) Neutralizing Proteins in Walnut Embryos to Fight Inflammation

Nicole Hensley
Sponsor: Abhaya Dandekar, Ph.D.
Plant Sciences

The South American snake, Bothrops jararacussu, secretes venom into its victim causing the amplification of PLA_2 activity. PLA_2 removes fatty acid from phospholipids which results in inflammation. Humans that are bitten are treated with antivenom that their body will accept. Many antivenoms have been produced in large animals. However, after a human is given the antibodies produced by these animals for a third time, they no longer accept them, the antivenom has no effect. The venom of the snake contains toxin neutralizing proteins that prevent PLA_2-caused inflammation and effectively make the snake resistant to its own venom. These proteins have been extracted from the blood of venomous snakes, and synthesized in model organisms, such as tobacco plants. Walnut embryos are a new factory for these proteins; they are smaller than tobacco plants and produce copious amounts of protein that are easy to detect and isolate. This research experiment is determining the difference in protein production in walnut embryos transformed with a plasmid containing His or FC-tagged sequences of the anti-inflammatory protein. The proteins can eventually be utilized to help prevent inflammation due to the snake bites, or even help humans fight inflammation in the formation of cancerous tumors.

Data Quality in the Visual Comparison Task

Anna Herbolzheimer
Sponsor: Lisa Oakes, Ph.D.
Psychology

The visual paired comparison (VPC) task is used to measure individual differences in infants' memory abilities, and is based on the foundational finding that infants look longer to novel stimuli (Fantz, 1964). In this task, infants are first shown a single stimulus for a period of time (the familiarization phase) and then that now-familiar stimulus is paired with a novel stimulus (the test phase). The measure of infants' memory of the initial stimulus is a novelty preference score, which is the proportion of time infants look to the novel object in each trial. In our study, infants received up to 9 VPC tasks, and we aggregated their novelty preference scores over all the trials completed. However, infants' average scores are based on different numbers of completed trials, perhaps causing issues in the stability of their final scores. The goal of this project is to understand the statistical properties of scores as a function of the number of trials completed. Preliminary analysis indicates that aggregate scores become more stable with data per infant. We will run simulations to gain a deeper understanding of how variability in these scores changes as a function of the amount of data collected from each infant.

Investigating the Mechanism Behind the Tumor Suppressive Properties of miR-127

Maria Hernandez
Sponsor: Colleen Sweeney, Ph.D.
MED: Biochem & Molecular Med

Breast cancer causes the most cancer-related deaths in women worldwide. About 80% of breast cancers highly express estrogen, progesterone, and Her2 receptors, allowing these cancers to be highly responsive to hormonal ER-, PR-, and Her2-specific therapies. However, triple negative breast cancer (TNBC), the most aggressive type of breast cancer, lacks these drug-targetable receptors, and therefore has no effective targeted therapies. Thus, TNBC poses a challenge for effective treatment,which has led to increased interest in identifying genetic drivers for this breast cancer type. MicroRNAs (miRs) are small, non-coding RNAs that negatively regulate gene expression by interacting with the 3'UTR of mRNAs. miR-127 is a tumor suppressor miR that is downregulated in TNBC, suggesting that it may play a role in TNBC pathogenesis. However, the molecular mechanism behind miR-127 function is yet to be identified. The goal of this project is to elucidate this mechanism. Through RNA sequencing, we have identified potential targets of miR-127. Western blots will be utilized to determine if they are down regulated by miR-127 at the protein level. If this is the case, Luciferase assays will follow to determine if they are direct binding targets.

The Function of OsKCH2 in Coordinating Microtubules and Actin Filaments During Cell Division in *Oryza sativa*

Eduardo Hernandez Ramirez
Sponsor: Bo Liu, Ph.D.
Plant Biology

This project is focused on the microtubule motor protein, OsKCH2 in the monocot rice species Oryza sativa. OsKCH2 is a plant-specific kinesin belonging to a subgroup called kinesin-14s which have a calponin homology domain that binds actin filaments. We are specifically interested in how OsKCH2 allows for the cross-talk between microtubules and actin filaments, the components of the cytoskeleton essential for cell division. Research shows that OsKCH2 is localized in the mitotic microtubule arrays during cell division, therefore discovering the function of OsKCH2 allows us to further understand cell division. Methods used to study OsKCH2 include physiological treatments comparing a wild-type line, TP309, and two mutant lines, R167 and R164, generated by CRISPR/Cas9-based genome editing. The treatments include temperature stresses which manipulate cytoskeletal dynamics, the use of the drug Latrunculin A which inhibits actin polymerization, and the herbicide Oryzalin which inhibits microtubule polymerization. All seeds are planted in growth media with their respective treatments. The growth and morphology after treatments will be recorded. Immunofluorescence microscopy will be applied to examine the effects of treatments on microtubules and actin filaments. Outcomes of these experiments will advance our understanding of OsKCH2's role in coordinating the two cytoskeletal systems during cell division.

Examining the Intersection of Buddhist Non-Attachment and Attachment Security in Experienced Meditators

Ruha Heydari
Sponsor: Clifford Saron, Ph.D.
Center For Mind & Brain

Close relationships are core to the human experience, and questions of how best to be in relationship with the self and others are found across cultures. Western psychological attachment theory and the Buddhist concept of non-attachment both grapple with these core questions. Attachment theory posits that secure attachment is developed through experiences with early caregivers, with consequences for relationships in adulthood; whereas non-attachment holds that security is not attained relationally, but through cultivating one's mind. Using self-report scales, we examined the relationship between these two constructs in experienced meditators (n=61). We found negative correlations between both dimensions of Western attachment insecurity (avoidance and anxiety) and Buddhist non-attachment, suggesting that greater non-attachment is related to more secure attachment profiles. We then examined correlations among retreat-related changes in these scales following a month-long meditation retreat attended by half of the original participants (n=29). Here we found that increases in non-attachment were related to decreases in attachment anxiety, but not attachment avoidance. These findings suggest that these constructs are related, but may not be equivalent. They further suggest that both may be influenced by meditation training. We will also test whether these findings replicate in a second retreat cohort.

Structural Characterization of Tumor Microenvironment Using Multicellular Tumor Spheroid Models

Lainey Hibbard
Sponsor: R holland Cheng, Ph.D.
Molecular & Cellular Bio

The tumor microenvironment (TME) plays a critical role in the rearrangement of the extracellular matrix (ECM) which enable progression and mitigation of cancer spread and tumor growth. Key macromolecular components of the ECM such as collagen promote an increased internal pressure in solid tumors, which may inhibit successful delivery of anti-cancer therapeutic agents. Using multicellular tumor spheroid (MCTS) models, we studied the role of collagen in the formation of TME by genetically knocking-out and knocking-in of one of the collagen's primary receptors, a2ß1 integrin. MCTS are reliable models of in vivo solid tumors that mimic key features of solid tumors, such as spatial architecture, physiological responses, cell to cell contacts and drug resistance mechanisms. Using electron microscopy, we studied morphological features of the cells and the ECM in the presence and absence of functional a2ß1. Our preliminary observations indicate that in the absence of a2ß1, the TME is generally less dense. As a part of an ongoing investigation, we used hepatitis E viral nanoparticles (HEV-NP) to evaluate the accessibility and penetration of the NPs into the MCTS +/- a2ß1; and to further validate our observations, we used highly focused ultrasound to induce hyperthermia for evaluations of delivery success.

Sex Chromosome Recombination is Exquisitely Sensitive to the Levels of Paralogous SUMO E3 Ligases, RNF212 and RNF212B

Rachel Hirota
Sponsor: Neil Hunter, Ph.D.
Microbiology & Molec Genetics

Crossing over in meiotic cells enables accurate chromosome segregation and gamete formation. While ~300 double-strand breaks (DSBs) form in each meiotic cell, only a small portion (~10%) result in crossing-over. Each pair of homologs obtains at least one crossover to ensure proper chromosome segregation, and defects in crossover formation cause aneuploidy, which may lead to birth defects or infertility. We have found that RNF212, a RING SUMO E3 ligase, and its paralog RNF212B are essential for crossing-over during mouse meiosis. Rnf212 alleles have been associated with heritable variation in human recombination rate, and recent studies have linked Rnf212b to recombination rate in Bovidae. Consistent with these genome-wide association studies, both proteins demonstrate dosage-dependent regulation of crossing-over in mice: heterozygotes for either gene show a reduced number of crossovers. To investigate the relationship between the two paralogs, we prepared metaphase-I chromosome spreads from spermatocytes of $Rnf212b^{+/-}/Rnf212^{+/-}$ double heterozygotes. Overall, we observed fewer crossovers than in either single heterozygote. Surprisingly, $Rnf212b^{+/-}/Rnf212^{+/-}$ heterozygosity synergistically reduced crossing-over between the X and Y chromosomes, resulting in smaller testes indicative of apoptosis of defective meiotic cells. Ongoing studies aim to understand why sex chromosome recombination is so sensitive to the levels of RNF212 and RNF212B.

Genome Wide Association Study Identifies Two Loci for Distichiasis in Friesian Horses

Erin Hisey
Sponsor: Rebecca Bellone, Ph.D.
VM: Population Hlth & Reprod

Distichiasis, a condition reported in Friesian horses, occurs when lashes grow from the Meibomian glands along the inner eyelid. These lashes can cause irritation and corneal ulcers, which can lead to vision loss or eye removal. Because of its bilateral nature and prevalence in a breed with known monogenic disorders, this condition is hypothesized to be inherited as a Mendelian trait. To test this, a genome wide association study (GWAS) was performed utilizing the Equine Affymetrix 670K array (MNEc670k) on fourteen cases and thirty-eight controls phenotyped for distichiasis. A chi-squared test for a basic allelic association identified a 1.83 Mb locus on ECA5 and a 371 kb locus on ECA13 as associated with the disorder ($p_{corrected}$=0.025 and $1.5x10^{-4}$, respectively), however genomic inflation was high (λ=1.50). To correct this, a single locus mixed linear model (EMMAX) was employed. In an additive model, both loci were further supported ($p_{corrected}$=0.016 and 0.032, respectively). A haplotype analysis (hapQTL) narrowed the region of association on ECA5 to 235 kb and on ECA13 to 163 kb. Whole genome high-throughput sequencing data from 3 cases and 2 controls is being analyzed in the associated regions to identify variants that explain the genetic risk for distichiasis.

Modeling Stochastic Environments with Markov Decision Processes

Johannan Hjersman
Sponsor: Zhaojun Bai, Ph.D.
Engr Computer Science

The field of robotics has undergone considerable growth with many advancements in navigation hardware and software. However, similar to humans, robots perceive the world with incomplete information. Since robots gather incomplete data, we propose to focus on optimizing its decision making by utilizing a Markov Decision Process, a mathematical model that produces partly random effects, but the controller possesses a modicum amount of control. These values will be modified based on the accuracy of its performance when introduced to interference during an event with a deterministic outcome. These modifications will also account for any Hidden Markov Models from unknowns in the system. This learning algorithm will be optimized based on empirical evidence with the intent to produce the best decision for artificial intelligence possible given the circumstances. Using Gilbert Strang's textbooks on Linear Algebra and Stuart Russell's Artificial Intelligence as a foundation, Markov Chains will be developed to handle complex decisions from a multitude of variables from the robot's observed environment. The goal of this project is to further our understanding of techniques in artificial intelligence in a world of uncertainty.

Stormwater Bioremediation: Testing the Efficacy of Biochar for Reducing Nutrient Pollution, and Greenhouse Gases in Bioreactors

Amanda Ho
Sponsor: Benjamin Houlton, Ph.D.
Land Air & Water Resources

This project treats contaminated runoff coming from an off-campus facility discharging into Putah Creek. The runoff's excess nutrients are a cause of eutrophication that can lead to ecological consequences including hypoxia, fish die-offs, and trophic cascades.Thus far, most bioreactors have been used for agricultural tile drainage, whereas this one will test their use on stormwater runoff. Moreover, the majority of bioreactor studies only account for nitrate removal; however, this project will look at phosphate concentrations and nitrous oxide emissions, as well. For this project, 3 field-scale bioreactors were built to filter stormwater and test the efficacy of different designs in facilitating microbial denitrification and phosphate solubilization. The north bioreactor is the control filled by woodchips, the center is 90% woodchips and 10% biochar, and the south is filled with miscellaneous mulch.Chemical analyses of stormwater samples may demonstrate a reduction in nitrates and phosphates in the runoff and whether biochar can enhance the results. Gas samples will be taken from gas chambers on the north and center bioreactors and gas chromatography will show whether biochar has an edge in limiting N_2O production. These findings can guide future construction of bioreactors to optimize their ecological benefits while minimizing consequences.

Engaging the *Hmong Population* through Participatory Research Surveys: Concerns of High Blood Pressure Prevalence.

Chun Kit Ho
Sponsor: Christian Bohringer, M.D.
MED: Anesth & Pain Medicine

Since their acculturation into American society from Laos, there is a lack of health research on the current Hmong demographics in larger Hmong populated areas. California houses the largest population of Hmong in the country, with Sacramento being the third highest Hmong populated city. In order to account for lacking data, we have conducted surveys from April-October 2018 at heavily populated Hmong locations such as Hmong Supermarkets and community events in Sacramento. Participants completed a demographics survey and had vitals taken voluntarily. This study evaluates age, gender, amount of exercise, annual household income, formal education, blood pressure status, and glucose levels. It further discusses the limitation of the data collected and compliance due to cultural practices. Finally, this analysis aims to identify shortcomings of current methods, as well as channels for improving data collection, and effective outreaching towards individuals without formal education. Emerging potential results show a higher blood pressure reading amongst male participants compared to female participants. Data shows, with age, blood pressure tends to increase in Hmong individuals regardless of gender. Results of this study will be useful to health care workers who are looking to learn more about significant comorbidities among Hmong populations.

Under, Over, but Never Spot On: Rules of Thumb for a Population Proportion Interval Estimate Miss the Mark

Scott Hogan
Sponsor: Shelley Blozis, Ph.D.
Psychology

Many introductory statistics textbooks suggest a rule-of-thumb for computing an interval estimate of the population proportion, that is to say, the proportion of 'successes' relative to the number of observations. The rule is that, given a random sample, sample size times the population proportion and sample size times the value of 1 minus the population proportion should both be at least equal to 10. We investigated this rule for situations in which combinations of sample size and population proportions just satisfied this rule. That is, combinations yielded sample size values close to 10 (but not below). Using a Monte Carlo data simulation study design, we evaluated this rule along with two other amended procedures intended to improve estimates. Even if the population proportion was close to 0.5, the interval estimates overestimated the interval, with this tendency for overestimation worsening as the population proportion moved towards the extreme value of 0.1.

Atrazine exposure causes errors in oocyte chromosome segregation and impaired fertility

Michael Hori
Sponsor: Neil Hunter, Ph.D.
Microbiology & Molec Genetics

Atrazine is a widely used herbicide often found contaminating aquatic environments. As an endocrine disrupter, atrazine exposure affects meiotic processes in male mice. However, the effects of atrazine exposure during female reproduction are poorly understood. To address this question, mice were exposed to two doses of atrazine (low, 100 mg/L; high 33 mg/L) during fetal development through weaning (21 days post-partum). When mice were 3 months old, various aspects of oocyte development and reproduction were analyzed. Atrazine exposure did not alter the number of germinal vesicle stage oocytes or their maturation efficiency. However, metaphase II oocytes with chromosomal abnormalities were elevated at both low and high atrazine doses. Furthermore, in vitro fertilization data showed that atrazine exposure reduced the overall fertilization rate and elevated the numbers of fragmented early embryos. When atrazine exposed females were mated with normal males, numbers of dead pups were increased and surviving pups had significantly reduced body weights. Our data reveals that even low dose atrazine exposure during the early life of female mammals may lead to detrimental defects on reproduction outcomes, including chromosomal abnormalities, reduced fertility, and long-term health.

Severed Axons and Extracellular Debris in the Optic Nerve Head at Very Early Stages of Non-human Primate Experimental Glaucoma

Catherine Hou
Sponsor: Nicholas Marsh-Armstrong, Ph.D.
MED: Ophthalmology

This experiment studied severed axons within the optic nerve head (ONH) in Non-Human Primate (NHP) Early Experimental Glaucoma (EG) to determine whether there is a relationship between electrolucent extracellular structures and the location of axon ends. Two serial block-face scanning electron microcopy (SBEM) volumes of the ONH obtained from a NHP early in degeneration were compared to axons in a second control nerve. Approximately 1140 (1%) axons were randomly chosen on the vitreal side of the blocks and traced to establish their continuity. The eleven axons that ended within the block were from animals whose eyes were subjected to EG. They were found both in unmyelinated and myelinated portions of axons, often associated with phagocytic cells and/or large pockets of extracellular electrolucent material, and several turn sharply near their ends. Reconstructions of nearby electrolucent extracellular material do not match any known structure. The mean distance of axon ends to the nearest electrolucent pocket was not significantly different from distances from random points within the same blocks to the nearest electrolucent pocket. Axons that contact the severed axons or pockets of extracellular material will be traced and compared to randomly selected control axons to determine significant deviations attributable to glaucomatous degeneration.

The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Greek Orthodox/Eastern Orthodox" in the New York Times (1900-1909)

Natalie Hovsepian
Sponsor: Suad Joseph, Ph.D.
Anthropology

My research analyzes the New York Times' (NYT) representation of the Middle East through textual data from the decade of 1900-1909. I researched relevant articles through the ProQuest Historical Newspaper database containing the search terms "Greek Orthodox" and "Eastern Orthodox" (the terms are considered synonymous in this context and often used interchangeably). I have examined 208 articles and will have completed work on 307 by the end of my research. I have found that the decade's NYT representations of the Middle East are largely concerned with conflicts between religious groups and the legal protections of these groups, with intense focus on shifting colonial powers' involvement in these affairs. I argue that this trend in reporting perpetuates Middle Eastern peoples' religious affairs as inherently conflicting and that Western powers' competition in the region was narratively naturalized in light of this perpetuation. These misrepresentations depicted the Middle East as vitally unstable and in need of political and legal intervention. This research is part of a larger project analyzing 150 years of The New York Times conducted in the lab of Professor Suad Joseph.

MiR-22 Promotes Intestinal Proliferation by Attenuating Expression of the C/EBPd Gene

Tanya Hsiung
Sponsor: Bo Lonnerdal, Ph.D.
Nutrition

MicroRNAs function in RNA silencing which has downstream effects on protein expression. Previous studies on human milk have shown a high concentration of microRNA-22 (miR-22), and that miR-22 is resistant to in vitro digestion under conditions mimicking those of the human infant gut. We therefore hypothesized that miR-22 plays an important role in intestinal development. To determine effects of miR-22 on the intestine, human intestinal epithelial cells (HIEC cells) were transfected with miR-22 and microarray assays were conducted. Based on the results, miR-22 contributes to cellular proliferation, and the C/EBPδ gene may be a direct target as there is a potential binding site for miR-22 in the 3' untranslated region of the C/EBPδ gene. Furthermore, C/EBPδ RNA and protein levels were significantly attenuated by miR-22. C/EBPδ is a transcription factor and is involved in a wide range of biological activities, including cellular proliferation. To evaluate effects of C/EBPδ on cellular proliferation, HIEC cells were transfected with C/EBPδ siRNA. After expression of C/EBPδ was inhibited by ~ 70%, cellular proliferation dramatically decreased. In summary, miR-22 stimulates intestinal proliferation by inhibiting expression of the C/EBPδ gene.

Water Pollution and Abundance of Toxic Cyanobacteria *Microcystis* in the Sacramento-San Joaquin River Delta During the Drought in 2014 and 2015

Jessica Hsiung
Sponsor: Tomofumi Kurobe, Ph.D.
VM: Anat Physio & Cell Biology

Harmful algal blooms, the rapid growth of algae that can cause toxic effects on humans and wildlife, has become more persistent in the Sacramento-San Joaquin River Delta due to longer and severe periods of drought in California. Invasive aquatic vegetation has also become more prevalent in the drought conditions, leading to increased herbicides application. Based on our previous findings, toxigenic cyanobacteria, namely Microcystis, was most abundant in 2014, the worst drought year on record in California, but was unusually low in 2015, the second worst drought year. To determine if the low abundance of Microcystis in 2015 resulted from either water pollution or nutrient deficiency, Microcystis was cultured in water samples preserved from eight field stations in August to November of 2014 and 2015 and in the water samples spiked with nutrient-enriched media. Herbicides such as fluridone, glyphosate, and penoxsulam were measured using enzyme-linked immunosorbent assays. Water quality data were also analyzed by station to provide context to Microcystis growth under varying environmental and anthropogenic influences. A synthesis of our findings on water pollution in the Delta during the 2014 and 2015 drought and its possible connections to Microcystis abundance will be discussed.

Chromosomal Localization Patterns of Paralogous SUMO E3 Ligases, RNF212 and RNF212B, During Meiosis Point to Distinct Fuctions in Crossing-over

Lin-Ya Hu
Sponsor: Neil Hunter, Ph.D.
Microbiology & Molec Genetics

Meiosis is the specialized cell division that produces gametes. We have previously shown that RNF212, an E3 ligase that catalyzes protein modification by the Small Ubiquitin-like Modifier (SUMO), is essential for meiotic crossing-over in mouse. We have recently began studying the function of RNF212B, a previously uncharacterized paralog of RNF212, and found that it is also essential for crossing-over. Although Rnf212b mutant mice show similar phenotypes to Rnf212 mutants, the chromosomal localization patterns of the corresponding proteins are distinct. Both RNF212 and RNF212B form numerous punctate foci along synapsing homologous chromosomes. After synapsis is complete, the focus number decreases, and just 1 or 2 foci per chromosome are retained that specifically mark crossover sites. Co-staining experiments revealed that RNF212B attains this crossover-specific patterning earlier than RNF212, indicating that the two paralogs cannot be functioning as an interdependent heterodimer. Ongoing experiments aim to further characterize the distinct contributions of RNF212 and RNF212B to meiotic crossing-over.

Kinetic Characterization of the Bacterial Protein Cell Division Protein FtsZ and Its Potential Inhibitors

Julie Hua
Sponsor: Andrew Fisher, Ph.D.
Chemistry

A bacteria's ability to rapidly evolve combined with the absence of new antibiotics feeds into the pressing issue of antibiotic resistance. Targeting a highly conserved bacterial protein, FtsZ, shows potential as a novel antibacterial mechanism. This protein forms a ring structure that is essential in the division of a bacterial cell into its daughter cells. The goal of this research is to decipher the kinetic activity of the protein and the protein-inhibitor complex.. Positive control assays were conducted to confirm the GTP hydrolysis activity of FtsZ and the compatibility of the wildtype protein with the assay components. Further kinetic assays will be conducted to determine the kinetic activity of wild type and mutant FtsZ proteins in the presence of potential inhibitors. This project will provide data for advances into innovative broad spectrum drugs to serve as a new generation of antibiotics that will target a specific aspect of the cell cycle.

How do Spanish-English and Cantonese-English Bilingual Children Differ in Their Development of English Narrative Skills?

Yuhui Huang
Sponsor: Yuuko Tonkovich, Ph.D.
Education

This longitudinal study investigated the differences in macro-level components of English oral narratives among a total of 40 bilingual children (16 Spanish-English and 24 Cantonese-English) who were enrolled in transitional bilingual educational programs. Children's English narratives were collected by having them tell a story using Frog, Where are You?, a wordless picture book. The narrative quality was assessed using the Narrative Scoring Scheme (NSS), which measures children's narratives along seven elements (introduction, character development, mental states, referencing, conflict resolution, cohesion, conclusion), each of which is scored holistically on a scale of 1–5. Scores from each category of the NSS were compared between Spanish-English and Cantonese-English children. Results showed that on average, narratives scores developed over the three years. Results also showed that Spanish-English children scored higher than Cantonese-English children on character development, cohesion, conclusion and significantly higher on mental states. Cantonese-English children scored higher than Spanish-English children on the introduction elements. The conclusions from this study may help inform educational strategies to best support language development among different groups of bilingual children.

Functional Analysis of the Kinesin-14 Motor AtKCH During Cell Division in *Arabidopsis thaliana*

Calvin Huang
Sponsor: Bo Liu, Ph.D.
Plant Biology

Microtubules and actin filaments undergo rigorous reorganization during mitosis and cytokinesis. When plant cells undergo cell division, they colocalize transiently in the microtubule-based structures of the preprophase band (PPB) and the phragmoplast. However, it is unknown how they interact with each other. To gain insights into mechanisms that regulate the interaction, we focused on a subclass of microtubule motors kinesin-14 called KCH, kinesin with calponin homology domain, because they bind to both microtubules and actin filaments. We hypothesized that AtKCH, expressed during cell division, served as a dynamic linker between the two cytoskeletal filaments during cell division in Arabidopsis thaliana. To test this hypothesis, we examined a homozygous null Atkch mutant in order to learn whether there are cell division defects in rapidly growing organs like the root. In the meantime, we transformed the mutant with a KCH(p)::AtKCH-GFP (green fluorescent protein) construct into the Atkch mutant and recovered transformants that express the AtKCH-GFP fusion protein. To learn the dynamics of AtKCH-GFP, I performed immunofluorescence microscopy experiments and detected the protein at different stages of cell division. Results of AtKCH-GFP localization and phenotypic assays will be presented that will help us determine the function of AtKCH during cell division.

Half-Virtual-Half-Mechanical Artificial Cardiac Tissue - A New Way of Approaching Cardiac Diseases

Yuqing Huang
Sponsor: Daisuke Sato, Ph.D.
MED: Pharmacology

There is about one in every four adult Americans who die from cardiac diseases every year. There is a need to develop a new approach to cure cardiac diseases. The goal of this research is to create a durable mechanical tissue that can replace heart tissue for treating patients with cardiac diseases without biological materials. The methods to make the "muscle" include using shape memory alloys (SMA) and 3D printed structure, or microelectromechanical systems (MEMS) devices, with Arduino and electrical circuits. The mechanical part of the system can detect the displacement of SMA or MEMS. The strength of contraction is controlled by pulse width modulation (PWM) based on signals generated from the physiologically detailed cardiac muscle model simulated in real time. A 10*10*50 mm heart muscle cell with the ability to contract and follow the heart muscle model is created as a result. Cardiac muscle models used include the single cell model and 1D tissue model. Future development of this project can lead to a decrease in the size of each heart muscle cell and eventually the development of a whole artificial heart.

Phenotypic Traits of *Plantago lancelota* as Related to Population Structure and Herbivory

Jin Huang
Sponsor: Jennifer Gremer, Ph.D.
Evolution & Ecology

This project is a continuation of a study on the globally-distributed perennial plant Plantago lanceolata that has been conducted annually since 2015. This study uses the protocol of Plant Pop Net, an international project, which aims to understand the factors driving the spatial dynamics of plant populations in response to climate change using data from P. lanceolata populations around the world. At our site in Davis, CA, we measured abundance and phenotypic traits of P. lanceolata for three years. Trait data included floral characteristics, phenology, morphology, and signs of herbivory. Using these data, we will compare density and herbivory experienced by different plants within our transect, as well as how how the population structure has changed over time. The results of this study can be used to further understand how plants respond to herbivory and competition, and a continuation of this study will allow us to ask questions in the future about the factors influencing these traits, including disease and climate change.

SOFA CONNECT - Bloom

Linda Huang
Sponsor: Jiayi Young, M.F.A.
Design Program

The UC Davis submission for the Sculptural Objects Functional Art & Design CONNECT competition is an immersive installation titled, BLOOM. Our Design Department emphasizes social responsibility, human-centered practice and sustainability. We are uniquely poised with a biodesign program which gives us the opportunity to work with innovative and sustainable materials. Given the opportunity to build an exhibit for an international audience, we dedicated BLOOM to tackling the negative environmental impact of consumerism by providing a comfortable, desirable and modern lounge space, with everything except the electronics composed completely of biodegradable materials. We provided the audience with an environment in which they could connect with the environment through materials like mycelium –a unique biomaterial grown from root-like strings that extend from underneath mushrooms. They were able to experience an immersive exhibit in which they could engage in social activity and feel comfortable in a lounge space that was 97% biodegradable. They were also given the opportunity to interact with a coded projection that moved as they did. BLOOM proves that products aren't limited by their life spans.

Mechanisms of Action of Perfluorooctane Sulfonate and Perfluorooctanoic acid in purple sea urchin embryos (*Strongylocentrotus purpuratus*)

Nikita Hudson
Sponsor: Gary Cherr, Ph.D.
Environmental Toxicology

Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic acid (PFOA) are ubiquitous in the environment, causing environmental concern due to their resistance to degradation and ability to bioaccumulate. Organisms have developed multidrug resistance (MDR) transporter proteins to deal with toxins, which act as their first line of defense and actively keep chemicals out of cells. This study looked to identify how PFOS and PFOA cause toxicity in purple sea urchin embryos. The proposed mechanism for toxicity is chemosensitization, which occurs when two chemicals are present at relatively harmless levels, however one of them acts as an inhibitor of MDR efflux pumps, causing an accumulation of the other chemical. A 96 hour range finding test was conducted resulting in the EC50 for PFOS being 1.5µM and the EC50 for PFOA being 4.16µM. A dye accumulation experiment was then conducted to assess the activity of efflux pumps. Both PFOS and PFOA were seen to increase the accumulation of fluorescent dye within the embryo, indicating they both inhibit pumps, however PFOS's accumulation rates were higher than PFOA's. We believe that PFOS may simultaneously act to change membrane permeability as well as being a chemosensitizing agent, and once tested, this was confirmed.

Molecular Response to Injury in *Hydra vulgaris* and its Relevance to Aging

Elizabeth Huezo
Sponsor: Celina Juliano, Ph.D.
Molecular & Cellular Bio

Regenerative ability varies among species and declines with age. However, the molecular basis for regeneration is not well understood. A growing body of research suggests that highly regenerative animals upregulate regeneration genes in response to all injuries, even injuries that do not require regeneration. In non-regenerative injuries, regeneration genes are subsequently downregulated. By contrast, my preliminary data suggest that in the highly regenerative cnidarian, Hydra vulgaris, the wound response becomes rapidly specialized to a specific injury (i.e. regenerative vs. non-regenerative wounds). To test my results further, I will use quantitative PCR (qPCR) to examine expression of regeneration-specific genes during different types of wound healing in Hydra: 1) non-regenerative injury (incision) and 2) two types of regenerative injuries (head and foot regeneration following bisection). Additionally, because canonical Wnt signaling plays an important role in differentiating different types of wound healing in Hydra, I will use immunofluorescence to characterize ß-catenin localization during wound healing. Altogether, this research will provide insight into the variability in regenerative capacity among species and why regenerative capacity declines with age.

Application of Seismic Refraction Surveys and Seismic Tomography's for the Geologic Understanding of Surprise Valley, C.A.

Maria Huitron Ramirez
Sponsor: James Mcclain, Ph.D.
Earth And Planetary Sciences

Surprise Valley, located in northeastern California, is a developing extensional basin, with extension accommodated by faults at the east and west boundaries of the Valley. It is a geothermal system with growing interest as an energy source. Surprise Valley is believed to be a fault-controlled system with an unidentified heat source and unknown conduits feeding thermal waters to the surface. The study focuses on two geophysics techniques, seismic refraction surveys and seismic tomography, to create a subsurface model to test this hypothesis and find a possible heat source. Seismic refraction exploits elastic waves when passing between bodies of rock having different seismic velocities and differentiates subsurface material based on the speed of sound waves. Seismic refraction surveys require data to be collected for travel times of seismic waves traveling between a source and receiver. Seismic tomography is used to image the subsurface of the Earth with seismic waves that are produced by a source. The solution can create a 3D image of seismic velocity inconsistencies which can be interpreted as structural, thermal or compositional variations. The seismic velocities, geologic interpretations, and seismic tomography profiles can provide insight on Surprise Valley's structural framework and possible heat source of the geothermal system.

UC Davis REALOPs Satellite Mission

Timothy Hulse
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The Remote Experimentation and Analysis of LEO Phenomena (REALOPs) is a 2U CubeSat development project focused on data acquisition for use in STEM education. This project presents the idea of developing a thermal model, based on flight data, to predict thermal properties of a nanosatellite with respect to its onboard hardware and its orientation in orbit. There will be a secondary payload onboard (micro dosimeter) that will be used to collect data on the low Earth orbit (LEO) radiation environment as well. The resulting models and raw data collected during the life span of the satellite will be used to introduce students of all levels and disciplines to data analysis with regards to the development of scientific conclusions. Additionally, the developed models will be compared to existing software that has thermal analysis capabilities such as SolidWorks and NASTRAN/PATRAN for validation. Lessons learned from the development lifecycle of this mission will be used to create a robust and reliable base bus that can be modified to perform a multitude of future space missions.

UC Davis REALOPs Satellite Mission

Roberto Hurtado
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The Remote Experimentation and Analysis of LEO Phenomena (REALOPs) is a 2U CubeSat development project focused on data acquisition for use in STEM education. This project presents the idea of developing a thermal model, based on flight data, to predict thermal properties of a nanosatellite with respect to its onboard hardware and its orientation in orbit. There will be a secondary payload onboard (micro dosimeter) that will be used to collect data on the low Earth orbit (LEO) radiation environment as well. The resulting models and raw data collected during the life span of the satellite will be used to introduce students of all levels and disciplines to data analysis with regards to the development of scientific conclusions. Additionally, the developed models will be compared to existing software that has thermal analysis capabilities such as SolidWorks and NASTRAN/PATRAN for validation. Lessons learned from the development lifecycle of this mission will be used to create a robust and reliable base bus that can be modified to perform a multitude of future space missions.

Effects of Post-Translational Modifications of Bovine Milk Osteopontin on Intestinal Proliferation

Stephanie Huynh
Sponsor: Bo Lonnerdal, Ph.D.
Nutrition

Osteopontin (OPN) is a multifunctional protein involved in many biological processes, including cellular proliferation and immune modulatory functions. OPN is a highly post-translationally modified protein, with modifications including phosphorylation, glycosylation, and proteolytic processing which affect its structure and biological functions significantly. OPN is abundantly present in human milk (~138 mg/L), but not in bovine milk (~18 mg/L) or infant formula (~9 mg/L). Therefore, formula-fed infants are unlikely to obtain beneficial effects from milk OPN. Adding OPN to infant formula would make it more comparable to human milk, but while bovine milk OPN (bOPN) and recombinant OPNs are commercially available, glycosylation of these forms is different or lacking. The purpose of this project is to determine whether glycosylation of bOPN affects its effect on intestinal proliferation, and thus provide evidence to find a way to possibly incorporate OPN into infant formulas. When human intestinal epithelial cells (HIEC) were treated with bOPN or deglycosylated bOPN (Dg bOPN), both promoted cellular proliferation. No significant differences were found between bOPN and Dg bOPN, suggesting that glycosylation is not required for promotion of intestinal proliferation. This also suggests that glycosylation may not be required for other biological activities.

Identification and Validation of Beta Cell Dedifferentiation Markers

Justin Huynh
Sponsor: Mark Huising, Ph.D.
Neuro Physio & Behavior

Type 2 Diabetes is characterized by insulin resistance and/or impaired insulin release. Healthy, functionally mature beta cells secrete insulin into the bloodstream to lower blood glucose levels when they are high. Simultaneously, they co-secrete peptide hormone Urocortin3(Ucn3). Interestingly, our lab has demonstrated that beta cells in diabetic individuals show a loss of Ucn3 expression, marking the beginning of beta cell dysfunction and dedifferentiation. While it is known that mature and dedifferentiated beta cells are different, the markers that distinguish between the two are incompletely known. I hypothesize that beta cells in diabetic mice that lack expression of Ucn3 express dedifferentiation markers such as Aldh1a3. To address the hypothesis, I identified potential dedifferentiation markers from a RNA-seq dataset and used immunofluorescence and confocal microscopy to determine their expression patterns in healthy and diabetic mice. I predict that beta cell dedifferentiation markers will be more highly expressed in diabetic mice than in healthy mice. In the future, these markers can potentially be used to distinguish between healthy and dysfunctional beta cells in diabetic patients.

Machine Learning of Diagnostic Predictors for Autism Spectrum Disorders

Hyeyeon Hwang
Sponsor: Janine Lasalle, Ph.D.
MED: Medical Microbiology & Imm

Autism spectrum disorders (ASDs) are a diverse collection of neurodevelopmental disorders characterized by restricted interests, repetitive behaviors, and impairments in social interaction. There are currently no reliable biomarkers for the diagnoses of ASDs, so they are clinically diagnosed by behavior, which makes early diagnosis challenging. To address this challenge, I established machine learning models to discover potential DNA methylation predictors of ASDs. DNA methylation is a common type of DNA modification that does not change the underlying DNA sequence and is dynamically shaped by neurodevelopment. I used the caret package in R to perform 5-fold cross validation with a model built using the random forest (RF) machine learning algorithm on individual and combined DNA methylation datasets generated from three sets of brain samples and one set of placenta samples. RF models from three individual brain, placenta, combined brain, and combined brain and placenta datasets yielded accuracies of 1, 1, 0.927, 0.975, 0.723 and 0.816, respectively. The results suggest that RF models built from brain and placental DNA methylation data may significantly aid in early diagnosis of ASDs. Early diagnosis is crucial as it allows for early intervention, the key to optimal outcomes for children diagnosed with ASDs.

Communication of Droplet Printed, Artificial Cell Mimics

Rachel Ibrahim
Sponsor: Cheemeng Tan, Ph.D.
Biomedical Engineering

Artificial cells have emerged as an important tool in the field of synthetic biology because they provide a simplified model of natural cells in a more controlled environment. They have the capability to replicate many important biological functions, including the transcription and translations of proteins, membrane signaling pathways, and division. However, communication between artificial cells thus far has been limited compared to the range of communication present in natural cells. Our work combines the ability of artificial cells to sense extracellular chemicals and a microfluidics droplet printer to create fluorescing patterns from a 2-dimensional array of artificial cells. The gene network in these cells regulates the release and detection of chemical inducers between artificial cells, which controls the fluorescent patterns. Droplet printing these artificial cells provides a fast, consistent cell distribution method. Together, these methods provide a high throughput means of artificial cell communication to induce gene expression. Our work opens the door to more complex gene networks with the potential to create a variety of chemical-sensing biological assays that may be applied in clinical or portable diagnostics.

Economic Normalization in Palestine

Khadeja Ibrahim
Sponsor: Justin Leroy, Ph.D.
History

How does economic development function under the backdrop of colonialism? The Palestine Investment Conference was established in 2008 with the vision of improving the economic and social living standards in Palestine through increased investment in the Palestinian economy. Its goal was neoliberal regional development, and it had already recognized Israel in the framework of a two-state solution. It also rejected a resistance-oriented approach to liberation. This was to be enabled by a strong partnership between the public and private sectors. This research examines the rise of neoliberal developments in the West Bank of Palestine, and whether these developments are functioning as a tool of normalizing the Israeli occupation among Palestinians. One of the goals of the Palestinian Investment Conference was to squash resistance as a means of liberation. How successful have they been in this goal? A part of this research examines Rawabi city as a case study. This Qatari-funded city is the site of brand name shops, restaurants, and other high-priced attractions, and is aimed at creating a luxurious lifestyle for elite Palestinians. The city provides high standards of living and employment --things that will make people less willing to abandon their lives of comfort for resistance fighting.

Improving the Accuracy and Reliability of pH Readings in Small-Scale Cell Culture Bioreactors

Lisa Illes
Sponsor: Ruihong Zhang, Ph.D.
Biological & Ag Engineering

Genentech currently uses the traditional multi-use glass electrode pH probes and phenol red to assess the pH of their cell cultures. The glass electrode pH probes are prone to drift, and the phenol red on its own does not provide a quantitative measure of culture pH. Given the importance of real-time monitoring of pH,we reverse engineering the glass electrode pH probe to better understand the cause of this drift and improving upon its design to minimize drift in this probe type. Because the drift of a single probe cannot be completely eliminated, the group also proposes creating a single bundle of probes consisting of multiple pH probes with different measurement mechanisms to minimize the effect of probe drift on pH readings. Commercially available optical probes and conducting polymer electrode probes will be tested as supplemental means of reliable online pH measurement. Employing probes with different means of pH measurement will allow for probe drift to be detected as it occurs, thereby providing data necessary to improve the accuracy and precision of measurement. A sensor fusion algorithm will be modified and tuned to analyze the collected data, thereby maximizing accuracy and precision of the pH reading.

The Syntax-Space Effect in American Sign Language

Zunaira Iqbal
Sponsor: David Corina, Ph.D.
Linguistics

In psycholinguistic research when subjects are asked to identify the thematic role of transitive sentences (e.g. Who is doing the helping? given: Alex helps Brian), it has been discovered that there is a spatial preference. Studies show that there is a spatial advantage when the agent of the sentence appears to the left in a two-item forced choice (Alex, Brian). This is especially true for left-hand responses. This syntax-space effect is thought to reflect a stage of embodied spatial semantic conceptualization of sentence meaning. My research seeks to understand whether this syntax-space effect is observed in American Sign Language (ASL), which requires the overt manual articulation of spatial loci in transitive sentences. This research aims to understand when producing sentences, whether there is a preference for handedness with agents and patients. Deaf ASL signers are asked to produce transitive sentences in ASL based on presented stimuli. These responses are video recorded to determine which hand is more frequently used with which thematic role of the sentence. We expect to see that in right-handed signers, the left hand (or the space to the left of the signer) will be used more often when establishing the agent of the sentence.

Morphological Variation Across an Ancestry Cline in Africanized Honey Bees

Jodie Jacobs
Sponsor: Graham Coop, Ph.D.
Evolution & Ecology

The introgression of African honey bees is a well-documented biological invasion that has led to hybridization of European and African Honey Bee populations in North and South America. As honey bees of African ancestry migrated through the Americas, they mated with local bees and displaced local populations. Honey bees with admixed ancestry display greater defensiveness and are poor honey producers; thus bees with European ancestry are preferred for agriculture over admixed populations. Past large-scale surveys have used morphological data as a proxy for African ancestry. Identifying honey bees of African ancestry through morphology is beneficial for apiculture because it is more cost effective than genetic sequencing. Morphological variation in wing and femur length have been correlated to African ancestry when compared to mtDNA. However, a study in Texas using measurements from known ancestry bees showed that mtDNA and morphology aren't always correlated (Pinto, et al.). Throughout the Americas, there are varying levels of Africanized ancestry in Honey Bee populations across ecological gradients. These "hybrid zones" are areas in which an ancestry cline is seen. In this study we assessed how well morphological variation predicted the amount of African ancestry between honey bee populations throughout the hybrid zone.

Identifying Mechanosensitive Protein-Protein Interactions Surrounding Zyxin

Kyle Jacobs
Sponsor: Soichiro Yamada, Ph.D.
Biomedical Engineering

In multicellular organisms, cells constantly sense and respond to forces exerted by adjacent cells and the extracellular matrix. These forces have been shown to regulate critical cellular functions and disease processes, such as cancer metastasis. However, traditional methods to analyze protein-protein interactions do not detect force-induced protein interactions. Instead, using an in situ proximal Biotinylation IDentification (BioID) approach, we identified candidate proteins that may interact with zyxin (a focal adhesion and potential force-sensing protein) in a force-dependent manner. To verify the mechanosensitivity of the candidate proteins identified in the BioID screens, cells are adhered on an elastomeric membrane and are strained by stretching the membrane. We showed that cell shape and actin organization depend strongly on the magnitude of substrate stretch, and currently, we are systematically analyzing relative protein localization of zyxin and candidate proteins under control and stretch conditions. Our analysis is the first critical step toward a molecular understanding of the force-induced response of cells.

Effects of Minimum wage on Employment Probabilities and Average Hours of Work: Differentiated by Gender

Sheila Jamshidi
Sponsor: Giovanni Peri, Ph.D.
Economics

There seems to be little consensus in previous literature on the effects of minimum wage laws on employment probabilities. Conflicting results point to two main economic theories: Perfect Competition and Monopsony. These two theories are explored in this paper and later tested for empirical support by instrumenting workers' wages with minimum wages. In order to test these theories, this paper uses CPS, Current Population Survey, data coupled with state and federal minimum wage figures (in 1999 dollars). In addition to effects on employment probabilities, effects on average hours of work are explored in this paper: an alternative way of measuring employment effects at a more micro level.
Furthermore, within the framework of these two conflicting theories, this study focuses on how these minimum wage changes might affect the female demographic, differently. The primary focus on this demographic is due to their overrepresentation among those who earn the prevailing minimum wage.

Augmented Reality and Gaze-directed Beamforming for Improved Speech Comprehension

Niranjana Jayakrishnan
Sponsor: Lee Miller, Ph.D.
Neuro Physio & Behavior

Individuals with hearing loss have a reduced ability to focus their attention on a select auditory source while filtering out competing background noises, commonly known as the "cocktail party effect". Conventional hearing aids simply amplify the sound to make it more audible, but do not solve this issue and in many cases make this situation worse. This is because they do not adequately address the true problem, which is not primarily sound audibility, but rather the ratio of the signal compared to the noise (SNR), for which straight auditory amplification has no effect. The Miller lab has created a spatially selective and dynamically steerable assistive hearing platform called Cochlearity which consists of a wearable microphone array and an eye tracker, and uses a technique known as auditory beamforming to enable the listener to hear best wherever they are looking. While Cochlearity has already been shown to be highly effective as a directional hearing aid, we are now working on adding more advanced audio and visual perceptual techniques to further improve speech perception, including real-time language captioning and visual augmentation (highlighting) of the attended speaker using Virtual Reality/Augmented Reality, a virtual reality headset (HTC Vive), and the Pupil Labs World Camera.

Assessing Somatic Compatibility Conversion and Genetic Recombination among Strains of *Fusarium circinatum*

Bradley Jenner
Sponsor: Thomas Gordon, Ph.D.
Plant Pathology

Aggressive fungal plant pathogens tend to reproduce clonally, often resulting in populations dominated by a single genotype. This lack of diversity includes little variation among genes determining somatic compatibility (het genes), creating an interconnected population at high risk for parasitism from viruses transmitted through hyphal fusion. It is hypothesized that filamentous fungi generate diversity in somatic compatibility via spontaneous mutations at het loci, limiting the frequency of hyphal fusion and reducing the risk of virus transmission without deconstructing a successful genotype. This possibility was explored with Fusarium circinatum, an important pathogen of pines. Somatically incompatible isolates with complementary mutations in a nitrate-utilization pathway were grown together on a medium where nitrate was the sole source of nitrogen. Robust growth indicated a change in compatibility, which allowed hyphal fusion and the utilization of nitrate. DNA from the co-cultured isolates and those from which they were derived was sequenced and their genomes reconstructed. Relative distances among these genomes were calculated and used to determine if recombination had occurred. Variant calling between progeny and parental genomes was also conducted to identify possible genes and mutations responsible for the change in somatic compatibility.

Real-Time Radiation Dosimetry Reporting to an EVA Astronaut

Kaden Jeppesen
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

Astronauts conducting surface Extravehicular Activities (EVAs) will be operating in a minimally-shielded environment at high risk of physiologically-damaging radiation exposure. Thus, the astronaut should be aware at all times of both the accumulated radiation exposure since the beginning of the EVA and of short-term radiation spikes delivered by solar coronal mass ejections. This research is focused on the integration of radiation sensors and display technology with current and anticipated spacesuit architecture for crew reporting of radiation exposure. The radiation display will be comprised of electrochromic thin-film polymers mounted outside the pressurized helmet, on a manually-deployed pull-down sunshade. A key factor of this display is to provide the necessary data to the suited astronaut in a manner requiring minimal cognitive demand. The desired results of this research are to have a working prototype of the integrated radiation sensor and display system, and to demonstrate the effective nature of a display that is both informative and non-intrusive.

Epilepsy alters theta oscillations and disrupts the septo-hippocampal circuit

Consuelo Jimenez-Ornelas
Sponsor: Gene Gurkoff, Ph.D.
MED: Neurological Surgery

While anti-epileptic drugs reduce seizures in many patients with epilepsy, about 40% of those with temporal lobe epilepsy (TLE) are pharmacologically-resistant. Additionally, epilepsy can cause deficits in learning and memory. Therefore, there is a need to develop novel targets to improve quality of life in patients with TLE. Theta oscillations, prevalent in the hippocampus, are essential for cognition and modulating excitability. These oscillations are modulated by projections from the medial septum (MSN) to the hippocampus. I hypothesized that deep-brain stimulation of the MSN at 7.7Hz would promote a regular theta rhythm in rats with chemically-induced TLE, improve cognition, and reduce seizures. To test this, 76 adult male Sprague-Dawley rats received either pilocarpine (350mg/kg ip) to induce epilepsy or a sham injection (saline ip). Epileptic rats were split into two groups: control and deep brain stimulation (DBS; 7.7 Hz). A Barnes maze was used to assess cognition, and the GABA antagonist flurothyl to assess seizure threshold. Epileptic rats had impaired cognition and a lower seizure threshold compared to both sham and DBS treated rats. Stimulation of theta oscillations represents an exciting new target for treatment of refractory epilepsy.

Changes in White Matter Integrity and the Development of Introspection Ability: A Longitudinal Analysis

Simran Johal
Sponsor: Simona Ghetti, Ph.D.
Psychology

Metamemory monitoring, the ability to introspect on one's own memory accuracy, improves throughout childhood and into adolescence (Fandakova et al., 2017). Previous research has shown that the medial temporal lobe (MTL) supports memory performance, and the prefrontal cortex (PFC) and the parietal cortex (PC) may be particularly important for metamemory (Fandakova et al., 2017; Chua, Schacter, & Sperling, 2009). However, little is known about how white matter tracts, which allow for communication between these brain regions, support the improvement in metamemory monitoring, and how this changes with development. To address these questions, we examined a longitudinal sample of participants between the ages of 7 and 15 years (T1: N = 155, T2: N = 122, T3: N = 92) who were assessed for their metamemory monitoring abilities. Additionally, data on participants' white matter tracts were collected using diffusion tensor imaging, a structural brain imaging technique. We hypothesized that tracts connecting the PFC, PC, and MTL would show increased connectivity during this transitional period, and that these improvements would predict the development of metamemory monitoring ability. This investigation will help reveal the development of connectivity between brain regions during middle childhood and adolescence, and their role in memory and metamemory improvements.

The Correlation between Cognitive Function and Intelligence in Children with Attention Deficit/Hyperactivity Disorder

Kristen Johansson
Sponsor: Julie Schweitzer, Ph.D.
MED: Psychiatry & Behav Sci

Previous research on executive functions, a set of psychical processes necessary for the cognitive control of behavior, has explored the influences of these processes on memory and mental health. However, little research has been conducted on the correlation between executive function and intelligence, specifically in young individuals with ADHD. In this study, we investigate the correlation between parental-reported executive function characteristics in children and intelligence test results. In this procedure, parents completed the Barkley Deficits in Executive Functioning Scale (BDEFS) which evaluates various dimensions of executive function use in daily life. The child participants were assessed using the Wechsler Intelligence Scale for Children (WISC) to determine working memory abilities and overall intellect. These scores were compared later and preliminary results suggest a higher correlation between executive function measures and Letter-Number Sequencing, but not Digital Span. The results also suggested a higher correlation between executive functioning and Coding but not Symbol Search subsets. These findings can possibly be attributed to the Letter-Number Sequence and Coding requiring more cognitive demands and higher load management, resulting in need for greater executive functioning skills.

Mosquitofish Personality Influences on Behavior in the Presence of Novel Stimuli

Chelsea Johnson
Sponsor: Andrew Sih, Ph.D.
Environmental Science & Policy

Within animal populations, variation exists between the behaviors of individuals that remains consistent across time and context. These behavioral syndromes, otherwise known as animal personalities, can be used to predict how certain individuals will behave in various situations. For our study system, we are investigating personality in mosquitofish (Gambusia affinis) and specifically how an individual's personality influences their reaction to novel stimuli. We will perform personality assays in order to evaluate the personality traits of individuals in a population of mosquitofish, such as their position along a spectrum of shyness to boldness. We will then put them in groups and introduce them to a novel environment arena that will contain a barrier separating one end from the other. We will then observe how long it will take for the fish to cross the barrier into the unknown environment and see how the data correlate with the data from the personality assays. Mosquitofish are an invasive species and thus, understanding variation in personality may help give insight into how a population will behave in a novel environment.

A Theoretical and Experimental Investigation of Manganese-Intercalated $MoSe_2$ Pressurized to 7 GPa

Virginia Johnson
Sponsor: Kristie Koski, Ph.D.
Chemistry

Two-dimensional (2D) layered transition metal dichalcogenides (TMD) are of interests due to their unique structures and properties. $MoSe_2$ is of particular interest due to its unique optoelectronic-properties. In this work, Raman scattering of two-dimensional layered $MoSe_2$ intercalated with atomic manganese was investigated from ambient pressure to 6.9 GPa using computational and experimental methods. Experimentally, this pressure is induced using a Bragg-mini diamond anvil cell and observed on a custom built micro Raman spectrometer. The theoretical and experimental response are in good agreement, demonstrating how the dependence of the Raman shift ($d\omega/dP$) is unaffected by the intercalant. Experimentally, manganese-host bonding results in a new pressure-induced Raman peak in the intercalated sample at 325 cm^{-1}. The electronic band structure and density of states show that the intercalated system is spin-polarized and that the band gap narrows with the application of pressure. This study illuminates how an electron-donating intercalant, manganese, alters the pressure-dependent optical phonon behavior within its host and shows promise for applications in spintronics.

Behavioral Responses of Black Widow Spiders to Olfactory Cues in an Urban Context

Kyle Johnson
Sponsor: Andrew Sih, Ph.D.
Environmental Science & Policy

Animals are known to utilize olfactory cues to make decisions that can influence fitness. Spiders do so for at least two important features of their life history: web site choice and web modification. However, in response to anthropogenic sources of environmental change, animals may not respond appropriately to these elements, thereby directly influencing fitness. Deciding where and how to construct a web can influence a spiders' foraging success, mating success, and risk of predation and competition. In this study, we investigated separately how the western black widow spider Latrodectus hesperus, a common urban species, responds to a prey cue and a common urban insecticide. We first conducted a two-choice outdoor design where individuals decided between settling near a microhabitat with or without a prey or pesticide cue. Using an indoor cardboard enclosure, we then examined how these cues influence the phenotype of and investment in constructed webs by assessing webs constructed by individuals in the absence and presence of cues. By investigating how an urban species may make decisions or adjust behavior in response to common aspects of the urban environment we can gain a firmer understanding of animal response to anthropogenic change.

RGD Modified Fibrin-Alginate Interpenetrating Networks As a Tool to Accelerate Mesenchymal and Endothelial Cell Co-Culture Spheroid Vasculogenic Potential

Shreeya Joshee
Sponsor: Jonathan Leach, Ph.D.
Biomedical Engineering

Stem cell therapies for tissue regeneration are exciting tools for treating many injury related defects. Deployingstem cells as spheroids rather than monodispersed cellspromotes significant advantages in cell survival and vascularization, ultimately increasing implantation success. Mesenchymal Stem Cell (MSC) spheroids increase anti-inflammatory and angiogenic potential whereas Endothelial Colony (EC) spheroids delay apoptosis and induce cell differentiation via cell-cell contacts. In vivo implantation of spheroids requires stable cell carriers, but current materials are large and hinder efficient gas exchange and nutrient transport. Many tissue engineering studies target fibrin gels because of EC cells' ability to adhere to, migrate, and remodel its matrix, yet rapid degradation and unstable shape make it ineffective. Alginate exhibits robust mechanical properties andmodification with arginine-glycine-asparagine (RGD) sequences increases MSC spheroid cell attachment and growth. We propose a Fibrin-Alginate Interpenetrating network (FA-IPN) with independently tunable adhesion and mechanical properties for co-culture MSC/EC spheroids. This study investigates mechanical properties of FA-IPNs as a function of hydrogel composition and explores theeffects of RGD modified FA-IPNs on MSC/EC co-culture spheroid sprouting. This study emphasizes the role of engineered biomaterials to provide robust scaffolds for stem cells to regenerate bone and vasculature in the human body.

Whole Body Hypothermia – Effect of Body Temperature and Blood Gases on Carotid and Pulmonary Blood Flow

Houssam Joudi
Sponsor: Payam Vali, M.D.
MED: General Pediatrics

Neonates exhibiting moderate to severe hypoxic-ischemic encephalopathy (HIE) may be treated with whole body hypothermia [to 33.5°C] to reduce the risks of death or other disabilities related to brain damage. More extensive hypothermia [to 32°C] is correlated with a higher frequency of persistent pulmonary hypertension of the newborn (PPHN). This failure to transition from fetal to neonatal circulation may require treatment via extracorporeal membrane oxygenation (ECMO). Within healthy lambs, hypoxia and hypercarbia tend to decrease pulmonary blood flow and increase cerebral blood flow. Within models of perinatal asphyxia, the effects of hypothermia on this correlation of blood flow are not known. Using a repeated measures design in an experimental lamb model, we sought to assess how best to account for temperature when using blood gas measurements corrected for body temperature to predict pulmonary and carotid blood flow. We hypothesized that inducing whole body hypothermia in neonatal lambs exhibiting moderate to severe HIE results in depressed pulmonary blood flow (Qp) without altering carotid blood flow (Qca).

Increase concentration of *Vibrio spp*. results in higher mortality of Giant Keyhole Limpets at larval stage

Alexes Juarez
Sponsor: Jason Gross, Ph.D.
Animal Science

Keyhole Limpet Hemocyanin (KLH) is an immune-stimulating molecule used in pancreatic cancer research which is derived from the blood from Giant Keyhole Limpets (Megathura). Megathura, a gastropod from the Pacific Ocean, supplies KLH through wild harvest as little is known of their culturing methods. The aim of this study was to determine the effectiveness of water disinfection in three different limpet culture systems, and to determine if Vibrio is present during spawning and contributing to larval mortality. Vibrio was chosen because it is a ubiquitous bacterium that serves as an indicator of total bacteria within a system. Bacteria were quantified by agar plate inoculum and incubation at 45°C for 24 hours. Sampling occurred in seawater flowing through various filters, on the animals, and source water used for spawning. Preliminary results indicate the concentration of bacteria throughout the system is dependent on the tide. When the tide was low, the incoming water contains more sediment which results in larger bacterial concentration, and vice-versa. The presence of bacterium suggests the culturing and spawning of Megathura is dependent on incoming water quality and the spawning of these animals must have minimal contaminants because they are more susceptible to disease at a larval stage.

Sustainable Water Treatment and Sanitation for Public Schools in Kampala, Uganda: The Impact of Drinking Water Filters on Student Outcomes

Kemi Kakonge-Ruyondo
Sponsor: Mark Lubell, Ph.D.
Environmental Science & Policy

Over 20 million Ugandans currently lack access to clean drinking water. The Ministry of Health in Uganda identified drinking water and juices as the main sources of the 1,940 typhoid cases in the 2015 typhoid outbreak. In a 2018 pilot project, locally produced ceramic filters were installed in 16 low-income primary schools in Kampala, Uganda. Education and outreach workshops were conducted in one of those schools, and 20 third grade students surveyed. The survey results identified the students' increased understanding of waterborne diseases and trust in the water source as the main factors motivating students to drink filtered water. Through informal conversations and observational studies, the staff and administration's opinion that the additional cost of purchasing filters and cups is unnecessary was identified as an administrative barrier. The second phase of this project will provide empirical facts on the costs and benefits of drinking water sanitation in public schools in Kampala through the use of a randomized control trial used to estimate the average treatment effect of drinking water filter interventions on student outcomes. This project aims to show that an increase in the frequency of students drinking filtered water will decrease waterborne disease cases and improve academic performance.

Sex-Biased Dispersal in a Model Organism, Tribolium confusum

Jo Hsuan Kao
Sponsor: Alan Hastings, Ph.D.
Environmental Science & Policy

Understanding the movement of individuals across space and time is an important concept in ecology, with applications in the management of biological invasions. Multiple factors, such as sex-biased dispersal, have the potential to alter the rate of spatial spread of a population. Sex-biased dispersal occurs when one sex disperses farther than the other and can be used to avoid inbreeding or kin competition. For our research, we are using confused flour beetles, Tribolium confusum, to determine whether sex-biased dispersal is present and to assess its effects on polyandrous organisms. T. confusum are widely used to model population dynamics and dispersal due to their high reproductive rate and fast generation time. In a pilot experiment, we did not find a strong bias when the two sexes were put together. However, we did find that 50% of the males dispersed in the absence of females, and no females dispersed in the absence of males. We are currently conducting a full-scale experiment, where we expect T. confusum to demonstrate a male-biased dispersal. Sex-biased dispersal in polyandrous species may be an important consideration for those who study these types of model organisms and for larger-scale management policies.

Feasibility of Tea as a Commodity for California Smallholder Farmers

Chin Yi Kao
Sponsor: Katharine Burnett, Ph.D.
Art

In the recent years, there has been a national shift of interest towards tea, which is the second most consumed beverage in the world. Tea is known to grow in higher altitudes; however, some research state that elevation is secondary to soil conditions. In the agricultural field, one of the most vulnerable groups of people are smallholder farmers. In California, they consistently are trying to find agricultural commodities that would bring more revenue, which usually results in growing specialty crops. Therefore, my research explores, first and foremost, whether or not is it possible to grow tea in the context of Northern California, and second, if it is a feasible crop that could generate more income for smallholders. The analysis is conducted through the four lenses of sustainability: environmental, financial, social, and technological, a method introduced by UC Davis D-Lab. This research has been on-going since its initiation in Fall of 2017. The current results of my project show potential, though still incomplete since agricultural research is slow due to its dependence on time. If proven successful, this shows that tea can be grown regardless of altitude, and that it could be a new source of income for California smallholder farmers.

Ancient Human Migratory Patterns on the San Francisco Peninsula Revealed Through Sulfur Isotopic Analysis

Nikoletta Karapanos
Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

Sulfur is an essential element for humans and is obtained through food and water intake. This sulfur is then incorporated into bone and teeth, tissues that can survive for hundreds to thousands of years. Sulfur isotopic composition varies over geographic space. The sulfur isotopic composition of food and water is determined by the local environment, especially geology and hydrology. Therefore, sulfur isotope ratios in human bone and teeth provide information on the mobility patterns of an individual and can help archaeologists reconstruct how groups of people moved across the landscape in the past. This study examines sulfur isotopes of bone collagen in a set of human burials from CA-SFR-191, a pre-contact period shellmound on the San Francisco Peninsula, occupied between 1500 and 800 years ago. The analysis focuses especially on the mobility of adult males vs. adult females to help evaluate whether the group followed a matrilocal or patrilocal post-marital residence pattern. Results are compared to other archaeological sites in the region, and to a set of canid remains from CA-SFR-191.

Socioeconomic Status and Cortisol Responses to a Social Stressor in Children

Mona Karimi
Sponsor: Camelia Hostinar Caudill, Ph.D.
Psychology

Prior studies have linked exposure to poverty with altered functioning of the hypothalamic-pituitary-adrenocortical (HPA) axis, whose primary product is the adrenal hormone cortisol. However, much less is known about protective factors that could buffer children against these alterations. The current study aimed to examine whether socioeconomic status (indexed by family income) was associated with children's cortisol responses to a laboratory public speaking stressor, the Trier Social Stress Test modified for use with children. We recruited 110 participants between the ages of 9 and 10 and randomly assigned them to one of three conditions: no-stress, stress after 10 minutes of parental support, or stress without parent support in the prior 10 minutes. Cortisol levels were assessed in saliva samples every 20 minutes starting 10 minutes after arrival to the laboratory. We plan to examine whether low-income children differ from higher-income children in their response to the stress condition, and whether parental support provided in the laboratory can act as a buffer to these differences. This evidence would point towards parental support as an effective defense against chronic stressors such as poverty, therefore allowing for the development and improvement of intervention strategies to aid impoverished youth.

The Swing Voter and the Ground Campaign: How Political Practitioners and Political Scientists Understand Persuadable Voters.

Spencer Katz
Sponsor: Christopher Hare, Ph.D.
Political Science

Campaign organizations seek to change the outcome of elections through tactics collectively known as the ground campaign. These efforts are focused on mobilizing supporters and persuading those with ambiguous allegiances. The decisions made by campaigns as they design their winning coalition holds important implications beyond the electoral context. Recently, the rise of big data and microtargeting models has provided political operatives with extremely advanced methods of identifying voter groups. Popular media ascribes a nearly omnipotent predictive power to these data models, however, political science research casts doubt on such characterizations. Likewise, practical considerations regarding implementation and electoral context underlie the targeting decisions and strategies pursued by campaign operatives. Political science has long theorized about the causes and characteristics of swing voters. While social science research has directly impacted ground campaign tactics, the academic literature on persuadable voters is disconnected from the practical implementation of persuasion targeting. Using survey data from the 2016 Cooperative Congressional Election Study (CCES), this study will evaluate how swing voters from the 2012 to 2016 Presidential elections map onto the traditional targeting tables designed by campaign strategists.

South Asian and Asian Indian Women's Exposure to Culturally-Specific Domestic Violence Resources in California

Manpreet Kaur
Sponsor: Christina Smith, Ph.D.
Sociology

Twenty percent of all Asian Indian (AI) immigrants in the U.S. reside in California, with multiple studies showing that immigrant South Asian (SA) and AI women are at a particularly high risk for intimate partner violence (IPV). Additionally, the AI population has increased at a rate of 69.4%, between 2000 and 2010, making it one of the fasting growing ethnic groups in the U.S. In this study, I conduct a content analysis of websites of twenty randomly selected domestic shelter organizations throughout California metro-areas with the ten highest and ten lowest percentages of AI populations. I scrape organizations' websites to identify general and culturally-specific keywords, the language services offered, and SA specific resources and/ or personnel mentioned. My research method assumes the perspective of a SA/ AI victim of domestic violence (DV) looking for resources in her area. I examine similarities and differences in website content by metro area AI population. I conclude no stark differences by metro area AI population in culturally-specific resources, via terms, offered; however, I do find a lack of DV organizations in the metro-areas all together, signifying the need for more resources in general, let alone those specific to SA/ AI needs.

Purification and Cryallizationn of KAI2 Karrikin-Sensing Protein.

Alexander Kehl
Sponsor: Nitzan Shabek, Ph.D.
Plant Biology

Wildfires have deleterious effect on nature, but they also play a major part of shaping the ecosystem around the world. Fires provide opportunity for new growth of plants. Smoke and charred plant material contain small organic molecules called karrikins that stimulate seed germination. KAI2 protein serves as the receptor of karrikin and plays a key role in plant signaling pathway. Interestingly, KAI2 found across all plant's kingdoms including bryophytes that do not have seeds to stimulate germination. This raises questions about the function of the receptor in bryophytes. Solving the atomic structure of KAI2 in bryophytes will help to decode the mechanistic properties of KAI2-karrikin and to clarify its function in comparison to other plants. To that end, we use cDNA from Physcomitrella patens, a type of moss with an early evolutionary deviation. The amplified sequence was transformed into E coli and the bacterial cells were induced to produce large amount of KAI2 protein. The protein was subsequently purified using chromatographical methods, and crystallization trials have been performed. Here, we present the first step towards uncovering moss KAI2 structure function and establishing a research platform to explore KAI2 with other key proteins in signaling pathway.

Lecture Capture and Implications of its Use by Students in General Chemistry

Amanda Kelly
Sponsor: Julia Chamberlain, Ph.D.
Chemistry

Lecture Capture is a tool that gives students online access to video recordings of class material which they can use at their convenience. Students may use Lecture Capture as a replacement for class or as a study tool and supplement to class. A primary aim of our resaerch is to investigate the effectiveness of Lecture Capture as a learning and teaching tool for first-year chemistry at UC Davis, and to gain insight into students' affective response to this resource. Preliminary results show students' positive affective response to Lecture Capture, and indicate that this resource may play a significant role in students' feeling supported in a large introductory STEM course. Our research will ultimately give instructors and students evidence-based results which can guide their decision to use or not to use Lecture Capture in their courses. Lecture Capture has potential implications for student affect and performance in large introductory courses such as introductory chemistry.

Investigating Flavivirus Protein NS4A Interaction With Human ANKLE2 Protein

Shahabal Khan
Sponsor: Priya Shah, Ph.D.
Chemical Engineering

Mosquito-borne flaviviruses, such as dengue virus (DENV) and Zika virus (ZIKV), are a source of emerging and re-emerging infectious diseases. Therefore, it is crucial for cell and molecular biologists to better understand the underlying molecular mechanisms of viral hijacking and develop therapeutics. A recently identified ZIKV-specific interaction between NS4A, a conserved viral protein, and ANKLE2 – a human protein involved in mitotic regulation has been discovered. ANKLE2 is known to be linked to hereditary microcephaly, and the new findings show ZIKV NS4A causes microcephaly in Drosophila in an ANKLE2-dependent manner. The questions that remain to be investigated are if the NS4A and ANKLE2 interaction is limited to certain types of viral NS4A and which specific domain of NS4A is interacting with ANKLE2. In order to so, we have assembled different DNA plasmids containing the different versions of the NS4A gene using Gibson Assembly protocols. With the assembled plasmids, we have transfected HEK cells and are now testing the NS4A and ANKLE2 affinities by Co-Immunoprecipitation and Western Blot analysis. The findings for these can be significant in future therapeutic designs by targeting specific domains of NS4A which have the greatest affinity for ANKLE2.

The Value of Scaffolding and Learning in Children

Umm-E- Khan
Sponsor: Kali Trzesniewski James, Ph.D.
Human Ecology

Previous research has shown that the type of feedback that parents give their children influences their later academic achievement. Like, toddlers who received praise for their hard work had higher grades seven years later, compared to children who received praise for being smart (Gunderson et al., 2017). Our current study's goal is to extend these findings to test other ways of scaffolding children's achievements. Parent and their child (of age 4 to 8) will participate in a lab task that elicits parent-child challenging task conversation. In the first and second tasks, parents will direct children as they complete a challenging Lego task while discussing a time that child struggled and succeed and a time that child struggled but did not succeed. We also aim to discover the relationship between parental scaffolding strategy (like praising the process vs praising the person) leading to growth mindset in children (of age 4 to 8). Qualitative responses and nonverbal behavior will be analyzed for common themes. We expect to replicate the previous findings, that both types of praise scaffolding strategies will contribute to growth mindset and achievement in children, but praising the process will have a stronger positive impact than praising the person.

Novel Bacterial Metabolism May Mitigate Earthquake Damage

Mahanoor Khan
Sponsor: Douglas Nelson, Ph.D.
Microbiology & Molec Genetics

Microbially induced calcite precipitation (MICP) can stabilize saturated sands, thereby potentially preventing soil liquefaction caused by earthquakes. Certain naturally occurring bacteria can hydrolyze urea and, when exposed to calcium salts, lead to the formation of calcium carbonate and the bio-cementation of soils, preventing destabilization. To optimize the strength of bio-cemented soil, we constructed five 3.5 meter long columns of natural soils and treated them in three ways to establish microbial ureolytic activity. Once the native bacteria were enriched, dissolved oxygen was depleted for 90+ % of daily solution injections.Our earlier similar experiments showed dominance by Sporosarcina spp., which we hypothesized was due to a novel energy generation process, studied 30 years ago by others in Sporosarcina pasteurii. Our research confirmed that Sporosarcina pasteurii shows urea-dependent growth in an anaerobic chamber, a unique physiological feature that we hypothesize allows them to dominate our enrichment conditions. Furthermore, our data show that acetate, an expensive component of our treatment medium, is probably not utilized by Sporosarcina spp., thereby suggesting its omission to reduce costs. The analysis of the data obtained from this project will provide information that can further optimize the process of bio-cementation in terms of stability, cost, and rate.

Engaging the *Hmong Population* through Participatory Research Surveys: Concerns of High Blood Pressure Prevalence

Awais Khan
Sponsor: Christian Bohringer, M.D.
MED: Anesth & Pain Medicine

Since their acculturation into American society from Laos, there is a lack of health research on the current Hmong demographics in larger Hmong populated areas. California houses the largest population of Hmong in the country, with Sacramento being the third highest Hmong populated city. In order to account for lacking data, we have conducted surveys from April-October 2018 at heavily populated Hmong locations such as Hmong Supermarkets and community events in Sacramento. Participants completed a demographics survey and had vitals taken voluntarily. This study evaluates age, gender, amount of exercise, annual household income, formal education, blood pressure status, and glucose levels. It further discusses the limitations of the data collected and compliance due to cultural practices. Finally, this analysis aims to identify shortcomings of current methods, as well as channels for improving data collection, and effective outreaching towards individuals without formal education. Emerging potential results show a higher blood pressure reading amongst male participants compared to female participants. Data shows, with age, blood pressure tends to increase in Hmong individuals regardless of gender. Results of this study will be useful to health care workers who are looking to learn more about significant comorbidities among Hmong populations.

An Examination of the Relationship Between Language Ability and Attention-Deficit/Hyperactivity Disorder (ADHD) Symptoms in Young Children

Aminah Khan
Sponsor: Julie Schweitzer, Ph.D.
MED: Psychiatry & Behav Sci

For children, developing self-control is a critically important step toward success in academic settings and social relationships, yet there are few non-pharmacological approaches that successfully contribute to increased self-control. The present study focused on parent and teacher reports to help us better understand how language skills in early childhood are related to hyperactivity and inattention, symptoms often associated with a diagnosis of ADHD. Preliminary analysis focused on two screening measures: the NIH Toolbox Picture Vocabulary Test (TPVT) and ADHD Rating Scales. The TPVT is a measure of language skills and is commonly used as a brief cognitive screener. The ADHD Rating Scales are a measure of hyperactivity and inattention in children. The scores from both of these measures were analyzed to examine the relationship between hyperactivity, inattention, and language skills. Preliminary results show small negative correlations between hyperactivity and language skills as well as between inattention and language skills for males and females. These findings suggest further research could be useful to show how symptoms associated with disorders such as ADHD relate to language and cognitive abilities, and thus provide more information how to approach hyperactivity and inattention in the classroom and at home.

Anisotropic Analysis of Seismic Data From Surprise Valley, California

Danielle Kinkel
Sponsor: James Mcclain, Ph.D.
Earth And Planetary Sciences

Surprise Valley is located in Modoc County of Northern California. It forms part of an accommodation zone at the edge of the Basin and Range Province of extension. The valley edges are the site of significant hydrothermal activity, and numerous studies have been done in the area to try and constrain the details of where the source for the hydrothermal fluids is and how they are transported. This research is aimed to try and see if the water could possibly be coming up through fractures in the ground using previously collected seismic velocity data from the area. I am trying to find the azimuths of the possible fractures using the principle of seismic waves, which concludes that seismic waves travel faster parallel to the orientation of fractures and slower perpendicular to them. My research is analyzing the arrival time information from various geophone lines and then modeling the results in MATLAB. If there are fractures present, and the geophone lines don't run parallel to them but instead cross over them, the models should be able to show the orientation of the fractures based on drastic changes in travel time that aren't attributed to distances away from the shot source.

Identifying Novel Players in Nuclear Migration with Forward Genetics

Jonathan Kirkland
Sponsor: Daniel Starr, Ph.D.
Molecular & Cellular Bio

Successful nuclear migration is essential for organismal development. Failed nuclear migration causes defects in cell migration, causing neurodevelopmental defects and incomplete organogenesis, and may be important in cancer metastasis. The LINC complex, composed of SUN and KASH proteins, recruit the microtubule motors Kinesin-1 and Dynein to the nucleus which facilitate nuclear migration along the microtubules. The unc-84 null mutation in C. elegans knocks out the canonical LINC pathway, exhibiting egg laying deficient (Egl) and uncoordinated (Unc) phenotypes at 25 C, but nuclear migration occurs independent of unc-84 when grown at 15 C. We hypothesize that there is an enhancer pathway that helps facilitates nuclear migration events in the absence of the LINC pathway. In order to identify this pathway, a forward genetics screen was performed using unc-84 null worms that were mutagenized with EMS, and screened for Egl and Unc phenotypes at 15 C. The possible enhancer mutants are then screened to determine if failure of nuclear migration occured.Our goal is to identify the enhancer gene using a bioinformatic approach though whole genome sequencing and screening. The successful identification of an enhancer pathway of nuclear migration mechanisms will allow for a greater understanding of developmental diseases and cancer metastasis.

Small Unmanned Aerial System (sUAS) for Remote Air Quality Monitoring

Erina Kitamura
Sponsor: Zhaodan Kong, Ph.D.
Mechanical & Aerospace Engr

The development of inversion layers restrict the vertical dissipation of air pollution and trap poor air quality just over the surface of the earth. This could have negative health effects on humans that could lead to cardiovascular issues in the future. While stationary air quality monitoring could provide useful information, it is restricted to monitoring only a specific region while air quality varies with altitude. This project presents the idea of using a small unmanned aerial system (sUAS) to perform remote air quality monitoring, with a flight time of at least one hour. Test flights have been performed on board a DJI S100+, proving the detection of inversion layers in the early morning. Trends regarding particulate matter (PM) with altitude and temperature have also been observed that agree with current science. This project can pave the way for the implementation of robust and affordable air quality monitoring system in applications such as refinery monitoring and ship emission monitoring.

Non Serviam: Dismantling Normativity in James Joyce's *Ulysses*

Jared Kohn
Sponsor: Gregory Dobbins, Ph.D.
English

James Joyce's Ulysses explores the relationship between personal identity and narrative. The novel shows how different characters interact with and understand the world on a personal level by tethering their narration to literary styles. Literature, newspapers, and stories frame every narrator's thoughts. Leopold Bloom thinks in direct sentences that resemble news articles, and Gerty casts herself as the lead in a romance novel with sentimental prose. Everyone in Ulysses understands themselves based on what they read. At the same time, storytelling invents normativity. Almost every character in Joyce's Dublin uses literature and tropes to define what they consider normal. Narratives build normative frameworks that codify everything from how an artist acts to gender roles. Those frameworks cannot account for Gerty MacDowell's physical disability or the complex natures of Stephen and Leopold. These characters alienate themselves by forcing their identities into restrictive archetypes. They lack the cultural imagination to understand themselves and rely on generic tropes for self-classification. Ulysses eventually reveals that the transformative power of creativity can dismantle these frameworks, creating space for self-understanding. Imagination subverts cultural expectations and allows the characters to transcend the normative, prompting them to challenge their orthodox identities.

Shah Abbas I and the Safavi Gunpowder Revolution

Hamid Kolahdouz-Isfahani
Sponsor: Ali Anooshahr, Ph.D.
History

Orientalists have long questioned whether the Safavi military constituted a modern force, successfully integrating gunpowder technology into a standing army. According to Parker, the adoption of gunpowder and fortification technology led to the establishment of modern, centralized states from 1500-1800 in Europe, through what he coined the "Gunpowder Revolution." Savory and Mathee have asserted that Iranians were resistant to gunpowder technology due to cultural values based in a "steppe-mindset" and chivalric "manliness." However, the examination of two 17th century eyewitness sources, Iskender Beg Monshi's Chronicle of Shah Abbas the Great and Sir Anthony Shirley's account of his time at Safavi court, illustrates that the Safavi state did undergo a "Gunpowder Revolution." The organizational changes made by Shah Abbas to the Safavi military and state through the reorganization and expansion of the Gholam and Qurchi corpus exemplifies the centralizing process. An examination of Shah Abbas's official chronicle proves modern weapon systems and fortifications were integral to Safavi military success. Abbas's reforms castrated the traditional Qizilbash Khanan that had once dominated the state, without destroying the fighting strength of the state. The modernity of the Safavi state complicates the anachronistic, orientalist projection of Western imperial domination of Iran as a 'natural' outcome.

Linking Probability of kDNA minicircles

Aparna Komarla
Sponsor: Francisco Arsuaga, Ph.D.
Molecular & Cellular Bio

Trypanosomes are single celled protozoans with a unique mitochondrial DNA structure called kinetoplast DNA (kDNA). kDNA is partitioned into minicircles and maxicircles that are topologically linked forming a network. This network is often regarded as the most structurally complex mitochondrial DNA in nature (Lukes, 2002). Different biophysical models can be used to simulate minicircles in kDNA as polymer chains. Three polymer chain models that have used are: geometrical circles or rigid circles, freely jointed chains (FJC) and worm-like chains (WLC). In this work we aim at determining whether rigid circles are a valid representation of minicircles. In particular, we test whether the linking probability of two geometrical minicircles of radius R is comparable to the linking probability of two chains (freely jointed chains or worm-like chains) with radius of gyration, R. We develop a function that compares the results from these models and provides insight into the properties of the different simulations.

Sex-Biased Dispersal in a Model Organism, *Tribolium confusum*

Erica Kono
Sponsor: Alan Hastings, Ph.D.
Environmental Science & Policy

Understanding the movement of individuals across space and time is an important concept in ecology, with applications in the management of biological invasions. Multiple factors, such as sex-biased dispersal, have the potential to alter the rate of spatial spread of a population. Sex-biased dispersal occurs when one sex disperses farther than the other and can be used to avoid inbreeding or kin competition. For our research, we are using confused flour beetles, Tribolium confusum, to determine whether sex-biased dispersal is present and to assess its effects on polyandrous organisms. T. confusum are widely used to model population dynamics and dispersal due to their high reproductive rate and fast generation time. In a pilot experiment, we did not find a strong bias when the two sexes were put together. However, we did find that 50% of the males dispersed in the absence of females, and no females dispersed in the absence of males. We are currently conducting a full-scale experiment, where we expect T. confusum to demonstrate a male-biased dispersal. Sex-biased dispersal in polyandrous species may be an important consideration for those who study these types of model organisms and for larger-scale management policies.

Characterizing Candidate WY-Effector Proteins of *Bremia lactucae* in Lettuce

Jennifer Kopetzky
Sponsor: Richard Michelmore, Ph.D.
Plant Sciences

Downy mildew diseases devastate numerous agriculturally important crops, including lettuce, despite the use of fungicides. Naturally resistant lettuce varieties need to be identified for breeding programs and biotechnology approaches to mitigate the threat of downy mildew. Putative effector sequences cloned from Bremia lactucae, which causes lettuce downy mildew, were transformed into Agrobacterium tumefaciens and transiently expressed in both cultivated and wild lettuce lines. The candidate effectors were also examined for their ability to suppress plant immunity by measuring the production of reactive oxygen species in the presence and absence of an elicitor. Of the 34 candidate effector sequences tested, two effector clones were recognized by two separate accessions of Lactuca saligna. Preliminary assays indicated that the presence of an elicitor generally increased the production of ROS as a result of plant immune responses. However, the candidate effector SW4 produced a greater ROS burst than any other candidate effector, suggesting that the SW4 candidate effector may be an activator of pathogen triggered immunity. Further analysis is needed to confirm the possible PTI activation property of the SW4 candidate effector. These results indicate that some effectors are recognized across multiple varieties, which could help identify new resistance genes in lettuce.

Photochemical Preparation of 1,2-Dihydro-3*H*-indazol-3-ones in Aqueous Solvent at Room Temperature

Niklas Kraemer
Sponsor: Mark Kurth, Ph.D.
Chemistry

Indazolones are privileged heterocycles as they have been found to demonstrate a variety of biological properties, such as anti-cancer, anti-tumor, anti-inflammatory, antiviral, and antibacterial activities. Previously, we modified the Davis–Beirut reaction to give indazolones in an one-pot approach from o-nitrobenzylalcohol and primary amines. This synthesis however required rather forcing conditions of 100 °C and 20 equiv of base to generate the key o-nitrosobenzaldehyde intermediate. Literature precedent suggested that the o-nitroso intermediate could also be generated in situ using ultraviolet irradiation. Indeed, this led to a much greener indazolone synthesis methodology, requiring no base at room temperature in an aqueous solvent. The optimized reaction conditions gave indazolone in up to 83% yield, comparable to the base-mediated conditions. The gentler conditions also allowed us to expand the substrate scope of the reaction to include benzyl amines. Thus, we found an improved green photochemical route to the very biologically interesting indazolones. We are now looking to expand the substrate scope to include phenyl amines.

In-vivo Validation of a Putative Regulatory Enhancer Region of Chd8.

Ellie Kreun
Sponsor: Alexander Nord, Ph.D.
Neuro Physio & Behavior

Embryonic development depends on the spatial, temporal, and quantitative control of gene expression. This process is tightly regulated by thousands of distant-acting transcriptional enhancers. Nevertheless, identifying enhancers that are essential for the expression of their target genes has proven challenging. Mutations in the chromatin remodeling factor, CHD8, have emerged as a key genetic risk for ASD. Chd8 has been shown to be essential for brain development in mice as constitutive Chd8-coding hemizygous mutations are embryonically lethal and its haploinsufficiency produces ASD-like phenotypes in the mouse. Previously, we identified a robust specific interaction between Chd8 and a putative specific enhancer region. To interrogate the role of this interaction in Chd8 regulation in-vivo, we used genome editing to delete the putative enhancer in mouse (Chd8_eKO). Although we predicted this deletion would completely disrupt the interaction, hemizygous and heterozygous Chd8e_KO mice are viable. Here, we evaluated mendelian rates and determined Chd8 transcript and protein expression levels by qPCR and IHC respectively. Our results allow us to assess whether specific physical interactions at essential developmental genes are valuable for identifying enhancer mutations with strong loss-of-function phenotypes. In future studies we plan to compare neuroanatomical phenotypes of Chd8_eKO mice to traits present in Chd8 haploinsufficient mice.

Creation of a Mammalian Cell-Based Bioassay for the Detection and Quantification of Physiological Stress

Alexander Krueger
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

In the field of environmental toxicology, in vitro models are becoming more common in substance toxicity studies. Historically, the gold standard for studying physiological effects of chemicals has been whole animal in vivo studies. However, these studies require substantial time, money, and resources, such as specialized facilities and expertise. Additionally, these studies expose animal to harm, and bioethical considerations require that we minimize animal suffering. Therefore we determined that mammalian cell lines were the appropriate chassis for our biosensor, since these lines are relatively inexpensive but still retain the ability to link the presence of a substance to mammalian stress. With this in mind, we designed a mammalian cell-based bioassay that reports activation of specific stress pathways via fluorescence. When exposed to chemically induced stress, mammalian cells activate complex cellular pathways comprised of many genes. By coupling the expression of enhanced green fluorescent protein to promoters from these stress-response genes, we are able to quantify the activation of these pathways in mammalian cells. Preliminary experiments have shown promising results, with one promoter-reporter construct able to detect the stress induced by one toxin at 10 times lower concentration than the threshold of the cytotoxicological limit defined by the EPA.

Human-Specific Duplicated Genes and the Evolutionary Expansion of Human Neo-Cortex

Matangi Kumar
Sponsor: Megan Dennis, Ph.D.
MED: Biochem & Molecular Med

Human-specific segmental duplications (HSDs) are regions of the genome that have been duplicated uniquely in the human lineage and are highly similar in sequence. Previous research suggests that certain genes contained within HSDs, such as SRGAP2C and ARHGAP11B, are involved in neuronal migration and proliferation and could play an important role in the expansion of the human neocortex. We hypothesize that additional uncharacterized HSD gene paralogs could have played an evolutionary role in the human neocortex expansion. We focused on four HSD gene families likely involved in dictating membrane structure as well as neuronal motility, differentiation, and proliferation. We used ex vivo methods to quantify filopodia outgrowths in COS-7 cells overexpressing HSD genes. We also used in vivo methods via in utero electroporation to measure neuronal migration in developing mouse cortex. We have preliminary data suggesting ARGHAP11B results in a decrease in the rate of neuronal migration along the developing cortex. Further work includes collecting additional data from both ex vivo and in vivo experiments to make conclusions on how HSD genes play a role in affecting human neocortex expansion via changes in membrane dynamics.

How Do Hinduistic Elements And Characteristics In The Devotional Literature Of The Ginans In South Asia Reveal Core Theological Principles About Ismailism?

Dinar Kurji
Sponsor: Mairaj Syed, Ph.D.
Religious Studies

Originating from the Sanskrit word jñana (knowledge), ginans are the devotional literature that was composed by Pirs and Sayyids for the Ismaili communities in South Asia. Ginans contain knowledge about wisdom and theology. However, the scholarly debate is of how one should interpret the ginans. Some scholars such as argue that the ginans should be read as works of poetry while others believe that the ginans contain core theological principles. This research project explores this debate and explains that the ginans indeed include various Hinduistic ideas. By analyzing over 700 Ginans from various translated sources and "Ginan Central," I selected pieces that specifically allude to Hindu figures, deities, and apocalyptic themes. The ginans contain ideas that Ismailis typically do not acknowledge as part of their theological commitments. Given that Ismailism relies on secrecy and esoteric approaches to scripture, I claim that the ginans communicate hidden theological ideas borrowed from Hinduism, despite the apparent contradiction between the content of the ginans and more publicly avowed religious ideas.

Contemporary Paintings of the Chinese Diaspora: The 1.5 Generation

Jessica Kwong
Sponsor: Katharine Burnett, Ph.D.
Art

When discussing contemporary art of the Chinese diaspora, the focus is usually on artists who began their practice in mainland China and emigrated to places such as the United States, Europe, or Australia in adulthood. Although they have lived abroad for decades, they are generally still considered Chinese artists. On the other hand, much less discussed are artists who were born in China but raised overseas; in other words, the 1.5 immigrant generation. I look at three artists: Taiwan-born, America-raised Fay Ku, and Hong Kong-born, Australia-raised John Young and Kate Beynon. All three artists use imagery or techniques from Chinese painting, but their reasons for doing so are not so much about expressing "Chineseness" in style or in their backgrounds, as they are about critically investigating cultural identity and world history. Although their work has been collected and exhibited internationally and is considered important by critics such as Jason Kuo and John Clark, these artists have been left out of the canon of Chinese painting due to their upbringing. Widening the canon to include artists raised in the diaspora would acknowledge the global nature of Chinese identity today.

Using Trace Elements to Understand ENSO Precipitation Extremes in California

Daphne Kuta
Sponsor: Isabel Montanez, Ph.D.
Earth And Planetary Sciences

El Nino Southern Oscillation (ENSO) events and related anomalous warm-water upwelling in the Pacific Ocean has steadily increased in recent years. California experiences El Nino events through heavy downpour of rain interspersed with colder sea surface temperatures (SST) of La Ninas. This research aims to reconstruct signals of past El Nino events using cave calcite deposits, or stalagmites, and calibrate the deposits to modern cave environments. Stalagmites record increased rainfall through elevated concentrations of trace elements and lower alkalinity of the water. We hypothesize that there is a relationship between trace element concentrations and precursor El Nino signals. Using collected drip water data from Lilburn Cave and California Caverns, we attempt to correlate concentrations of Mg, Ba, and Sr to heavy rainfall events while still accounting for prior calcite precipitation (PCP) and different modes of transport based on storm type. We then project this relationship to the past using a stalagmite from the western Sierra Nevada that spans the Holocene to develop a timeline of El Nino events. Here, we layer precipitation, mechanisms of transport, and trace elements to reconstruct previous storm timelines. With this knowledge we provide the first El Nino impact timeline available for the western Sierra Nevada.

Synthesis of Indole-Based Hydroxamic Acids to Investigate as HDAC Inhibitors

Adon Kwong
Sponsor: Annaliese Franz, Ph.D.
Chemistry

The various isoforms of histone deacetylase (HDAC) enzymes have been linked to cancers and inflammatory diseases. Hydroxamic acids are commonly used as HDAC inhibitors due to the strong chelating effect to the Zn^{2+} in the active site. The goal of this research project is the synthesis of indole-based hydroxamic acids to investigate as selective HDAC inhibitors and the effect of structure on binding and selectivity. The target molecules were designed with inspiration based on a known HDAC8-selective molecule, featuring a hydroxamic acid as a zinc-binding group and an indole core. The synthetic route to access the target molecule involves four steps, each of which has been investigated and optimized. The synthetic steps include an N-substitution of the starting indole, hydrolysis to reveal a carboxylic acid, amide coupling to attach a linker component, and the final transformation to the desired hydroxamic acid. The final products are characterized using H^1 NMR spectroscopy and mass spectrometry. By changing both the length of the molecule and the substituents on the indole cap, this exercise in synthesis aims to produce a set of compounds whose HDAC selectivity and inhibition will be used to find structure-activity relationships on HDACs.

Environmental Pollution and Systemic Inflammation in Children Residing in Greater Sacramento

Jennifer La
Sponsor: Camelia Hostinar Caudill, Ph.D.
Psychology

Children's health is often linked to the environment in which they grow up. Previous research has found that environmental pollutants contribute towards markers of systemic inflammation in adults, posing numerous health risks. In order to examine if this positive relation between environmental pollutants and systemic inflammation can be found in children, we measured children's inflammation through circulating levels of Interleukin-6, Interleukin-8, and TNF-a in their blood samples obtained from our Social Support Study. We recruited 100 healthy children aged 9 or 10 from the Greater Sacramento area to participate in the study, which included obtaining two blood samples before and after a public speaking task. We will examine daily air quality index (AQI) and average PM 2.5 levels from the United States Environmental Protection Agency's database. Through this study, we predict that children who reside in locations with a higher AQI on the day of each session and higher average PM 2.5 levels will have greater markers of systemic inflammation compared to those from locations with fewer environmental pollutants. This study may help identify early-life risk factors for poor physical health and suggest programs to buffer children from future environmental-linked diseases stemming from systemic inflammation.

Determination of the Tau Domain Responsible for Condensate Formation

Aileen Lam
Sponsor: Richard Mckenney, Ph.D.
Molecular & Cellular Bio

Tau, a microtubule associated protein, is present in neurons and commonly associated with protein aggregates found in Alzheimer's disease. Using single molecule imaging, we recently discovered a new physical state of tau wherein reversible, high-density condensates form in spatially distinct regions on microtubules (MTs). Tau condensates were found to affect the activities of MT effector proteins, potentially revealing a role for non-aggregated tau in living neurons. We set out to determine which regions of the tau molecule are necessary and sufficient to form tau condensates. To address this, we cloned the six natural isoforms of tau and truncated various versions to observe the MT binding properties of tau. Using TIRF microscopy, we found that all six isoforms form condensates and identified the evolutionary conserved pseudo-repeat domain of tau as essential for condensate formation. Further truncation experiments in the C-terminal pseudo-repeat domain revealed this domain is critical for the formation and entry of tau molecules into existing condensates. From this, we propose that tau has a unique mode of self-association on the MT surface that is important for the regulation of MT effector proteins, and which may be affected by disease-causing mutations, providing further insight into tau-mediated neurodegeneration.

Investigation of the Influence of Problem Construction on Chemistry Students' Success with Stoichiometry Problems

Shannon Lamb
Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Chemistry students struggle with interpreting given information in problems and separating relevant information from distractors, causing failures in generating successful solutions. Chemistry educators have implemented different methods such as using solution maps to teach their students how to approach problems and successfully tackle them. However, the effectiveness of problem construction by utilizing given solutions on students' problem-solving achievement has not been studied yet. In this study, a group of chemistry students (N=45) participated in three think-aloud sessions. The group was divided into a control group (N=15) and an experimental group (N=30). During the pre-intervention session, all the students were asked to solve five stoichiometry problems while thinking aloud. After two weeks, the intervention session was conducted in which the experimental group was asked to construct eleven chemistry problems by examining the given detailed solutions. In the post-intervention session, both groups solved slightly modified versions of the pre-intervention questions in order to observe changes in their strategy, knowledge, and accuracy. The goal of this study is to better identify students' struggles with solving chemistry problems, and to examine the effects of problem construction as a potential method to increase students' success with problem solving in chemistry and other subjects.

Creation of a Mammalian Cell-Based Bioassay for the Detection and Quantification of Physiological Stress

Jacob Lang
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

In the field of environmental toxicology, in vitro models are becoming more common in substance toxicity studies. Historically, the gold standard for studying physiological effects of chemicals has been whole animal in vivo studies. However, these studies require substantial time, money, and resources, such as specialized facilities and expertise. Additionally, these studies expose animal to harm, and bioethical considerations require that we minimize animal suffering. Therefore we determined that mammalian cell lines were the appropriate chassis for our biosensor, since these lines are relatively inexpensive but still retain the ability to link the presence of a substance to mammalian stress. With this in mind, we designed a mammalian cell-based bioassay that reports activation of specific stress pathways via fluorescence. When exposed to chemically induced stress, mammalian cells activate complex cellular pathways comprised of many genes. By coupling the expression of enhanced green fluorescent protein to promoters from these stress-response genes, we are able to quantify the activation of these pathways in mammalian cells. Preliminary experiments have shown promising results, with one promoter-reporter construct able to detect the stress induced by one toxin at 10 times lower concentration than the threshold of the cytotoxicological limit defined by the EPA.

Changes in Genetic Expression Patterns of Female Tsetse Fly (*Glossina morsitans*) Reproductive Tract Tissues in Response to Male Seminal Secretions after Mating.

Joseph Laughlin
Sponsor: Geoffrey Attardo, Ph.D.
Entomology/Nematology

Studying reproductive biology of insects that vector human and animal disease can provide insight assisting in development of novel vector control methods to prevent disease transmission. This study focuses on the genetic response to mating by female tsetse flies (Glossina morsitans), vector of human and animal African Trypanosomiasis. Currently, tsetse flies are controlled using sterile male technique but little is known at the molecular level regarding underlying changes occurring in females after mating. Several dramatic behavioral and physiological changes occur after females are mated including complete refractoriness to further mating attempts by males and the start of ovulation. Prior to this study, nothing was known regarding the genetic response to mating in females. This analysis has provided a better understanding of the molecular response by females to male seminal secretions and also lays the groundwork for identification of new molecular targets for the creation of novel vector control methods. Several genes show significant changes in their expression patterns after mating. Among them were several structural constituents of the uterine tissues including collagen and cuticular proteins which may assist in restructuring the reproductive tract to facilitate ovulation. Also, several tsetse specific genes were identified that could be future targets of study.

The evolution of ATP synthase machinery amongst order Myxococcales members

Bryant Law
Sponsor: Mitchell Singer, Ph.D.
Microbiology & Molec Genetics

The order Myxococcales consists of a unique group of organisms within the class Deltaproteobacteria, which have exceptional qualities such as gliding motility, sporulation, aerobic respiration, larger genomes, and higher GC Percentage. One of the broad questions in Singer lab is to understand how these exceptional physiological and genomic qualities evolved amongst Myxococcales. We are trying to address these questions via comparative genomics and phylogenetic analysis. In this study, we (a group of six undergrads in Singer Lab) studied the proteins building ATP synthase machinery amongst 40 available myxobacterial genomes along with 66 outgroup organisms including Non-Myxococcales Deltaproteobacteria, Alphaproteobacteria, Betaproteobacteria, Gammaproteobacteria, and Epsilonproteobacteria. We looked at the distribution, genome localization (synteny), and phylogeny of all nine proteins involved in this energy machine. Our preliminary data suggests that these nine proteins are arranged in different kind of clusters amongst the three suborders in Myxobacteria. We are trying to look into their phylogeny to understand a broader evolutionary picture.

The Effects of Temperature on Flour Beetle Dispersal

Julia Layne
Sponsor: Alan Hastings, Ph.D.
Environmental Science & Policy

It is economically important to understand the effects of climate change on agricultural pests. Poikilothermic pests like insects have higher metabolic rates and are more active at higher temperatures, which suggests that pests dispersal may be affected by climate change. Local temperatures are expected to be more extreme during weather events, while global average temperatures are going to increase. Thus, climate change may give individual farmers less time to detect and react to pests. On larger, regional scales, climate change may cause acceleration in the spread of invasive pests. To study these phenomena experimentally, we use Tribolium confusum, also known as the flour beetle. Flour beetles are considered a household pest. We predict that beetles will disperse farther under stressful conditions, such as high and low temperatures. We are testing a range of temperatures between 10°C and 45°C and are comparing results to a control temperature of 31.5°C. Already we are seeing that beetles at 42°C and 20°C disperse 1.5 times farther than the control. This suggests that beetle dispersal distances are temperature-dependent. Knowing if pest dispersal rates are temperature-dependent will help farmers prepare for future climate change.

Effects of *Ganoderma* 'Butt Rot' on Non-structural Carbohydrate Content in Almond Trees

Sylvia Le
Sponsor: David Rizzo, Ph.D.
Plant Pathology

Ganoderma causes butt rot in trees, leading to reduced structural stability and tree mortality from windfall. However, little is known about the impacts of Ganoderma infections in the tree prior to mortality. The goal of this study is to use NSC content to determine the potential impact of Ganoderma infection on tree health, flower fecundity, or yield. Non-structural carbohydrates (NSCs) are sugars and starches obtained from photosynthesis and play an essential role in plant growth, flowering ability, and yield determination. A plant's NSC content can differ significantly among plants depending on various environmental stressors, such as weather, drought, and fertilizer use. In this study, we aim to explore the effect of wood-decay fungi on NSC content in almond (Prunus dulcis). 'Wood Colony' almond grafted on 'Nemaguard' peach seedlings were inoculated with a wooden dowel colonized with Ganoderma. The dowel was inserted into a hole drilled into the tree trunks below the graft union approximately 5 cm above soil level. The treatments included two isolates each of Ganoderma applanatum, Ganoderma brownii, and Ganoderma adspersum. Each month, wood and bark samples are taken from each tree and NSC content is measured using an acid-treated colorimetric method.

High Frequency Magnetotelluric Sounding for Constructing Subsurface Resistivity Models of Surprise Valley Hot Springs, Northern California

Huy Le
Sponsor: James Mcclain, Ph.D.
Earth And Planetary Sciences

Surprise Valley Hot Springs (SVHS) in Modoc County, northern California, is the site of fault-controlled geothermal system. Because of the presence of numerous hot springs in the region interest in exploitation of the geothermal energy resources has grown. In this area, combination of geological and geophysical techniques have been used to investigate the subsurface structure and to identify the location of potential heat sources and fluid pathways. One geophysical tool exploits the electrical resistivity in the Earth's subsurface. This research utilizes high frequency electromagnetic waves transmitted into the Earth. Data collected from previous studies is analyzed in order to construct 2D and 3D subsurface electrical resistivity models. Our sites of data collection are located between Warner Mountain Range and Hays Canyon Range. The main purpose of this study is to interpret the shallow subsurface structure related to fluid flow and the potential heat source. The low resistivity zone is a good indication of hydrothermal flow compared to high resistivity of surrounding rocks. Our models can be combined with previous models using low frequency magnetotelluric sounding to get the full resolution of resistivity with depth which allows a clearer model of the geothermal system of Surprise Valley Hot Springs.

Sensors and Algorithms for CubeSat Attitude Determination

Isabella Leal
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The Remote Experimentation and Analysis of LEO Phenomena (REALOPs) is a 2U CubeSat development project focused on data acquisition for use in STEM education. The objective of the Attitude Determination and Control System (ADCS) is to develop low-cost solutions that meet mission orientation and stability requirements. This presentation discusses sensors and underlying algorithms that determine the small satellite's orientation in space and controls the magnetorquer coils and reaction wheels. Attitude, location, and angular velocities are determined using a gyroscope, accelerometer, magnetometer, sun sensors, horizon sensors, and Global Positioning System (GPS). The sensor data is given in the body frame of the CubeSat. Models are used to translate attitude and rotation in the body-frame to the inertial-frame, which is then used for attitude control. An Extended Kalman Filter is utilized to combine sensor data, mitigate sensor noise, account for external forces, and proportionally weigh inputs to achieve higher accuracy with a short computation time. This is crucial for the mission objectives, which require a high degree of angular accuracy. The REALOP mission aims to develop and integrate an accurate, precise, and low-cost network of sensors and corresponding algorithms for the current and future CubeSat missions.

Hyperarticulation in Infant Directed Speech

Sofia Ledesema
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Research suggests that caregivers fluctuate their speech when directed towards infants versus towards adults (e.g. emphasizing vowels). This is known as infant-directed speech (IDS). The current study explores this by investigating whether parents hyperarticulate, or exaggerate speech sounds more clearly in IDS. Specifically, we are investigating how parents differentiate their production of "t" sounds in speech towards infants versus adults. We are coding emphasized and dulled "t" sounds (e.g. "boddle" for "bottle") at the middle and ends of words (e.g., hyperarticulated "hat" as "hat-tuh"). We are studying word positioning in sentences (e.g. beginning or ending a sentence with a word) and its influence on hyperarticulation of target words, or items used consistently throughout the experiment. Parents engage in tasks with their infant and with an experimenter. Parents are asked to use target words, in order to encourage repetition of target words with "t" sounds. Sessions are recorded and analyzed for the "t" sound articulation and sentence positioning of target words. We predict hyperarticulation of "t" sounds in IDS because it may function as a language teaching tool. Our preliminary data with seven parents support that parents hyperarticulate more when talking to infants than to adults.

Effects of Dietary (-)-Epicatechin on Novel Object Recognition Memory in High-fat Diet-induced Obese Mice

Promise Lee
Sponsor: Patricia Oteiza DeFraga, Ph.D.
Nutrition

Obesity is a worldwide health concern. Evidence from studies in humans and mice have shown that obesity negatively affects brain structure and cognition. Some studies have shown improvements in memory and brain function upon the consumption of dietary (-)-epicatechin (EC). Furthermore, after oral ingestion (-)-EC is found in the brain. Thus, we investigated the capacity of dietary (-)-EC to mitigate hippocampal neuroinflammation and impaired recognition memory in high fat diet-induced obese mice. Healthy 6 weeks old male C57BL/6J mice were fed for 13 weeks either control or high-fat diets (HFD) with or without supplementation with (-)-EC. On week 11, novel object recognition (NOR) and object location memory (OLM) were performed to assess object recognition memory and spatial memory of mice respectively. Quantitative RT-PCR on the hippocampus of mice was used to analyze a potential neuroinflammation status measuring tissue inflammatory markers (TNFa, IL-1ß, IL-6, NOX2, and NOX4). Results suggest that (-)-EC supplementation can alleviate HFD-induced recognition memory impairment in mice, potentially through the mitigation of the neuroinflammation status caused by HFD in the mouse hippocampal region.

Expression of Caseins in *Kluyveromyces lactis* Towards the Synthesis of a Sustainable, Animal-free Cheese

Jessica Lee
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

In recent years, products accommodating vegan and vegetarian diets have come to market as consumers are increasingly concerned about the ethical drawbacks of food production, primarily the environmental impact of animal products and the cruelty sometimes prevalent in the meat and dairy industry. Attempts to find alternatives to animal-derived proteins have resulted in products that do not always taste, smell, and feel like the traditional product. We are exploring whether some or all of these problems can be solved by using microorganisms to synthesize the proteins integral to traditional animal products. In this study, we are creating transgenic strains of Kluyveromyces lactis, an FDA-listed generally regarded as safe (GRAS) yeast used to produce food-associated products, to express the major proteins in bovine cheese: alpha-s1, alpha-s2, beta, and kappa caseins. Currently, we are cloning these genes into several expression vectors, developing an economic assessment pertaining to cost of production, and plan to explore various purification strategies. If successful, we propose that a cheese made from lab-produced proteins would be more environmentally sustainable, free of pathogens, and would also satisfy public interest in cruelty-free products that taste nearly identical to the traditional version.

Investigating the Interplay Between Copper Biology and Sugar Consumption in Liver Disease

Hannah Lee
Sponsor: Marie anne Heffern, Ph.D.
Chemistry

Non-alcoholic fatty liver disease (NAFLD) is currently the most common chronic liver disease in Western nations and is believed to affect about one-quarter of the global population. Characterized by fatty acid accumulation in the liver, NAFLD can result in cirrhosis, liver failure, and even death if left untreated. Fructose consumption is posited to play a key role in the pathogenesis of NAFLD by inducing lipogenesis and oxidative stress in the liver. Interestingly, copper may also contribute to NAFLD pathogenesis: on the one hand, mice fed copper-deficient diets accumulated fatty acids in their livers while, on the other hand, mice fed high-fat diets exhibited decreases in hepatic copper. We hypothesize that fructose is involved in the hepatic copper dysfunction found in NAFLD. To investigate this potential interplay between fructose and copper in NAFLD pathogenesis, this study investigates copper biology in human liver cells (HepG2) stimulated in varying fructose concentrations. Copper chaperones and transporters are monitored at both a gene expression and protein level using qPCR and Western blots respectively. By investigating how copper regulation changes in this cellular model of NAFLD, we hope to elucidate the underlying molecular mechanisms contributing to NAFLD and provide insight to facilitate disease diagnosis.

Investigating Time of Colonization by Spotted Skunks (*Spilogale Gracilis Amphiala*) of the California Channel Islands Through Mitochondrial Genetic Analysis

Andy Lee
Sponsor: Benjamin Sacks, Ph.D.
Veterinary Genetics Lab

Islands provide valuable insights into speciation and evolutionary processes due to their geographic isolation. Mammalian carnivores are rare on islands. Two of the California Channel Islands, Santa Cruz and Santa Rosa, are unusual in that they host two endemic carnivores: island foxes (Urocyon littoralis) and island spotted skunks (Spilogale gracilis amphiala). The evolutionary history of island foxes is well studied; foxes colonized the Channel Islands approximately 7100 to 9200 years ago and each island supports a different subspecies. In contrast, it is unknown when skunks colonized the islands and whether Santa Cruz and Santa Rosa may support different subspecies. It is important to learn about island spotted skunk evolutionary history, as skunk abundance has recently declined toward rarity with the potential for extinction. To infer time of divergence between skunks on Santa Cruz and Santa Rosa, I sequenced DNA from non-invasive hair extractions to examine the cytochrome-b (cyt b) and displacement loop (D-loop) regions of the mitochondrial genome; then I examined the mutational differences in these regions for each island and used a molecular clock calibration to estimate the divergence time. Findings of this study will inform our understanding of the evolutionary history and taxonomic status of the island skunks.

The Impact of Seed Morphology on Wind Dispersal Potential in California Serpentine Environments

Grace Lewin
Sponsor: Jennifer Gremer, Ph.D.
Evolution & Ecology

Wind dispersal of seeds in a serpentine environment is an important phenomenon as it prevents inbreeding depression and increases genetic diversity. This study, conducted at McLaughlin Reserve, focuses on nine species within the Asteraceae family that have been observed to disperse by wind. I will evaluate how the morphology of these seeds impacts wind dispersal ability. The wind dispersal potential of seeds is measured through two methods to determine seed settling velocity and relative distance traveled. The results of these measurements will be analyzed to determine if there are general trends regarding the impact of morphology on dispersal potential. These patterns are also analyzed in the context of native and invasive species and dimorphic seeds within the same species. Serpentine environments are an important habitat for native species because of the harsh and infertile soils that prevent invasion of exotic species. General patterns in dispersal ability of species in these vulnerable environments will be useful in accurately predicting future changes to species composition.

Socioeconomic Status and Hair Cortisol in Children

Jing Li
Sponsor: Camelia Hostinar Caudill, Ph.D.
Psychology

Previous studies have shown that lower levels of parental education are associated with poorer mental health and increased behavioral problems in children. However, the biological mechanisms involved are unclear. Currently, researchers have suggested the potential role of the hypothalamic-pituitary-adrenal(HPA) axis, one of the body's primary stress-response systems. To examine the relationship between parental education and children's HPA functioning, we measured children's hair cortisol concentration (HCC), an index of chronic HPA output. We collected hair samples from 49 children between the ages 9 to 10 (mean age = 9.42 years; 41.7% female, 58.3% male) from the greater Sacramento area. We conducted a multiple linear regression predicting child HCC from maternal education level, while controlling for the following covariates: age, sex, body mass index, and hair treatment. Multiple linear regression revealed no significant association between maternal education level and child HCC. In conclusion, we did not find that maternal education, an index of socioeconomic status (SES), predicted child chronic HPA output, suggesting that maternal education level may not be highly related to child's HCC levels in this low-risk sample. Future research could benefit from collecting a larger, more diverse sample, and from testing multiple measures of SES.

Functions of Lis1-Nudel/NudE and Dynactin on Dynein's Motor Activity

Wenzhe Li
Sponsor: Richard Mckenney, Ph.D.
Molecular & Cellular Bio

Cytoplasmic dynein is an intracellular motor protein that carries a variety of cargoes toward the minus ends of the microtubule cytoskeleton. Lis1-Nudel/NudE and dynactin are two conserved protein complexes that regulate dynein-based motility. Recruited by Nudel/NudE, Lissencephaly protein Lis1 causes dynein to enter a persistent force-generating state, whereas dynactin promotes dynein's processive movement on the microtubules in the presence of a variety of adapter proteins. Interestingly, both Nudel/NudE and dynactin interact with dynein through its intermediate chain (IC), raising questions about the role IC plays in the two regulatory pathways. We are interested in the sequential and temporal manner of the two regulatory events indicated by their shared interaction site on dynein. Using Flp-In T-Rex mammalian cell system and Big-Bac baculovirus system, we generated cell lines expressing a wild type IC or a N-terminally truncated IC to eliminate dynactin-IC and Nudel/NudE-IC interaction. To study the potential interaction between Lis1-Nudel/NudE and dynactin during dynein regulation, and further understandings of dynein's transitions between its open and close conformations, we will use a combination of biochemical and biophysical approaches, including TIRF and pull-down experiments. These experiments will provide insight into a new underlying mechanism of dynein mobility.

Identifying Small Molecule Inhibitors for the Homologous Recombination Endonuclease Mus81-Eme2

Hong Kun Li
Sponsor: Wolf Heyer, Ph.D.
Microbiology & Molec Genetics

A variety of exogenous and endogenous threats such as radiation or genotoxic chemicals frequently cause strain in our genome. Interstrand crosslinks (ICL) are one of the most cytotoxic DNA lesions. To rectify the damage, cells in our body use a high-fidelity DNA repair mechanism called homologous recombination (HR). The HR pathway involves multiple steps and proteins including Mus81-Eme2, a heterodimeric endonuclease. Mus81-Eme2 is an endonuclease that resolves stalled replication fork, a consequence of ICL, during S phase of the cell cycle. In past studies, researchers have found that Mus81 was a vital protein in cells with alternative lengthening of telomeres (ALT). ALT cells account for 10-15% of all tumors. These cells lack the usage of telomerase and utilize HR-mediated DNA replication to maintain telomere length. Using the concept of synthetic lethality, we are interested in identifying and characterizing small molecules inhibitors for Mus81-Eme2 to knock down the usage of HR in ALT cells. Doing so will lead to slow progression of tumor cells and cell death. To start characterizing inhibitors, our lab has developed a High Throughput Screening (HTS) based on a fluorescence-based nuclease assay. Future data from the HTS will be identify and a dose-response curve will be generated.

Effects of Excess Iron on Cognition in a Suckling Rat-Pup Model

Emily Liang
Sponsor: Bo Lonnerdal, Ph.D.
Nutrition

There have been several recent reports suggesting excess supplemental iron is detrimental to infant brain development. Little is known about the mechanisms underlying these effects. To learn more, we are investigating the cognitive outcomes of excess postnatal iron supplementation in a suckling rat-pup model, through behavior tests, gene expression, and iron status assessment. Pups were supplemented with ferrous sulfate, an iron chelate (Ferrochel), or sucrose vehicle control beginning postnatal day (PD) 2. Some pups were euthanized at PD 15, while others were supplemented until weaning and underwent behavioral testing at PD 50. By PD 15, hemoglobin and hematocrit increased significantly in the iron-supplemented groups, as well as liver and spleen iron stores. This suggests that iron absorption is under-regulated during the postnatal period. Two cognitive tests were performed: T-Maze spontaneous alternation and Passive Avoidance. Spontaneous alternation results showed no significant difference among groups for males or females. However, males who received Ferrochel had a significant increase in latency compared to those given ferrous sulfate or control, indicating improved cognitive function. Although more studies are needed to explain these results, effects of iron excess are likely form-dependent. These findings are relevant for health professionals giving advice on infant nutrition.

RNF212B, a SUMO E3 Ligase, Mediates Oocyte Quality Control in Mice

Nelly Lim
Sponsor: Neil Hunter, Ph.D.
Microbiology & Molec Genetics

Meiosis is the process of cell division that creates gametes. During fetal development, human females produce 6 to 7 millions of oocytes, but by the time of birth, this number drops to one million. This dramatic oocyte attrition is due to quality-control processes that detect and eliminate defective oocytes via apoptosis. Our previous research has shown that RNF212, a SUMO E3 ligase required for crossing-over, also mediates the oocyte quality-control in mice. Here, we analyze the function of RNF212B, a previously uncharacterized paralog of RNF212, in oocyte quality control. Ovaries at post-partum day 18 were fixed, dehydrated and embedded in wax, sectioned, and immunostained for oocyte-specific markers to allow us to quantify oocyte numbers. Rnf212b$^{-/-}$ mutant ovaries contained more oocytes compared to wild-type controls. Moreover, Rnf212b$^{-/-}$ mutation could rescue the wholesale culling of defective oocytes that occurs in the Msh4$^{-/-}$ mutant. Thus, RNF212B also mediates oocyte quality control. Ongoing experiments aim to understand how RNF212B facilitates the targeting of defective oocytes by apoptosis.

Characterization and Evaluation of Kidney Injury in a Murine Blunt-Thoracic Trauma Model

Yung-Ling Lin
Sponsor: Ian Brown, M.D.,Ph.D.
MED: Surgery

Of the nearly 200,000 trauma-related deaths that occur in the United States annually, blunt-thoracic trauma (BTT) accounts for 20%-50% of these fatalities. Blunt chest injury is associated with significant organ failure, often involving the kidneys. In our study, the mouse model used is relevant to sports-, car-, and fall-related trauma. The goal of this project was to identify kidney injury and characterize its features to develop a consistent histopathological scoring system. To localize contusion in the kidney, paraffin-embedded kidney tissue sections from injured and control mice were stained with Masson's Trichrome and the immunofluorescent tubular epithelial injury marker, KIM-1. Immunofluorescent staining with KIM-1 demonstrated the presence of kidney injury in the tubules of injured mice seven days after trauma. From Masson's Trichrome Staining, we have reviewed and revised a histopathological scoring system that persistently identifies and defines kidney injury. Our scoring system is based on features such as loss of nuclei, loss of tubular polarity, and epithelial cell necrosis. This scoring system will allow us to identify kidney injury and ultimately guide us in our investigation in the mechanisms behind kidney injury after trauma.

Quantifications of Total Phenols in Olive Oil: A Comparison of Methods

Chang Lin
Sponsor: Selina Wang, Ph.D.
Food Science & Technology

Olive oil is known to be rich in phenolic compounds particularly found to be beneficial in enhancing endothelial function for patients experiencing hypertension and hyperglycemia (Valls et al., 2015). Phenolic compounds in olive oil can be categorized into secoiridoid derivatives, such as oleuropein, and phenolic alcohols, such as hydroxytyrosol and tyrosol (García et al., 2016). Multiple olive oil phenolic compound quantification methods are used in laboratories, and total phenolic compound concentrations resulted from each method are expressed in various ways based on different standards. A phenolic compound determination study comparing two olive oil phenolic compound quantification methods was conducted in our research group. Solid phase extraction(SPE), and liquid-liquid extraction(LLE) were applied to samples diluted to three different phenolic compound concentration levels. Internal standards were added to both SPE and LLE extracts, and prepared extracts were analyzed in the high performance liquid chromatography(HPLC) system. Results from the two methods were compared in the aspects of accuracy and cost effectiveness. Ultimately, the goal of this holistic study is to understand how different extraction methods integrating HPLC analysis impact the phenolic compound concentration results, and to help develop a phenolic compound determination method that is accurate, precise, and efficient.

Object Processing Biases in Infancy and Toddlerhood

Annika Lin
Sponsor: Lisa Oakes, Ph.D.
Psychology

Visual scenes can be processed in terms of local features (e.g., the color and shape of leaves on a tree, the color and shape of slats on a bench) or global features (e.g., tree and bench in a park scene). The purpose of this project is to investigate visual processing biases during toddlerhood. Using eye tracking, we will assess whether children employ a global information processing approach (e.g., noticing the global shape or features) versus a local approach (e.g., noticing the details). We will present children with an image in which a shape (e.g., triangle, heart) is made up of small objects (e.g., circles, spades). When children fixate this image, we will present two new objects; one that is made up of the same individual elements but is a different global shape (local match) and another that is the familiar global shape but different individual elements comprised of novel individual elements (global match). Children who employ a global processing strategy will direct their first looks towards the global match, and children who employ a more local processing strategy will direct their first looks towards the local match.

Cell Fusion Non-Conventional HIV Entry

Jennifer Lind
Sponsor: Satya Dandekar, Ph.D.
MED: Medical Microbiology & Imm

The purpose of this study is to understand how HIV infects the central nervous system's astrocytes cells, and how the virus sets up latent HIV reservoirs. I believe Syncytin (HERV-W. enV) is responsible for aiding the cell-to-cell fusion mechanism, promoting spread of HIV to cells other than immune defense cells. Previous research has focused on Syncytin involvement in cell-to-cell fusion within placental tissue. The goal of this project is to demonstrate Syncytin mediated cell-to-cell fusion occurs within SVGA brain tissue cells. I plan to simulate an authentic reproduction of the actual mechanism happening in humans. In doing so, I will prove the theory with an in vitro cell line. I created a transfected cell containing the gene pzs Green1-DR-LTR, which includes an overexpression of the syncytin protein. Thisnew cell line "SVGA-G" or clone H8 as I have named it will support this research. I am confident that the results will favor my hypothesis, as preliminary data suggests that to be the case. Once the mechanism is understood, it will unlock the possibility for future prevention and treatment experiments in HIV research.

Quantifying the Growth of *Fusarium oxysporum* f. sp. apii race 2 in Celery (Apium graveolens var. dulce) cv. Challenger to Determine if it is Resistant or Tolerant

Edmond Ling
Sponsor: Lynn Epstein, Ph.D.
Plant Pathology

F. oxysporum f. sp.apii race 2 (FoaR2) is a pathogenic fungus that grows in celery roots and crown. The celery cultivar Sonora is susceptible to FoaR2 while Challenger, another celery cultivar, yields well in FoaR2-infested fields. Challenger could avoid damage by either excluding the pathogen or limiting its growth, which is called resistance or immunity. It can also remain asymptomatic even when it is infected, which is called tolerance. In order to determine if Challenger is resistant or tolerant to FoaR2, symptom severity will be scored and the quantitative polymerase chain reaction (qPCR) will be used to quantify the amount of fungal biomass in the crown. Symptom severity is scored based on the quantity of discoloration in the crown tissue, which is the area of tissue between the stems and roots. Both cultivars are grown in two conditions in the greenhouse: in uninfested soil and in soil infested with FoaR2. Preliminary observations show a lower discoloration score in Challenger than in Sonora, consistent with symptoms in the field. Results from this experiment could help develop celery cultivars with higher crop-yield.

Communication of Droplet Printed, Artificial Cell Mimics

Hamad Linjawi
Sponsor: Cheemeng Tan, Ph.D.
Biomedical Engineering

Artificial cells have emerged as an important tool in the field of synthetic biology because they provide a simplified model of natural cells in a more controlled environment. They have the capability to replicate many important biological functions, including the transcription and translations of proteins, membrane signaling pathways, and division. However, communication between artificial cells thus far has been limited compared to the range of communication present in natural cells. Our work combines the ability of artificial cells to sense extracellular chemicals and a microfluidics droplet printer to create fluorescing patterns from a 2-dimensional array of artificial cells. The gene network in these cells regulates the release and detection of chemical inducers between artificial cells, which controls the fluorescent patterns. Droplet printing these artificial cells provides a fast, consistent cell distribution method. Together, these methods provide a high throughput means of artificial cell communication to induce gene expression. Our work opens the door to more complex gene networks with the potential to create a variety of chemical-sensing biological assays that may be applied in clinical or portable diagnostics.

Dysfunction of Degradative Enzymes in Liver Tissue Due to Ibuprofen Treatment

Leib Lipowsky
Sponsor: Aldrin Gomes, Ph.D.
Neuro Physio & Behavior

Non-steroidal anti-inflammatory drugs (NSAIDs) are commonly taken for fevers and inflammation. NSAIDs inhibit cyclooxygenases (COX-1, COX-2), enzymes that promote the production of prostaglandins, lipids that are part of the inflammatory response. Literature suggested that the NSAIDs, meclofenamate sodium, naproxen, and diclofenac lower proteasome activity within cardiac cells, while increasing levels of ubiquitinated proteins in these cells. The Proteasome is crucial for degrading unwanted and damaged proteins. While these reports demonstrate how NSAIDs could potentially be harmful to cardiac tissue, little is known about how NSAIDs affect hepatic function. I tested the hypothesis that proteasome activity decrease in the cytosol of liver tissue exposed to ibuprofen. 8-week-old mice were treated with ibuprofen (100mg/kg/day) for 7 days, after which, liver tissue was harvested, and cytosol was extracted. Western blots and proteasome assays were performed to measure relative expression and activity. Proteasome activity levels significantly decreased in the ibuprofen group compared to the control. Results show negative effects of ibuprofen on liver proteasome activity. NSAIDs also decrease lysosomal activity in the cytosol. Literature suggests that when cellular stress occurs the lysosomal morphology changes. I plan to test whether ibuprofen induces cellular stress to change the protease-like activity of the lysosome.

Phylogeny and Evolution of the Big-eyed Tree Ant Genus *Tetraponera* from Comparative Morphological Data (Hymenoptera: Formicidae)

Mia Lippey
Sponsor: Philip Ward, Ph.D.
Entomology/Nematology

The Pseudomyrmecinae are a diverse group of tropicopolitan ants commonly referred to as the "big-eyed tree ants". Our focal group, the genus Tetraponera, contains over 100 species and shows impressive variation in morphology. Recently, the phylogeny of this group was established with molecular data, but integration of morphology will provide insight into the evolutionary history of these ants. Therefore, we scored informative traits for the clypeus and mesosoma of 17 species of Tetraponera, as well as for outgroups, which included two species of Pseudomyrmex and one species of Myrcidris. We estimated a dated molecular phylogeny using MrBayes and benchmarked the morphological topology against it. This phylogeny was also used as input for the ace function of the R package ape to reconstruct the ancestral morphology of the clypeus. The resulting ancestral estimations will be used to interpret the pattern of character state change in an evolutionary context. The tree generated with mesosomal characters will reveal synapomorphies that will underlie future work with males in Pseudomyrmecinae. Combining evolutionary and phylogenetic approaches will create a more robust hypothesis of the morphological evolution for the genus Tetraponera.

Pelagic Cormorant Nesting Success and Oceanic Conditions in Northern California

Jade Little
Sponsor: Elisabeth Middleton, Ph.D.
Native American Studies

Nesting success is an important component of the growth of coastal seabird populations. Nesting success can be defined as the proportion of nesting or laying pairs that raise young to the age of fledging (i.e., the age when a fully-feathered offspring voluntarily leaves the nest for the first time). This study focused on the nesting success of one coastal seabird species, Pelagic Cormorant (Phalacrocorax pelagicus). Coastal bird species roles can be observed by not only aiming focus to their behavior and physiology but also their interactions with environmental conditions. Upwelling productivity in the California Current system brings abundant food to the ocean's surface and increases food web abundance and complexity. Nesting site observations were analyzed and compared to changes in oceanic conditions in the area across a 5 year interval from 2014-2018, a time period which includes an el Niño event and extreme warm water in the northeast Pacific Ocean (the "blob"). The objective of this study was to examine and analyze the relationship between oceanic conditions and the nesting success of the coastal bird species, Pelagic Cormorants. This study provides information on how local-scale oceanic variations influence coastal bird species populations and provides important context for conservation efforts.

In silico Investigation of Arrhythmia Mechanisms in Heart Failure

Caroline Liu
Sponsor: Eleonora Grandi, Ph.D.
MED: Pharmacology

Heart failure (HF) is a complex disease characterized by abnormal contraction, alterations in myocyte ion currents, and increased propensity for arrhythmias. Dysregulation of Na^+ and Ca^{2+} handling, leading to excessive intracellular Ca^{2+} loading, and upregulation of the Ca^{2+}/calmodulin-dependent protein kinase II (CaMKII) are thought to contribute to arrhythmia generation in HF myocytes. The Na^+, Ca^{2+} and CaMKII signaling pathways interact with each other forming a complex non-linear positive feedback system. Here, we extended a well-established computational model of the rabbit ventricular myocyte to tease out and quantify the integrated signaling components, and investigate their relative roles in promoting Ca^{2+} and action potential (AP) instabilities in HF. Based on previously published and novel experimental data, we modified the main repolarizing and depolarizing currents and cellular geometric properties in the control model to replicate the changes seen in HF. We validated the model against experimental data describing AP and Ca^{2+} transient properties and their pacing rate dependence in both normal condition and when various branches of the feedback system are blocked. We will use the model to characterize the Na^+-Ca^{2+}-CaMKII feedback system quantitatively and identify the key relationships in the network that could be targeted therapeutically in HF.

Behavior of Shiga Toxin Producing *Escherichia coli*, Salmonella spp., and Listeria monocytogenes on Dried Apricots Made with and without Sulfur Dioxide

Zhuosheng Liu
Sponsor: Luxin Wang, Ph.D.
Food Science & Technology

Dry fruits are one of the most economically valuable specialty crop products in California. The publication of the new Food Safety Modernization Act regulations has generated significant impact on the dried fruit industry due to the lack of literature information about the microbial risk assessment of dried fruits. Without such information, processors are not able to comprehensively understand the food safety risks and develop intervention strategies accordingly. The goal of this project is to bridge the knowledge gap identified above by systematically evaluating the behavior of three common foodborne pathogens, including Shiga toxin producing Escherichia coli (STEC), Salmonella spp. (SAL), and Listeria monocytogenes (LM), on dried apricots. Two types of dried apricots were used, one was made with sulfur dioxide and one was made without preservatives. These apricots were inoculated with a five-strain STEC cocktail, a five-strain SAL cocktail, and a five-strain LM cocktail separately, dried at ambient temperature for 5 days, and stored at ambient temperature in Ziploc bags for six months. Results showed that SAL and LM survived better on dried fruits compared to STEC and the use of preservatives significantly impact the pathogen survival during drying and storage ($P < 0.05$).

Development of a Food Carbohydrate Encyclopedia Using a Rapid-Throughput Monosaccharide Composition Analysis Platform

Yiyun Liu
Sponsor: Carlito Lebrilla, Ph.D.
Chemistry

Carbohydrates are not only one of the three macronutrients in food, but are also becoming increasingly important for their involvement in immune-modulation and gut microbiome interactions. However, understanding of the detailed carbohydrate structures of food is still limited due to structural complexity and a lack of advanced analytical platforms. To address this problem, our group has recently developed a rapid and precise method to analyze the monosaccharide composition of polysaccharides. The absolute quantitation of 14 monosaccharides were obtained from over 1000 foods to create a Food Carbohydrate Encyclopedia. The database encompasses natural produce, such as vegetables, fruits, grains, legumes, and mushrooms, as well as processed products, including snacks, beverages, and fermented foods. The method employs 96-well plate hydrolysis and derivatization procedures followed by a 10-minute ultra-high performance liquid chromatography triple-quadrupole mass spectrometry analysis. Our rapid throughput approach offers the opportunity for the first extensive food carbohydrate study. Statistical techniques were used to organize the entries based upon their carbohydrate homology. This encyclopedia does not only expand far beyond the current knowledge of food composition, but also opens up new possibilities for designing specialized diets, personalized health, and microbiome manipulation.

Validating the Feeding Competition Test as a Proxy for Social Dominance in Group-Housed Gestating Sows

Joshua Liu
Sponsor: Kristina Horback, Ph.D.
Animal Science

Female swine that are housed in groups develop social hierarchies through acts of direct and indirect aggression. Social ranking, which can be inferred by displacement at feeding and non-feeding times, has been found to be correlated with production characteristics such as weight gain. Paired feeding competitions, which have been used to determine social ranking in previous studies, has yet to be validated as a reliable method. This poses an issue because the results of these competitions could reflect food motivation rather than dominance. To determine if the dominance relationships in pairwise settings reflects the hierarchies in group pens, we will conduct feeding competition tests among each dyad from a pen of eight gestating sows. In addition, we will observe sow behavior during feeding and non-feeding contexts and record physiological measurements of each sow (e.g. weight, lesion scoring, body condition, and lameness). An enhanced understanding of the impact of social rank on animal welfare in small group pens of commercial sows may help producers assess social compatibility of group pens as well as highlight individuals which are vulnerable to suffer from chronic social stress, which may impact immunity and fertility.

Biofilm Formation and Minimal Biofilm Eradication Concentration of Minocycline, amikacin, linezolid, rifampicin, and trimethoprim-sulfa in methicillin-resistant *Staphylococcus pseudintermedius*

Lucia Liu
Sponsor: Esteban Soto Martinez, D.V.M.,Ph.D.
VM: Medicine & Epidemiology

Methicillin-resistant Staphylococcus pseudintermedius (MRSP) are emergent pathogens of mammals that create significant treatment challenges in surgical site infections for orthopedic patients. Treatment against MRSP usually involves long-term antimicrobial therapy and have poor prognosis. Minocycline is a broad-spectrum bacteriostatic antimicrobial that inhibit 30S ribosomal subunit and protein synthesis, and has been shown to be effective against methicillin-resistant Staphylococci. The main objective of this study is to study the efficacy of five different antimicrobials against biofilm and planktonic MRSP. Initially, the capacity of ten MRSP strains recovered from veterinary patients of the UC Davis Veterinary Medical Teaching hospital to form biofilms was investigated using the Minimal Biofilm Eradication Concentration (MBEC™) assay. Additionally, the minimal inhibitory concentration, minimal biocidal concentration, and MBEC of amikacin, rifampin, linezolid, trimethoprim/sulfa, and minocycline to those isolates was determined. The results of this study will help guide treatment against biofilm-embedded MRSP, resulting in decreased side effects associated with long-term antimicrobial therapy.

Assessing Angiogenic Activity of microRNAs let-7b and miR-92a in Human Umbilical Vascular Endothelial Cells (HUVECS)

Zhishan Liu
Sponsor: Zeljka Mcbride, Ph.D.
MED: Ophthalmology

Diabetic retinopathy involves neovascularization that causes ocular blood leakage and can lead to blindness. We wanted to test angiogenic activity of candidate microRNAs that we found dysregulated in ocular fluids of diabetic patients. A Matrigel-based tube formation in vitro assay was used to quantify the angiogenic modulatory activity of these microRNAs at different concentrations and time points. Human adult retinal pigment epithelial (ARPE-19) cells were transfected with let-7b or miR-92a at 0nM, 10nM, and 25nM. Conditioned media containing regulatory factors were collected at 12h, 24h, and 48h, then incubated with HUVECS. Tube formations were visualized using Calcein Red-Orange AM staining, ImageXpress Micro high-content screening system, and MetaXpress software. The miR-92a (25nM/24h) showed the strongest statistically significant inhibitory activity ($p<0.01$) compared to 0nM for total tube length (FC=-2.64), total tube area (FC=-3.15), and number of nodes (FC=-2.05). MicroRNA let-7b (25nM/24h) also showed statistically significant ($p<0.05$) inhibition for total tube length (FC=-1.56) and area (FC=-1.61). Generally, miR-92a demonstrated more inhibition than let-7b with the strongest at 24h. Further research of these interactions is crucial for the advancement of anti-angiogenic miRNA therapy for diabetic retinopathy.

The Cinema of You

Jacob Lloveras
Sponsor: Timothy Lenoir, Ph.D.
Cinema & Digital Media

In today's world, things are becoming increasingly personalized to the individual from the news we read, the newest songs recommended to us, and how streaming services advertise films. But, in terms of cinema, what if we took personalization a step further? What if cinematic narratives were tailored to the individual in order to satisfy the broadest audience possible? With increasing competition of media streaming services, companies such as Netflix require innovation in order to stay ahead. By analyzing things such as your Facebook profile, browsing history, and even social connections, a taste profile supported by the OCEAN traits can be generated. Furthermore, with audio and video hardware being installed in our televisions, nonverbal communication cues can also be analyzed in real time in order piece together suitable narratives. From an ethical standpoint, we are increasingly becoming apathetic about what information is collected from us. There is chance that once this technology is public, not only will we accept it but we may embrace it. Finally, there is the concern of the cost of producing a film with multiple turns and endings. With increasing improvements of CGI technologies and robotic actors being developed by Disney, this could cut production costs significantly.

Identifying and interpreting how the spatial distribution of *Musculista senhousia* affects microbial community composition within a Zostera marina meadow in Tomales Bay, CA

Jolie Lobrutto
Sponsor: Tessa Hill, Ph.D.
Earth And Planetary Sciences

The addition of non-native organisms to a system can cause negative repercussions through alteration of trophic levels and changes in nutrient cycling. Ecological studies on the introduction of invasive species are abundant but, we have a limited understanding of what occurs at the microbial level. Musculista senhousia is an invasive mussel species that has been shown to hinder seagrass growth. Seagrass meadows are important for the support of fisheries, coastal sediment stabilization, and sequestering carbon on decadal timescales so, scientists interested in conservation must understand how invasive species, such as M. senhousia, impact seagrass meadows. In this study, I investigated 1) seagrass coverage in comparison to the spatial distribution of M. senhousia, 2) the microbial communities present in the rhizosphere, and 3) the geochemistry and sedimentology of the meadow, in order to further elucidate the interaction between M. senhousia and the seagrass Zostera marina. Preliminary data suggests mussel abundance positively covaries with seagrass coverage, corresponding to smaller grain size and higher percent total organic matter (%TOM). Further work will attempt to define and quantify the correlation between invasive mussel abundance, microbial community composition, and the health of Z. marina.

Chemical modification of cotton fabrics for improving dyeability of anionic dyes without use of inorganic salts

Leilah-Marie Lockett
Sponsor: Gang Sun, Ph.D.
Textiles & Clothing

Inorganic salts are commonly used to increase dyeability of cotton fabrics, one of the most popular materials in the textile products, with direct and reactive dyes. The used salts will be discharged in wastewater, making the textile dyeing less environmentally friendly. Diethylamonethyl chloride (DEAE-Cl) could react with hydroxyl groups on cotton cellulose to produce DEAE@cotton, and in the DEAE group could continue to react with DEAE-Cl to form an ammonium salt structure on DEAE-Cl modified cotton fabrics (DEAE@cotton). The formed positive charges on the cotton fabrics would increase electrostatic interactions with and consequently increased dyeability of anionic dye molecules without assistance of any inorganic salts. The modification process was optimized by carefully selecting the DEAE-Cl concentration, modification time and temperature. The as-modified cotton fabrics were characterized with Fourier-transform infrared spectroscopy, thermogravimetric analysis, scanning electron microscope, and mechanical strength tests. An increase in the dyeability of a direct dye by the DEAE@cotton was directly observed comparing with that of the unmodified cotton. Moreover, the washing color fastness of the DEAE@cotton was improved. This modification method is also applicable to polymeric membranes containing hydroxyl groups, the positive charges on surfaces of as-modified materials would allow them to have increased adsorptive capacity to anionic chemicals.

The Translation of Transformation in Ovid's *Metamorphoses*

Delaney Lods
Sponsor: Frances Dolan, Ph.D.
English

Ovid's Metamorphoses returns over and over to stories of transformation, but these are rarely simple or straightforward. Instead, they raise deeply ambiguous questions of agency. Themes of transformation in the Metamorphoses may be better understood by engaging the text with translation theory. If, as scholars such as Jacques Derrida argue, translation is a necessary yet impossible task, how may a work as complex as Ovid's 15-book poem of myths be recreated in other languages? How do translators depict transformation, which itself is a complicated concept? I apply the models of translation set out by Derrida and others in order to explore English-language translations of the Metamorphoses. With these theories, I analyze specific passages of transformation in Ovid's work. The Metamorphoses provides an excellent case study in Derridean theory and translation as a whole. Translations of the poem—and transformations within the poem— raise interrelated questions of who possesses agency and how they use it. Using these concepts to study each other helps us to understand both with greater nuance. Moreover, it reveals the ways in which life, whether ancient or modern, fundamentally relies on and struggles with the act of translation.

The Role of Socioeconomic Status and Childhood Stress on Memory and Hippocampal Development

Melissa Loomis
Sponsor: Simona Ghetti, Ph.D.
Psychology

Childhood environmental factors such as stress and socioeconomic status (SES) have been linked to both changes in brain development and performance on cognitive tasks (Farah et al., 2006; Hanson et al., 2012). Specifically, previous research has shown that higher SES is associated with better memory performance in elementary and middle school aged children (Farah et al., 2006). While some studies have found greater overall brain volume for children with higher SES (Lawson et al., 2018), none have specifically targeted the underlying neural changes associated with memory. In the present research, we collected memory performance on a variety of tasks, environmental questionnaires, and structural MRI scans from children aged 7-15 across three time points (T1: N=155, T2: N=122, T3: N=92). We hypothesized that children who experienced more stress, measured as a larger number of stressful life events and lower SES, will show lower memory performance over time. Additionally, we predicted that development in associated brain regions (e.g., hippocampus) would be affected throughout childhood, resulting in smaller volumes. The results of this study will help elucidate the lasting disparities that arise from childhood differences in SES.

The Regulation of Skeletal Muscle Connective Tissue Following Exercise

Christopher Lopez
Sponsor: Keith Baar, Ph.D.
Neuro Physio & Behavior

Age-dependent loss of skeletal muscle strength (dynopenia) represents a major health problem for our aging population, decreasing longevity and quality of life. Exercise remains the principle means to maintain strength and combat dynopenia, and strength depends on extracellular matrix (ECM) synthesis. ECM is composed mainly of collagen and little is known how it is regulated after exercise. Preliminary work suggests that synthesis of the ECM is regulated by p42/44 MAPK-induced regulation of the transcription factor Egr1 (early growth response 1), both of which are stimulated by load and the drug PMA. In vitro, PMA is used to simulate loading. The phosphorylation of ERK is necessary for Egr1 expression following PMA since the drug SCH (p-ERK inhibitor) blocked the increase in p-ERK and Egr1. To further test this hypothesis, I am using C2C12 muscle cells to determine whether Egr1 acts as a positive regulator of collagen expression, following PMA. Transfecting a collagen-luciferase reporter plasmid into cells prior to treatment with PMA for 3, 6, and 18 hours is being used to determine whether induction of Egr1 increases COL I transcription. These experiments will establish the importance of the ERK>Egr1 pathway in ECM expression.

Seeing Red: An optogenetically controlled mouse model for dry AMD

Nefte Lopez
Sponsor: Glenn Yiu, M.D.,Ph.D.
MED: Ophthalmology

Age-related macular degeneration (AMD) is the leading cause of vision loss in the elderly. In early AMD, oxidative stress in the retinal pigment epithelium (RPE) causes a build-up of waste deposits called drusen in the center region of the retina known as the macula. As the disease progresses to more advanced stages, areas of RPE loss leads to geographic atrophy (GA). Currently, there is no treatment or appropriate animal model for AMD. Our goal is to create an optically-inducible mouse model that allows us to generate reactive oxygen species (ROS) in the RPE to mimic AMD pathophysiology. Adeno-Associated virus (AAV) was used to transduce RPE cells in mice to express KillerRed,a red fluorescent protein that emits ROS upon irradiation. We employ immunohistochemistry to demonstrate KillerRed localization in the RPE, and utilize optical coherence tomography (OCT) imaging to monitor the progression of oxidative damage and RPE death in vivo. If successful, this model could be applied in non-human primates to further study AMD pathophysiology and identify novel treatments for GA.

Autonomous and Intelligent Wireless Router (ScAILeR)

Patricia Lopez
Sponsor: Linda Katehi-Tseregounis, Ph.D.
Elect & Comp Engr

In a world full of natural disasters and high rate casualties; we are focusing on creating a device that will be able to find victims, who are part of major disasters, at a faster rate. The device will have a snake-like shape and will be able to travel through narrow spaces. The snake agents will consist of five major components: its “nest”, the body, the skin, the head and the eyes; all parts have special features that will help the adaptability of the snake agents. The goal of the experiment is to have the snake agents to function autonomously, thus it requires for the snake agents to be able to adapt to its environment and like many species it should be able to communicate with its own “kind”. All these concepts are planned to be achieved through detail artificial intelligence, mechanical movement, semantic sensors, electronic sensors, and among other important components. Everything is integrated to create a system that will be able to run on its own with minimal, or no, human reliability. I will be focusing on researching the components of the snake’s core body; which consist of the robotics design, integration, dynamics and control.

Documenting the Undocumented High School Student Perception of Depression and Mental Health.

Enrique Lopez
Sponsor: Monica Torreiro-Casal, Ph.D.
Chicano Studies

Stigma has been placed upon the mental health of undocumented individuals. Such stigmas originate from cultural, political and sociological structures surrounding the migrant community and the lack of culturally sensitive safe settings. This stigmatization has darkened the awareness and acceptance of mental health issues among the undocumented community, leaving them largely unexplored. The suppression and unawareness of such feelings can lead to significant mental health issues on individuals of any age. In this research I attempt to better understand the perception undocumented high school students have towards depression and mental health. Methods used for this study will include the recollection of oral stories through focus groups, and interviews, with undocumented students at Berkeley High School. I aim to find commonalities and deviances on these perceptions. I intend to discuss topics regarding the project with field expects, school administration and teachers, with the goal of gaining a more holistic perspective. The objective is to obtain a clearer outline of communal perceptions of mental health, and how it affects the students' environment and outlook. While solutions to these problems are nuanced and often times individual-specific, this project aims to provide the groundwork to better understand the lived experiences of these students.

Antioxidant Activity in Brains from Ibuprofen-Treated Mice

Celena Lozano
Sponsor: Aldrin Gomes, Ph.D.
Neuro Physio & Behavior

More than 30 million people use Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) daily to treat pain, fever, and headaches. The common NSAID diclofenac has been linked to increased risk of cardiovascular disease by induced proteasome dysfunction. It has been suggested that disruption of the ubiquitin proteasome system (UPS) may play a role in neurodegenerative diseases such as Alzheimer's Disease. My preliminary data has provided evidence for decreased proteasome activity in the brain tissue of male mice treated with ibuprofen for seven days. I hypothesized that increased levels of reactive oxygen species (ROS) and/or decreased antioxidant activity is responsible for neuronal proteasome dysfunction. To test this hypothesis, I cultured neurons in their favorable growth conditions and treated them with 200 mM ibuprofen for one to seven days. Both prior to treatment and after treatment, I measured the relative enzymatic activity of three antioxidants commonly found in the brain: superoxide dismutase, glutathione reductase and glutathione peroxidase. I did the same measurement in the brain tissue of mice treated both with and without 100 mg/kg/day of ibuprofen for seven days. I expect to find a difference in the antioxidant activity of neurons and brain tissue treated with and without ibuprofen.

Potency Studies of Chemically Modified Antimi-R122 in HuH-7 Cells

Shannon Lu
Sponsor: Peter Beal, Ph.D.
Chemistry

MicroRNAs (miRNAs) are noncoding RNAs 20-23 nucleotides in length that mediate gene silencing post-transcriptionally in the RNA interference (RNAi) pathway. MiRNAs bind to messenger RNAs with sequences that are complementary to their seed regions (nucleotides 2-8), designating their targets for degradation. They regulate processes including cell proliferation, growth, and differentiation. Overexpression of miRNAs frequently result in various cancers, infectious diseases, and developmental disorders. Thus, antisense miRNA oligonucleotides (anti-miRs) are currently under development to downregulate overexpressed miRNAs. Anti-miRs contain a myriad of chemical modifications intended for enhancing their nuclease stability, binding affinity to target miRNAs, and potency. However, there are no reports of studies towards modifying antimiRs that enhance binding affinity towards specific sites of Argonaute2 (Ago2), the active component of RNAi. Our work has been focused on designing modifications on t1, which interacts with the t1 adenosine (t1A) binding pocket of Ago2. So far, we have identified a few triazole substitutions for adenosine on anti-miR21 that increases potency as determined by the dual luciferase assay on HeLa cells, which contain upregulated levels of miR21. Now, we are exploring the generalizability of these modifications to other miRNA sequences. Specifically, we are testing triazole modified anti-miR122 in HuH-7 cells.

Single Particle Reconstruction of Major Outer Membrane Protein of *Chlamydia trachomatis*

Weifeng Lu
Sponsor: R holland Cheng, Ph.D.
Molecular & Cellular Bio

Chlamydia trachomatis is the most common bacterial sexually transmitted infection worldwide and is the cause of pelvic inflammatory disease, ectopic pregnancy, and tubal factor infertility. The major outer membrane protein (MOMP) of C. trachomatis, with a molecular weight of 40 kDa, is a promising target for vaccination. Similar to many bacterial porins, MOMP is assumed to be assembled in a trimeric array and consists of three beta barrels, each with exposed extracellular variable domains (VD) that are highly immunogenic. In order to resolve the quaternary structure of native MOMP trimers, and to characterize the exposed VDs, we employed cryo-EM single particle reconstruction techniques. Initially, we determined the 3D trimeric structure of MOMP by the salt-embedded approach and used the calculated particle parameters to resolve the 3D structure in high-resolution cryo-EM. 3D structural analysis of MOMP confirmed that the native MOMP is assembled in a trimeric array, with dimensions of 9 nm width in 6 nm height. From the cryo-EM density map, three distinct porin channels are resolved, as well as apical protruding densities, which may be the VDs. Determination of C. trachomatis structure is a critical step towards vaccine design assessed by the accessibility of critical epitopes.

Veterinary Clinical Research: A Shortcut on the Path to Medical Innovation?

Corey Luna
Sponsor: Cassie Hemstrom, Ph.D.
University Writing Program

Veterinary clinical studies represent an underutilized resource for the human medical community. The time it takes to bring a drug for humans from discovery to Food and Drug Administration (FDA) approval and clinical use is painfully long (10 to 12 years), and estimates for the average total cost range between $868 million and $1241 million. This review of the literature examines if and how performing some clinical research in pet canines (as opposed to using only murine [mouse] and human models) may help to expedite the progression of drugs and treatments from research and discovery to clinical use. Preliminary analysis suggests that, biologically, canines are better models for complex diseases than murines. They may allow researchers to cease work on unpromising drug compounds more quickly and concentrate on the promising ones earlier in the process, saving time and resources. This should reduce the time needed for drug development and increase veterinary and human medical innovation. This presentation will overview canine and human clinical research, discuss the most significant scientific barriers to effective utilization of veterinary clinical studies and present ways to move forward with cross-disciplinary work in human and veterinary medicine.

Characterization of Antiferromagnetic Domain Patterns in Perovskite Oxide Microstructures

Peifen Lyu
Sponsor: Yayoi Takamura, Ph.D.
Materials Science&engineering

Perovskite oxide thin films and superlattices provide unique functional properties for a wide range of applications, including sensing, energy conversion and information technology. For example, the magnetic state of a bit can form the basis for many electronic devices. In this work, the procedure to characterize the antiferromagnetic (AFM) domains in patterned $La_{0.7}Sr_{0.3}FeO_3$ microstructures grown on $SiTrO_3$ substrates was developed. The microstructures consisted of square, diamond and circle shapes with 2 micrometer diameter, and the images of the AFM domain structure were captured by Photoemission Electron Microscopy technique performed at the Advanced Light Source. Our findings indicate that the AFM domains in all three shapes are dominated by four types of AFM spin directions, while the locations of these domains differed depending on the shape. This study provides the framework to characterize AFM domains, which can lead to effective control of spin directions in electronic devices made from perovskite oxides.

Microbial Volatiles Influence Bumble Bee Behavior and Feeding

Isabelle Maalouf
Sponsor: Rachel Vannette, Ph.D.
Entomology/Nematology

Pollinators like bumble bees have shown consistent attraction to floral nectar colonized by the clade of yeasts, Metschnikowia, due the various ways these microbes may affect nectar properties. A particular area of focus is pollinator response to microbial volatiles, however, whether bumble bees detect or prefer yeast volatiles is still unknown. While detection is suggested by prior research, we investigated whether or not taste may also play a role in bumble bee choice for floral nectar. To test this, we performed assays with bumble bees to assess their feeding versus olfactory responses for nectar with two commonly isolated microbes: either Asaia bacteria or Metschnikowia yeast. Contrary to expectations, the bumble bees prefered to feed on the yeast-inoculated nectar, yet showed a clear preference for the volatiles emitted from the bacteria-inoculated nectar. This data suggests that the effect of microbial life on floral nectar, and thus pollinator foraging behavior and choice, is more complex than previously thought.

Examining the Use of Social Cues by Early Word Learners

Julia Maclaren
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

An important social cue that young infants use is directing their eye gaze to the same objects or person that their caregiver does. Our research examines how infants integrate eye gaze cues and spoken-word cues by studying whether infants follow the gaze or the spoken label to guide attention. In our experiment, infants watch a video recording of an experimenter in the center of the screen and two familiar objects, for example, an object (e.g. shoe on the lower left side, key on the right). In one condition the experimenter says the name of one of the items while she looks at the item she is naming. In another condition the experimenter names an object but looks at the opposite object. We tracked the child's eye gaze during each trial to see if infants are more likely to look at the item that was spoken, or if they looked at the item the experimenter looked at. We predict that 24-month-old infants are likely to look where the experimenter looks, because early word learners are very attentive to social cues, which we expect to override the linguistic cues.

Behavioral Phenotypes in Maternal Immune Activation are Influenced by Baseline Immune Response and Sex

Jeremy Macmahon
Sponsor: Anne Usrey, Ph.D.
MED: Neurology

Previous population data in humans has shown that infection during pregnancy, or maternal immune activation (MIA), has been shown to increase risk for a wide range of psychiatric disorders, including autism spectrum disorders and schizophrenia. A mouse model of MIA has been developed, that allows for the discovery of pathways leading to this broad behavioral suite of changes in a way that is relatable to humans. However, the behavioral outcomes have been variable. In order to study the factors that contribute to the variation in offspring, we hypothesized that the baseline immune response (BIR) of pregnant dams modulates the phenotypic outcome off their offspring. Specifically, we investigated general activity and anxiety behavioral measures, including repetitive self-grooming, rearing, and freezing. Here, we show that low, medium, and high BIR groups affect not only offspring generally, but have differential effects in males and females. Determining the factors that control variability in this model will help elucidate possible mechanisms to target in future research.

Analyzing the effectiveness of wildlife crossing structures at reducing animal mortality

Mia Macneill
Sponsor: Fraser Shilling, Ph.D.
Environmental Science & Policy

Wildlife-vehicle conflict is a major issue due to impacts to human and wildlife safety and the associated financial costs. The Road Ecology Center at UC Davis studies wildlife movement, behavior, and highway collisions involving wildlife. We will examine the effect of wildlife crossing structures on the amount of vehicle collisions with various species grouped by size (small, medium, or large). Wildlife crossing structures include highway underpasses, culverts, and bridges, which allow animals to safely travel across a highway. We will be looking specifically at bridges over waterways. Using Road Ecology Center data, we will examine the number of collisions recorded between 2016-2018 within 100m segments of the road where wildlife crossing structures are i) present and ii) absent. We will look at a minimum of 30 crossing structures that have been identified along California highways. Crossing structures with exclusionary fencing will be omitted. We will use a t-test to analyze the quantity of wildlife-vehicle collisions on portions of highways with and without the crossing structure mitigation measure. By better understanding wildlife use of crossing structures, we can help inform Caltrans and other transportation agencies about future highway development and planning, and help reduce the amount of wildlife-vehicle collisions.

Germ Cell Transplantation to Enhance Reproductive Management and Production of White Sturgeon

Devon Maddex
Sponsor: Jason Gross, Ph.D.
Animal Science

Reproduction is a constant challenge in the culture of aquatic animals due to lack of species knowledge, artificial environments, and maintenance of genetic diversity in hatchery produced fish. This study explores the emerging method of germ cell transplantation (GCX) as a tool to magnify specific male and female genetic lines by utilizing natural gamete production without genetic modification. This research will work to optimize GCX in commercial white sturgeon (Acipenser transmontanus) production, an economically important Pacific Coast species. Newly hatched larval fish, lacking an immune system during the first weeks of life, are micro-injected with stem cells from a donor gonad. GCX can utilize primordial germ cells (PGCs), found in larvae, or other germline stem cells (GCSs) for transplantation and colonization of the immature immune-naive gonads of recipient larvae. Donor cells will have their germline stem cell origin confirmed by expression of VASA/DDx4, proteins specifically expressed by PGCs and early GSCs. Post-injection larvae will have gonads dissected at different ages to observe success of labeled donor cell colonization using fluorescence microscopy and cell dye. Hatcheries utilizing GCX would be positioned to amplify favored sex/genetic lines, produce single sex fish populations, produce genetically diverse and disease-resistant fish, and optimize production times.

Ring Nematode Resistance in Almond Rootstocks

Valerie Madrigal
Sponsor: Amanda Hodson, Ph.D.
Entomology/Nematology

Ring nematodes are microscopic worms that feed on the roots of plants, leading to lower yields and affecting the growth of almond trees. Finding almond rootstocks with nematode resistance is an important goal of the almond industry to reduce fumigant use and maintain healthy trees. This study examines five newly developed crosses of almond rootstocks to check for ring nematode resistance. Genetic material was propagated in sterile media and five adult ring nematodes were added per dish, with five replicates of each dish. Eggs, juveniles, dead nematodes, and nematodes feeding on roots were analyzed in four time periods. Nematodes were observed feeding more often on the (NL2) cross which had a fair amount of juveniles and few dead nematodes, however; high levels of variation were present for egg counts. These results suggest that NL2 should not be used as a rootstock by the almond industry and highlights the importance of ongoing studies to evaluate tree crop rootstocks.

Improving Social Belonging for Freshman and Transfer Students at UC Davis

Yessenia Magallanes
Sponsor: Susan Ebeler, Ph.D.
Viticulture & Enology

Focus groups are a small number of people brought together with a moderator for a discussion on a specific topic. Focus groups are often used in social science research projects to gather information about a target audience's opinion on a specific topic. For our research project we used focus groups to gather information about student's opinion of the social belonging program at UC Davis. The social belonging program at UC Davis is designed for incoming students to support their transition to campus. Research has shown that social belonging programs on college campuses contribute to an improvement in academic performance and student engagement. The purpose of the focus groups for the UC Davis social belonging project is collect information on the effectiveness of the current social belonging program and determine ways that the program could be improved. We were especially interested in determining effective ways to convey helpful information to students, and which struggles were the most common. We found that having students hear stories that are similar to their own helps to ease the transition process. Future work on the information we gathered involves coding participant responses to determine the best ways to enhance the social belonging program.

Comparing the Differential Effects of Colonization Resistance and Immunotherapy in Reducing *Salmonella* Invasion

Hiu Ling Mak
Sponsor: David Mills, Ph.D.
Food Science & Technology

Salmonellosis is the leading cause of diarrhea disease in children aged under 5, with over 20,000 cases in the US annually with limited prevention strategies. The secretory IgA antibody Sal4 can prevent Salmonella enterica serovar Typhimurium (ST) infection endogenously in mice but has had limited success as an oral prophylactic treatment. Probiotics have been regarded as beneficial to the host by competitive exclusion of pathogens for colonization sites in the gut environment. This project compares colonization resistance from probiotic administration of Bifidobacterium longum spp. infantis (BI) with Sal4-targeted immunotherapy to prevent invasion of ST in colonocytes. To investigate this, a gentamycin protection assay with a Caco-2 colonocyte culture was performed to determine total invasion of ST strain JS107. Treatment with Sal4 or BI showed a 11-fold and 8-fold decrease, respectively, in total invaded bacteria. In addition, BI treatment reduced IL-8 expression for neutrophil recruitment by 3.75-fold in Caco-2 cells. These data present slight differences in the efficacy of immunotherapy and probiotic administration at reducing ST infection, providing support for diverse prophylactic options.

Comparison of Food Safety Standards between the USA and Developing Countries

Samantha Magrath
Sponsor: Bwalya Lungu, Ph.D.
Food Science & Technology

Trade frequency between the US and developing countries is rapidly increasing, so we need to understand the food safety regulatory systems in these countries to ensure food safety and assure the American public that imported foods are safe for consumption. Countries that trade with the US, need to adopt preventive policies so that Americans face as little risk as possible from food borne illnesses. Methods such as Hazard Analysis Critical Control Point (HACCP) have been implemented in various countries, but the USA adopted sweeping changes to the food safety system in the form of the Food Safety and Modernization Act (FSMA). Currently, trading partners need to understand FSMA and implement equivalent food safety measures. Americans prioritize public health, so to ensure food safety, we need to assess the current food regulation policies of developing countries, specifically in the areas of preventative measures, transparency within the food system, and science-based standards. The goals of this study were to review the current food safety standards in the USA and compare them to food safety standards in developing countries and to determine the major challenges faced by these developing countries in their efforts to ensure food safety and public health.

RNA Editing Enzyme Contains a Vital Hydrogen Bond Linkage Between Active Site and Inositol Cofactor

Kimberly Maldonado
Sponsor: Andrew Fisher, Ph.D.
Chemistry

Adenosine deaminases acting on RNA (ADARs) are highly conserved enzymes that selectively convert adenosine to inosine in duplex RNA, which is read as guanosine by cellular translation machinery. This form of RNA editing is the most common leaving RNA susceptible to mutations. Aberrant editing of ADARs has been linked to disease, prompting us to ask how ADARs are regulated. Structural studies of the catalytic domain of human ADAR2 (hADAR2d) confirm the presence of a heavily charged inositol hexakisphosphate (IP6) cofactor linked to the active site by a highly conserved hydrogen relay of three residues. Interestingly, IP6 is known to be involved in mRNA export, a highly regulated process. This study focused on determining the effect of perturbations in this conserved hydrogen bonding network on hADAR2d deamination efficiency. Through site-directed mutagenesis, hADAR2d mutants K519M, K483M, and D392N were generated and their editing efficiencies tested on a known ADAR2 target RNA duplex. We found that mutant K519M exhibited no enzymatic activity and mutant K483M deaminated 35% of the target adenosine within 15 minutes. Thus, perturbing the hydrogen bond network highlighted a vital linkage for enzyme activity that may lead to a better understanding of the relationship between IP6 and ADAR activity.

The Economic Advantages of a Multilingual Workforce: Cognitive, Personal, Academic, Social, and Global Benefits Associated with the Wage Premium

Emma Maloney
Sponsor: James Chalfant, Ph.D.
Ag & Resource Economics

The highly monolingual American workforce is at a significant disadvantage when compared to the multilingual workforce in countries across the world, particularly in global business. Through the analysis of data sets and a variety of socio-economic benefits, as well as research on wage premiums, this thesis will quantify the benefits of multilingualism that economists seek to understand. A clear wage premium exists for multilingual individuals, even if they do not use multiple languages in their careers, suggesting that being bilingual could be capturing other individual characteristics desirable in the workforce. However, the benefits are not limited to this wage premium; they range from cognitive, personal, academic, social, and global benefits. While the data sets explore various research questions, all support my thesis which states that learning a second language is extremely beneficial and that the United States should advocate for multilingualism in schools. I have illustrated the research findings and analysis in such a way that emphasizes these benefits. With the positive results obtained in this thesis, suggestions can be made for policy changes in schools to provide for additional education in a second language and help encourage individuals to strive towards a multilingual workforce.

Anomalies in discrete time statistic for Langevin dynamics

Lorenzo Mambretti
Sponsor: Niels Jensen, Ph.D.
Mechanical & Aerospace Engr

We present an analysis of detected statistical anomalies in the results of applying the GJF algorithm for simulating Langevin dynamics in discrete time to a simple one-dimensional oscillator with friction and noise such that thermal equilibrium is obtained. The anomalies are detected in, e.g., calculations of energetic averages, where particular oscillations around the correct value are noticed as a function of the applied time step. The algorithm is expected to yield time step independent statistics regardless of the choice of parameter values. The magnitude of the anomalies increases with increasing temperature and decreasing friction, and the variations disappear when the dynamics become overdamped. We investigate the nature and the cause of the unexpected variations in the statistics for a simple system from which definite conclusions can be drawn. The results illuminate the cause of the observed anomalies, which are results of critical sensitivities in computational statistical mechanics when demanding high precision statistics.

Evaluating the Growth and Nutritional Composition of Water Spinach (*Ipomoea aquatica*) in a Hydroponic and Aquaponic System.

Geoffrey Mangalam
Sponsor: Jason Gross, Ph.D.
Animal Science

Water Spinach is a specialty crop that is highly nutritious with large amounts of Vitamin A and C, Iron, and Magnesium, and that is popular in many asian cultures. Many US states contain asian populations that provide growing demand, and on a related note, increasinging numbers of hydroponic and aquaponic farms are opening throughout the US, which both utilize the water-based culture system that water spinach is adapted to; suggesting that these farms would be good candidates for producing such a vegetable. This experiment evaluates the relative productivity of a hydroponic and aquaponic system when used to grow water spinach in a greenhouse environment, and determines which system is better suited for production based off final biomass and nutritional composition of the harvestable portion of the plant. Based off the results of past studies, we hypothesize that an aquaponic system will meet or exceed the performance of a hydroponic system while utilizing equal amounts of inputs. Additionally, this experiment is the basis for an extension manual that gives growers a set of best practices for water spinach cultivation. This experiment will help diversify the range of domestically grown produce while offering insights into the optimization of environmentally sustainable growing methods.

Exposure to the herbicide atrazine during adult life causes chromosomal abnormalities in the female germline

Rushali Manhas
Sponsor: Neil Hunter, Ph.D.
Microbiology & Molec Genetics

It is estimated that US alone uses 70 million pounds of atrazine, an herbicide, annually for agricultural purposes. Its wide application leads to groundwater contamination and raises concern about human exposure. Previous studies have suggested that atrazine exposure can induce feminization of male frogs and cause reproductive defects in mammals. In this study, we explore the potential impact of atrazine exposure on the chromosomal events of meiosis in mouse oocytes. Adult female mice were exposed to two different doses of atrazine (low 100 mg/L; high 33 mg/L), for 3 months via drinking water and then the efficiency of oocyte maturation and chromosome segregation were analyzed. Our results indicated that atrazine exposure does not impact the numbers of germinal vesicle stage oocytes present in the ovaries, or their efficiency of maturation. However, chromosomes were frequently misaligned during metaphase I, which is a risk factor of chromosome missegregation. Consistently, atrazine exposure increased the frequency of metaphase II oocytes with chromosome abnormalities. Importantly, oocyte chromosome segregation defects persisted even after atrazine exposure was discontinued. Chromosomal abnormalities are common in human oocytes and are a leading cause of infertility, miscarriage, and chromosomal disorders such as Down Syndrome. Atrazine exposure could exacerbate such defects.

Modeling Early Pancreatic Cancer Progression Using Organ-on-Chip Technology

Vishal Manickam
Sponsor: Steven George, M.D.,Ph.D.
Biomedical Engineering

Pancreatic cancer is one of the deadliest forms of cancer due to its being asymptomatic at early stages and lacking an effective cure. Using cutting-edge microfabrication techniques and tissue engineering principles, we can design a model of the early tumor microenvironment to understand cancer progression at a high spatial and temporal resolution. In this project, we constructed features of the early pancreatic tumor by using tumor cells and tumor-associated non-tumor cells. More particularly, we used pancreatic tumor cells, pancreatic cancer-associated fibroblasts (CAFs), and cord blood-derived endothelial colony-forming cells (ECFCs). We demonstrate the creation of a perfused microvascular network of vessels in the device. These pancreatic cancer-associated microvessels were more permeable than the microvessels formed when using non-cancer-associated cells in our device. This data is in line with the in vivo observations of tumor microvasculature. Furthermore, we have developed a protocol to develop these microvascular networks using cells thawed from storage in liquid nitrogen, which saves weeks that would normally be spent culturing the cells. Ultimately, such a model would not only be useful for basic science studies but also be useful as a tool for drug screening.

Kinesin Light Chain and Its Impact on the Motor Protein Activity and Microtubule Binding

Niloufar Mansooralavi
Sponsor: Richard Mckenney, Ph.D.
Molecular & Cellular Bio

Within cells, motor proteins transport various cargos along polarized microtubules. One predominant motor, kinesin, moves unidirectionally towards the plus-ends of microtubules. Kinesin consists of larger Kinesin Heavy Chain (KHC), and smaller Kinesin Light Chain (KLC) subunits. The dimeric KHC subunit contains motor domains necessary for movement along microtubules. Previous studies in cells have suggested that the KLC affects KHC's ability to attach and move along microtubules. Of the four KLC proteins expressed in mammals, the function of KLC1 is best understood, but characteristics of KLC2, KLC3, and KLC4 are less studied. Our goal is to understand the molecular interactions between these subunits, and their impact on kinesin movement. I tested the hypothesis that KLC2 would fully inhibit the movement and attachment of KHC, as was previously observed for KLC1. KLC2 was cloned, expressed in bacterial cells, and purified followed by functional testing using single molecule imaging. The preliminary results show that KLC2 does not fully inhibit the activity of KHC, in contrast to KLC1, as we observed significantly more KHC molecules interacting with microtubules. We are currently attempting to purify KLC3 and KLC4 from a eukaryotic expression system in order to test their function relative to the other isoforms.

Spatial Organization of Mitochodrial Metabolons in Budding Yeast

Zachary Markham
Sponsor: Jodi Nunnari, Ph.D.
Molecular & Cellular Bio

Spatially distinctive domains of metabolic pathway enzymes, so-called metabolons, function as microenvironments in cells and play an important role in higher-order cellular organization. Metabolons, such as the cytosolic de novo purine nucleotide biosynthetic pathway, the TCA cycle, or the mitochondrial coenzyme Q biosynthetic pathway, are multicomponent pathways that dynamically assemble and disassemble in response to substrates and other regulatory inputs. While we are starting to understand their dynamic organization within cells, further research is required to understand how metabolic pathways are organized and integrated with one another on a systems level. To examine how metabolons are positioned relative to one another in mitochondria, we took a cytological approach to characterize the sub-mitochondrial localization of metabolic pathways known to form metabolons in budding yeast using fluorescence microscopy. Our data reveals a model for the spatial organization of metabolic complexes within mitochondria, further helping to resolve human metabolic diseases, such as neurodegenerative disorders.

Breaking Down Barriers: *Making UC Davis Museum Spaces More Accessible for a Visually Impaired Audience*

Zoe Nicole Martin
Sponsor: Timothy Mcneil, M.F.A.
Design Program

Many museums display objects that can't be touched and the visitor experience is primarily visually driven and passive. The objects are out of reach, placed on museum pedestals or within display cases. This contemplative approach to exhibition design inherently excludes a population of people--the visually impaired, raising questions about accessibility and inclusion. Globally, several museums strive to make environments more accessible, since policymakers and museum managers have been pursuing an agenda of social inclusion (Lehn, 2010). Through analysis of best precedent examples and research through practice, this project implements and evaluates design solutions to make museum spaces at UC Davis more accessible for blind and low vision visitors. This study utilizes summative evaluation to improve on-campus museum spaces for visually impaired members of our campus community and will encourage the 11 museums and collections on campus to adopt standards that other institutions have established. Building on defined tactile standards and design interventions for breaking down navigational barriers promoted by the UC Davis Disability Center, the project goal is a series of illustrated guidelines and recommendations for museums and collections to follow, making UC Davis more accessible for visually impaired students and for faculty, staff, visitors and the entire campus community.

Exploring Changes in Students' Attitudes Toward Science and Career Aspirations Through Integration of Socio-scientific Issues into the General Chemistry Curriculum

Radhika Marwaha
Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Due to its inherent complexities, students perceive chemistry as a high-level and perplexing subject. Many students fear just hearing the word, "chemistry". Increasing motivation and making chemistry relevant to students' life are important goals in chemistry education and are meant to alleviate this stress. In this project, the goal is to explore the influence of socio-scientific issues such as Nanotechnology and Alternative Energies on changes in students' career aspirations and attitudes towards the relevancy of science. Two different learning environments on these topics were prepared by using Prezi. The study was completed in three steps. First, students were asked to take pre-intervention surveys and explore the learning environments. During the discussion session, they debated on these topics by assuming real world careers, like economists, scientists and health safety experts. In the last step, they completed post-intervention surveys and highlighted discussion points. In addition to analyzing students comments, a t-test will be performed to see if there are statistically significant differences between data collected in the pre- and post- survey results, which will help to see if such interventions are effective to influence students' attitudes and career aspirations.

"Re:Search, A Campus Story": An Educational Video Game to Teach Undergraduate Students Basic Research Concepts.

Bayan Mashat
Sponsor: Angelique Louie, M.D.,Ph.D.
Biomedical Engineering

Developed to make an online course more tangible and relatable, "Re:Search, A Campus Story" is an educational role-playing game, which takes players through time and space to meet prominent researchers of yore. From appealing on the behalf of Alexander Pushkin to secure writers for The Contemporary, to traversing the political realm of the Heian Imperial court alongside The Tale of Genji author Murasaki Shikibu, to meeting the mathematician AlKawarzmi, the scientist Rosalind Franklin, and many others, players (students) will get a well rounded look into the realm of research. Organized in 9 levels full of different characters, rich conversation, and exciting quests, students get a chance to learn the importance and benefits of research, understand personalities and interests, research techniques, and how to find research opportunities on campus. The game was offered in Spring 2018 for the first time as part of "Introduction to Research" class, taught by Prof. Angelique Louie with a total of 120 students from 7 UC campuses. Based on a feedback survey, 85% felt the story of the game aligned well with the nature of the class. 72% agreed the game helped reinforce weekly course concepts. And 71% believed the game should be offered again.

Survey of Magnetic Properties of Ferromagnetic Materials

Rogelio Mata
Sponsor: Valentin Taufour, Ph.D.
Physics

Our group focuses on the understanding and discovery of new materials, with novel magnetic properties. Due to their large number of application as sensors, or energy conversion technologies, permanent magnets are driving a lot of attention. To be used as permanent magnet, a key physical property of ferromagnetic compounds is the orientation in which the magnetic fields points towards. This direction is also known as the Easy Magnetization Direction (EMD). Another key property is the Curie temperature, above which the ferromagnetic property is lost. For decades the scientific community has invested resources to understand and develop magnets, publishing their discoveries and findings in scientific journals. A valuable strategy is to survey the literature to help identify compounds that require additional investigations. The focus of this project is to generate a database with cobalt-based compounds, containing their respective magnetic properties such as the Curie temperature (Tc), and EMD at a given temperature. We have already identified 657 cobalt base compounds to start build our database. Preliminary results on statistics, visual and data interpretation on the cobalt base compounds will be presented.

Phenotypic Traits of *Plantago lancelota* as Related to Population Structure and Herbivory

Gautam Mathur
Sponsor: Jennifer Gremer, Ph.D.
Evolution & Ecology

This project is a continuation of a study on the globally-distributed perennial plant Plantago lanceolata that has been conducted annually since 2015. This study uses the protocol of Plant Pop Net, an international project, which aims to understand the factors driving the spatial dynamics of plant populations in response to climate change using data from P. lanceolata populations around the world. At our site in Davis, CA, we measured abundance and phenotypic traits of P. lanceolata for three years. Trait data included floral characteristics, phenology, morphology, and signs of herbivory. Using these data, we will compare density and herbivory experienced by different plants within our transect, as well as how how the population structure has changed over time. The results of this study can be used to further understand how plants respond to herbivory and competition, and a continuation of this study will allow us to ask questions in the future about the factors influencing these traits, including disease and climate change.

A Socio-ecological Design Strategy For Monitoring Global Material Flows

Elisabeth Mcallister
Sponsor: Christina Cogdell, Ph.D.
Design Program

This project applies human-centered design practices to ecological challenges and outlines a strategy for the creation of an interactive tool to measure and monitor global material flows. This strategy was developed in partnership with Origin Materials, a biomaterials company based in West Sacramento, California. The creation of such a tool is predicated upon the fact that much of the information on the material flows that coalesce to shape our world is invisible. Current efforts to standardize the records of movements of materials communicate the available information to technical audiences but are inaccessible to consumers. As a result, both consumers and producers lack a common language with which to approach the resource-challenged world and, consequently, are unable to make well-informed manufacturing and purchasing decisions. Yet a multiplicity of underutilized data sources exist. Ethnographic research methods and a literature review of texts on network science, prospect theory, data visualization, and critical data studies were implemented to create a strategy to address these areas of disconnect. Finally, mock-ups were produced to imagine a successful strategy to empower both users and consumers with an interactive, open-source data visualization tool intended to provide clarity on the attributes of materials and their life-cycles.

Evaluating the Development and Integration of Learning Assistant Programs in General and Organic Chemistry

Jenna Mccarthy
Sponsor: Julia Chamberlain, Ph.D.
Chemistry

Learning assistant (LA) programs allow undergraduate students with a comprehensive understanding of course material to return to a course as peer-leaders to support the next cohort of undergraduates in their learning. LA programs are used in higher education nationwide to improve student learning outcomes and transform pedagogy. LA programs vary by institution and even within departments, demonstrating that there are many ways to teach with LAs. Since 2016, UC Davis Chemistry faculty and students have developed LA programs for General Chemistry and Organic Chemistry courses. LAs were placed in discussion sections and lecture classrooms to support student engagement, decrease the student-instructor ratio and provide the perspective of a student who has recently experienced learning the material for the first time. This project explores the differences between faculty-run and student-run chemistry LA programs through surveys and interviews with students, LAs, and instructors. In addition, this research examines LA practices that correlate with student engagement and positive learning environments. Initial survey results suggest widespread student satisfaction with the programs and include concrete suggestions for improvement. Understanding the structure and function of different LA programs in chemistry will inform the continued operation of current programs, as well as expansion to other courses.

Adult Interaction Strategies for Children with Low Language

Megan McGillis
Sponsor: L Harper, Ph.D.
Human Ecology

Children with little or no productive language can be at a disadvantage in social situations, such as among peers in preschool. We used a subset of videotaped observations, each 20 minutes long, from a much larger study to understand the adults' role in their social engagement. Subjects included 11 preschool children (5 female, 6 male) in 94 observations (4-10 observations per child) at a university-associated preschool during free play time. During free play, children can choose where, with what and with whom to play. We coded for adult-initiated interaction, child response, and conclusion of interaction. Our research evaluates the effectiveness of methods adults use to engage children with low language development in an activity or interaction. We hypothesize that talking alone is not enough to grasp a child's attention, and that there is a greater need for the use of touch or modeling of activities to spark interest. Data will be examined to better understand what practices adults can engage in, in order to better serve this population of children and aid their learning and social development.

Increasing Student Preparedness and Learning in the Laboratory: Redesigning the Laboratory Manual

Brooke Mcmahon
Sponsor: David Goodin, Ph.D.
Chemistry

Undergraduate students that are majoring in chemistry are often required to take course centered around laboratory techniques. While this curriculum is valuable for students intending to pursue a graduate degree or work in industry, these same students often feel frustrated when they are in these courses. This frustration stems from laboratory manuals that are poorly organized and do not promote critical thinking; an example of this is UC Davis' CHE 115 class. This course is an analytical chemistry course that intends to introduce students to laboratory techniques as well as expose them to instruments that they will likely use throughout their career. Using student surveys, problem areas of the CHE 115 manual were identified. The manual was then combed through to systematically remove outdated information, replace confusing language, update the layout for visual clarity, and reframe the post-lab section to focus on scientific practices. Beginning in Fall Quarter 2019, this redesigned manual will be replacing the current version of the manual at UC Davis. It is predicted that this new manual will increase the course's learning value as well as student preparedness in the lab.

Spatio-temporal Assessment of Water Demand of Pistachio Orchards Grown with Micro-irrigation on Non-saline and Increasingly Saline Soils in the San Joaquin Valley of California

Kyle Mcneil
Sponsor: Daniele Zaccaria, Ph.D.
Land Air & Water Resources

California grows more than 98% of all pistachios produced in the U.S. and feeds a multi-billion dollar industry with increasing acreage every year. With the passage of the Sustainable Groundwater Management Act (SGMA) in 2014, future groundwater extractions for agricultural users will be limited to sustainable levels in an effort to halt overdraft of groundwater basins. Thus, there is a need to develop reliable time-distributed information on water demand for pistachio production at various spatial scales. In this study we aim to derive a water demand hydrograph across the pistachio growing season for detailed analysis units (DAU) using the Cal-SIMETAW model. The model uses soil type, crop coefficients, rooting depths, and climate information to calculate the evapotranspiration of applied water (ET_{AW}). The results of the proposed analysis will provide a valuable knowledge base on time-distributed irrigation demand for pistachios and help inform water resources planning, allocation and management decisions.

Implications of prevalent non-nutritive suckling behaviors on activity levels and sleeping patterns in neonatal kittens

Sabrina Mederos
Sponsor: Charles Buffington, D.V.M.,Ph.D.
VM: Medicine & Epidemiology

It is known that maternal interactions have major effects on behavioral/ physical development of neonatal kittens; discrepancies between foster kittens and exhibition of behavioral abnormalities may be explained by this which jeopardizes welfare. One such behavior is routinely observed in foster homes and shelters: non-nutritive suckling. In this study, we looked at video footage of two different litter types: those raised by a human and bottle-fed and those under the care of their birth mother. We assessed differences in prevalence of non-nutritive suckling (oral contact to surfaces/littermates, not for the purpose of consumption) and the effect on activity level/ sleeping patterns. We quantified the fractional daily time budget of the kittens, including time spent engaging in these behaviors within the foster groups, compared to the litters housed with their mother. We investigated variation in activity level to detect any correlations between the two, done by observing time spent sleeping, time spent suckling, and time spent engaged in other motor activities during typical sleeping periods. Observations were pre-selected based on relevant time periods and in avoidance of feedings. By observing a possible relationship, we can examine perhaps how to better address the welfare issue it poses.

Design of human prolyl endopeptidase (HPE) as a potential anticancer prodrug activator

Linett Medina
Sponsor: Justin Siegel, Ph.D.
MED: Biochem & Molecular Med

Antibody-directed enzyme/prodrug therapy (ADEPT) for cancer treatment limits cytotoxic effects to tumor sites. This is accomplished by an enzyme-antibody construct that activates a prodrug once the antibody recognizes tumorous cells. The Siegel Lab is developing a prodrug as a form of cancer therapy that can be localized to treat cancerous cells. To achieve this, we are designing an antibody-enzyme construct using human propyl endopeptidase (HPE), which will be engineered to cleave the prodrug-D-peptide complex. We chose HPE as the model enzyme since in nature, HPE cleaves L-proline peptides, and the enzyme is well characterized for its function and potential use in drug therapy. I proposed to mutagenize human HPE and perform experiments to confirm whether the mutations enable cleavage of D-peptides, isomers L-peptides. To design HPE to cleave D-peptides rather than L-peptides, I will design mutants computationally. Once the mutations are created, I will evaluate whether the mutated HPE proteins cleave the D-peptide substrate by running assays that record the cleaving of the substrate by attaching a fluorescent reporter to the peptide. This process will be iterative to optimize the cleavage.

The Amargosa Vole: Life in Captivity with Hope of Release

Rebecca Mehiel
Sponsor: Janet Foley, D.V.M.,Ph.D.
VM: Medicine & Epidemiology

The Amargosa vole (Microtus californicus scirpensis), a highly specialized rodent endemic to Mojave Desert marshes, is currently endangered due to anthropogenic influence reducing habitat availability. A captive breeding project was established in 2014 to help preserve the species, with the hope of one day releasing individuals back into the wild once their habitat is properly restored. This captive colony is currently the only one in existence. Because of this, it is vital to maintain optimal living conditions to ensure the greatest chance of survival upon release. There are specific standards for diet, reproduction, disease control and maintenance that must be met. In an ideal captive colony, housing and management would mimic their natural environment as closely as possible to preserve natural behaviors and defenses. Protocol dictated by federal, state, and university agencies require those caring for and studying captive animals to follow certain procedures, such as regular health checks, to ensure humane treatment of the individuals. Despite the benefits they provide, there are a few drawbacks when maintaining a captive colony under these regulations – and in general - when the main goal is release. These drawbacks include increased human interaction and breeding interference causing behavioral shifts.

Making Money Move: Investigating Determinants of International Remittances

Joseph Melkonian
Sponsor: Giovanni Peri, Ph.D.
Economics

Money sent by immigrant workers to recipients in their countries of origin, also known as remittances, represents a significant international financial flow, particularly for developing economies. In recent years, remittance flows have exceeded official development aid and proven more resilient than foreign direct investment in the face of economic crises. While prior studies have examined various impacts of remittances on the developing world, I investigate what structural features and household characteristics may influence a migrant household's decision to remit. Combining World Bank and US Census survey data, I run a time series analysis to investigate which country of origin and diaspora community characteristics are associated with higher remittance flows from the United States. Using data collected from sub-Saharan immigrants residing in Belgium, I also conduct a cross sectional analysis to uncover how income, household size, and education, among other factors, may influence immigrant decisions on whether and how much to remit. By conducting a separate macro-economic and micro-economic analysis of remittances sent from two Western, developed countries, I hope to corroborate my findings and discover internationally consistent determinants of remittances.

The Effects of Family Influence on Psychological Distress in Appalachia

Celine An Mendoza
Sponsor: Patricia Roberson, Ph.D.
Human Ecology

Many rural areas of the U.S. are unable to receive adequate mental health services. Rural populations face difficulties with accessibility, availability, and acceptability of mental health services, which hinders the person's ability to cope with their mental distress. Research has suggested family influence plays a role in health. With this knowledge, the relationship between family influence and psychological distress (anxiety and depression) will be analyzed through a pilot study done at UC Davis. This study surveys individuals who attended the Remote Area Medical clinic in rural regions of Appalachia with limited healthcare access. The findings of this research may provide insight into how the overall culture and beliefs in rural communities may influence the family's impact on the development of anxiety and depression in a family member. Moreover, determining whether there needs to be more mental health interventions in rural areas that focus on the family interactions should be considered to help decrease its influence on psychological distress

Design of an Electric Bicycle Speed Controller

Trevor Metz
Sponsor: Jason Moore, Ph.D.
Mechanical & Aerospace Engr

Bicycles can potentially be designed to be safer by utilizing a theoretical handling quality metric (HQM). Past efforts to experimentally validate the HQM through measuring slalom and line tracking performance on a bicycle can be improved through maintaining the instrumented electric bike used in the experiments at a constant speed. Our hypothesis is that a PID controller, designed using a mathematical model of an electric bike derived from first principles and controller design software, can be used to maintain the speed of the electric bike within +/- 0.1 m/s of a desired speed. The derived model of the electric bike used in the design of the PID controller was validated using a grey box system identification method by matching the mathematical model to a measured time response of the electric bike. Initial computer simulations and benchtop tests indicate the PID controller implemented on the electric bike will satisfy our requirements, enabling further bicycle handling experiments.

Effects of the Marine Macroalga *Ulva* sp. on the Microhabitat Distribution of Mesograzers in Eelgrass (Zostera marina) Beds in Bodega Bay, CA (USA)

Emily Meyers
Sponsor: John Stachowicz, Ph.D.
Evolution & Ecology

Seagrasses comprise highly productive habitats that support many marine animals, including mesograzers (invertebrate grazers). The effects of mesograzers on seagrass are species-specific, making the consequences of community alterations in these systems complex and often unpredictable. As global seagrass area has declined, understanding the species-specific interactions between seagrass and mesograzers has become increasingly important, yet these interactions remain poorly understood. Both predatory fish and blooms of the macroalga Ulva sp. may influence the distribution of mesograzers in eelgrass, the effects of which have been tested using two field experiments: cages to remove predators and Ulva additions to uncaged plots. I found that the factors underlying microhabitat use vary among taxa: abundance of some taxa was clearly driven by predation (caprellid amphipods), whereas other species were clearly negatively influenced by Ulva presence (isopods). I also found evidence for antagonistic interactions among mesograzers, as predator-driven reductions in caprellids increased the abundance of polychaete worms and gammarid amphipods. Thus, my initial hypothesis that Ulva reduced all mesograzers was replaced by a more complex one in which predators, habitat, and antagonistic interactions among species determine grazer community composition.

Quantification of Hydrogen Bonding Ability of Medicinally Relevant Organic Molecules Using ^{19}F and ^{31}P NMR Spectroscopy

Mira Milic
Sponsor: Annaliese Franz, Ph.D.
Chemistry

Hydrogen bonding is a critical parameter in materials and drug design, as finely-tuned interactions between a drug compound and target receptor protein enhance the overall uptake and potency of the pharmaceutical agent. My research as part of the Franz group, and in partnership with students in two First Year Seminar Course-based Undergraduate Research Experience (CURE) courses, has quantified the hydrogen-bonding ability of over 100 compounds using ^{31}P NMR spectroscopy upon binding to triethylphosphine oxide (TEPO). This simple and rapid method has been employed to create a database of ^{31}P NMR values to characterize and quantify the hydrogen-bond donating abilities of medicinally relevant organic molecules including carboxylic acids, phenols, catechols, and alcohols. Currently, I am developing an NMR method to quantify H-bond accepting ability of organic molecules relevant to drug design where I am investigating ^{19}F and ^{31}P NMR spectroscopy to quantify the H-bond accepting abilities of select nitrogen- and oxygen-containing Lewis bases. Quantifying these molecular interactions will contribute to the understanding of hydrogen bonding in the design of novel synthons and isosteres for drug design.

Exploring Dynamic Nature of Knowledge and the Influence of the Chemistry Triplet on Students' Knowledge Construction

Alexandra Milkey
Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Chemistry is traditionally thought of as being difficult to master. One of the reasons for this is because of the wide variety of concepts and representations that must be linked together to form a complete understanding. Commonly cited in literature is the chemistry triplet, which identifies the submicroscopic, macroscopic, and symbolic representational levels of chemistry. Many factors influence a learner's success in bridging understanding between these three levels. Among them are prior understanding of mathematical and chemical concepts as well as the learner's ability to organize knowledge in an effective way. Constructivist theory emphasizes the interplay between these factors and holds that prior knowledge greatly affects the way that students incorporate new concepts into their minds. Thus, a student's prior understanding of basic concepts impacts the amount of success they achieve in learning more advanced concepts. The aim of this study was to visualize the knowledge structures of undergraduates as they progressed through the Chemistry 2 series to see how these structures changed as new concepts were introduced. The chemistry triplet provided a deeper method of analyzing these structures.

Characterization of the DA1 ubiquitin protein receptor regulating seed growth

Avalon Miller
Sponsor: Nitzan Shabek, Ph.D.
Plant Biology

Determination of seed size in plants is a major focus in the agricultural community. Seed size has a high correlation to seed quality, and ultimately overall performance of the crop. The ubiquitin system is proposed to be highly involved in this process by targeting certain proteins for degradation, alters location and activity, and regulation of potential protein interactions. DA1 encodes a ubiquitin receptor that is shown to be involved in ubiquitin-mediated protein degradation. It has been demonstrated through mutagenesis studies that DA1 regulates this final seed and organ size by working in the same regulatory pathway with other ubiquitin related proteins (DA2, and BB). Despite increasing understanding of this developmental pathway, little is known about the molecular mechanisms that determine the final size of seeds in plants. Our main goal is to decipher the mode of action of DA1 at the biochemical level. To produce DA1 protein, we first use molecular biology approaches and clone the Arabidopsis thaliana DA1 gene via PCR into specific protein expression vector. This work establishes the foundation for DA1 protein purification and structure-function investigation.

Environmental Enrichment: Methods for Reducing Stereotypy-Like Behavior in California Mice

Vanessa Minie
Sponsor: Brian Trainor, Ph.D.
Psychology

California mice (peromyscus californicus) have unique behavioral traits that make them a strong model for examining sex differences in psychiatric disease. Since California mouse studies are relatively new, there is little information regarding species-specific needs in laboratory housing. Under standard laboratory conditions, California mice exhibit stereotypy, which is repetitive behavior indicative of stress. Stereotypy manifests as repetitive back-flipping, spinning, or jumping in place. This study assesses whether increasing cage size and providing environmental enrichment (EE) affects social interaction (SI) behavior, physical health, and frequency of stereotypy in California mice. Mice were randomly assigned to one of three conditions since weaning: control cage, bigger cage, or bigger cage plus enrichment. Behavioral and physical health data were collected weekly throughout the experiment. At 3 months old, animals were tested in SI before and after social defeat stress (SDS). Under standard laboratory conditions, SDS induces stronger social avoidance in females than in males. Preliminary data suggest that bigger cage plus EE animals have the lowest frequency of stereotypy of all three groups, followed by the bigger cage group. Ongoing studies continue to assess stereotypy frequency as well as effects of housing on stress-induced social behavior.

Maize Dolabralexins Confer Anti-Fungal Properties

Hana Minsky
Sponsor: Philipp Zerbe, Ph.D.
Plant Biology

Maize (Zea mays) is a staple crop that is essential to the world's calorie consumption and production of downstream commercial products, such as biofuels. Pests and disease severely decrease crop productivity, which threatens global food security. The dolabralexins are an important group of secondary metabolites (small, specialized molecules) that are critical to the maize response to environmental challenges including drought and fungal pathogens. Notably, the maize mutant anther ear 2 (an2), which lacks dolabralexins, has shown heightened susceptibility to infection by the fungal pathogen F. verticillioides. We show several dolabralexins have potent anti-fungal activity against Fusarium pathogenic fungi. Fusarium verticillioides, a major pathogen of maize that results in significant annual crop losses due to impacts on plant health and grain mycotoxin contamination, was shown to be highly susceptible. In contrast, Fusarium circinatum, a conifer pathogen, was shown to be resistant to dolabralexins and capable of degrading the metabolites. This knowledge of dolabralexin efficacy and Fusarium resistance provides important insight to develop novel fungicides and breed or engineer plants that can better withstand Fusarium-related diseases.

Role of *CHD8* in the Cerebellum, a Neuroanatomical Characterization in Chd8$^{+/del5}$ Mutant Mice

Hafsa Mir
Sponsor: Alexander Nord, Ph.D.
Neuro Physio & Behavior

Mutations in the chromatin remodeling factor CHD8 have emerged as a key genetic risk factor for neurodevelopmental disorders (NDDs) and autism spectrum disorder (ASD). Most CHD8 mutations lead to a loss of function and carrier patients display, among other physiological malfunctions, intellectual disability, ASD-like behavior and macrocephaly. Chd8 haploinsufficiency in mice (Chd8$^{+/del5}$) develops similar ASD-like patterns, altered proliferative cortical dynamics, and MRI studies (magnetic resonance imaging) have determined that Chd8$^{+/del5}$ mice present smaller than average sized cerebellums amongst other anatomical brain alterations. The cerebellum is the region of the brain largely responsible for motor control and coordination, however behavioral motor testing has shown that smaller cerebellar formation in Chd8$^{+/del5}$ mice does not result in motor deficiencies. Here, in order to investigate the causal roots of the MRI findings and link our analyses to the unaltered motor phenotype of Chd8$^{+/del5}$ mice, we have studied cerebellar neuroanatomy in this model through immunocytochemistry (IHC) on coronal cross sections and looked at distribution of Purkinje cell neurons and proliferative dynamics in the cerebellum. Altogether our analyses allow us to draw conclusions regarding the role of CHD8 in the cerebellum and motor-coordination, an aspect of ASD that is overlooked across many NDD animal models.

Screen Time in 36-month-olds at Increased Risk for Autism Spectrum Disorder (ASD) and Attention Deficit Hyperactivity Disorder (ADHD)

Sabrina Mohamed Rafi
Sponsor: Sally Ozonoff, Ph.D.
MED: Psychiatry & Behav Sci

Many children use electronic media in excess of national guidelines. Previous research demonstrates links between increased screen time, attention problems and difficult behavior in children. We examined the relationship between total hours of video-based screen time and behavioral outcomes in one hundred and fifteen 36-month-olds at high risk for ASD (n=59), or ADHD (n=28), or low risk for either disorder (n=28) based on the diagnostic status of older siblings. Participants were classified into one of three outcome groups: ASD (n=18), ADHD Concerns (n=17) or Comparison Group (did not meet criteria for ASD or exhibit ADHD concerns; n=80), and also rated as difficult (n=35) or not difficult (n=80) to evaluate based on examiner assessment. Parents reported the average amount of time their child spent watching video content daily. Children with ASD or ADHD concerns showed significantly higher amounts of screen time compared to Comparison children. Children rated as difficult engaged in significantly more screen time than those rated as not difficult. This study supports an association between ASD diagnosis, ADHD concerns and elevated video-based screen time at 36 months, and shows increased screen time in children demonstrating difficult behavior. Further study is needed to determine the causal direction of the association.

Investigating the Regulatory Mechanisms that Underlie Suberin Deposition in Tomato Roots

Sana Mohammad
Sponsor: Siobhan Brady, Ph.D.
Plant Biology

Ensuring a dynamic border between the plant and rhizosphere is the most critical role of the plant root system. Plant cell walls act as a barrier through which exchange is regulated. The matrix that comprises the cell wall is composed of polysaccharide polymers, mainly cellulose. In certain cases, other polymers such as suberin are deposited, decreasing the rate of diffusion of molecules. Suberin can impact drought tolerance and plant-microbe interactions, but the extent to which it controls these processes is still poorly understood. To investigate this, we have focused on the suberized barriers present in the roots of tomato (Solanum lycopersicum). We identified several gene candidates for suberin deposition using transcriptomic data analysis of different root cell types. We then generated loss-of-function mutants of these candidates using CRISPR gene editing. Roots were stained with fluorol yellow and suberin levels were quantified. The characterization of these mutants has helped us elucidate the suberin deposition pathway. These mutants will become valuable resources to investigate the roles of suberin in greater detail. Ultimately, understanding the role of suberin and how to manipulate it will help maximize a crop's ability to face environmentally harsh conditions.

The Geography of Association: Exploring Longitudinal Gradients in Marine Symbioses in the Indo-West Pacific

Michael Montgomery
Sponsor: Geerat Vermeij, Ph.D.
Earth And Planetary Sciences

The biogeographic region known as the Indo-West Pacific is home to an unparalleled diversity and abundance of tropical marine organisms. It is also home to a striking variety of intimate ecological associations. For all their ubiquity, these relationships —mutualistic, parasitic, commensalistic, or of yet-undetermined reciprocity—have not received the same biogeographical attention as their participant taxa. Considering the vast range of habitats encompassed by the Indian and West Pacific Oceans and their established decline in shallow-water faunal diversity with distance east and west of the so-called "Coral Triangle," the question arises: to what extent do intimate associations in the Indo-West Pacific exhibit a longitudinal gradient of their own? Insofar as the associations have been studied at all, answering this question involves bringing together disparate data on their prevalence at specific locales and then comparing across longitude. By conducting just such a literature review, I am in the process of describing the existence—or nonexistence, as the case may be—of any cohesive geographic trends that arise, with the potential to generalize and make sense of such trends across multiple taxa and in a wider evolutionary and oceanographic context.

An Unspoken Relationship: Fashion and Designed Experiences

Melanie Montoya
Sponsor: Susan Abplanalp, M.S.
Design Program

Coachella, a funeral, a Beyonce concert, a museum, the Oscars, etc. are all some of the most evident examples of a designed experience. It is through designed experiences like these where people are immersed in spaces that transport them to worlds they never imagined. However, the designed environment is only part of the experience. Fashion, besides the environment is the most essential component that makes the experience such a meaningful one. Coachella would not be Coachella without the thousands of festival goers who carefully choose their outfits, and the Oscars would not be the Oscars without the opulence in the outfits that the nominees and attendees wear. Therefore, there is a clear intersection between fashion and designed experiences. Through my research I am investigating how designed experiences, have the power to impact people's fashion choices and set new trends on a global scale. Fashion is ever-changing and so is the experience economy, both are constantly feeding off each other in a cycle where one needs the other one to thrive.

Inexpensive Microfluidics Controller for RNA Sequencing

Jacqueline Moore
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

RNA-sequencing enables the relatively low-cost transcriptional profiling of biological samples. Heterogeneous samples, like complex tissues or environmental samples, can be sequenced to identify the different patterns of transcriptional activity present within. This type of profiling can be important in the various contexts, from medical diagnostics to environmental sampling. However, the sequencing of mixed samples does not easily allow one to associate specific patterns of gene expression to individual cells. For this single-cell sequencing is required. However, commercial tools for generating single celled sequencing libraries are expensive and therefore not readily accessible. Our project seeks to make single-cell sequencing more accessible by building a less expensive, quick, and reliable microfluidics droplet controller device. The device we are building contains micrometer-sized channels that enable the co-sorting of single cells and DNA barcoded beads into individual aqueous droplets from which uniquely-tagged sequencing libraries can be constructed. Built from inexpensive, commercially available components, this controller is under $550, easy to assemble, and user-friendly. We are in the process of validating the performance of our device using a variety of "simple" microfluidic designs. When finished, we hope that our work will provide greater access to single-celled transcriptomics for researchers both on and off campus.

The Putative Roles of Geosmin Synthase and Cyclase in *Myxococcus xanthus* Predation and Development

Elizabeth Moore
Sponsor: Mitchell Singer, Ph.D.
Microbiology & Molec Genetics

The facultatively predacious soil bacterium, Myxococcus xanthus, situationally implements a wide array of enzymes in response to fluctuating resource availability. In nutrient-rich environments, M. xanthus participates in highly social forms of group predation, sharing both the absorbed nutrients and the intracellular stress of producing the necessary prey degrading enzymes. Much is still unknown about their specific hunting methods but current research proposes that chemoattractants in conjunction with motility play a key role. One potential chemoattractant used by M. xanthus might be the diterpene geosmin, which is produced by the enzyme Geosmin Synthase using farnesyl diphosphate as a precursor. In times of limited nutrient availability, M. xanthus initiates a developmental program in which the colony forms a multicellular fruiting body as a means of prolonging survival until conditions improve. Previous studies have shown that cyclic molecules produced by cyclases are present in varying concentrations throughout specific stages of the developmental program, suggesting a correlation between cyclase products and fruiting body development. Knockouts of the Geosmin Synthase gene and various cyclase genes will be used to determine the necessity of their products in nutrient acquisition and survival under differing conditions.

Arsenic Related Bladder Tumors

Alexa Morales Arana
Sponsor: Luis Carvajal-Carmona, Ph.D.
MED: Biochem & Molecular Med

Millions of individuals around the world are exposed to arsenic through the ingestion of water, making them more susceptible to cancer. Our collaborative group has previously demonstrated that high arsenic concentrations in drinking water are associated with a >5-fold increase in the risk of developing bladder tumors. We are comparing genome-wide mutation patterns of tumors isolated from 34 patients of a Chilean population, seven of which were exposed to high arsenic levels, seven samples with low exposure, and 20 controls with no arsenic exposure, with the expectation that the patterns will differ between these groups. DNA from tumor and normal tissue patients were extracted using Qiagen's DNA isolation kit. An exome sequencing experiment is currently being performed using Agilent SureSelect V6 kit for library preparation and will be sequenced using an Illumina HiSeq4000. The primary goal of this pilot study is to establish the predominant mutation pattern present in arsenic-exposed tumors and compare them to those not exposed to arsenic. This has the potential to reveal novel insights into arsenic-related tumorigenesis and cancer evolution

Student-Facilitated Course on Writing Books for Pediatric Patients in Underserved Healthcare Communities

Paige Morgan
Sponsor: Marina Crowder, Ph.D.
Molecular & Cellular Bio

Oftentimes, there is a lack of reading material in the waiting rooms at clinics and children's hospitals; this is especially true for healthcare facilities in low income communities both locally and abroad. In order to engage students in creating books for children in these communities, we designed a first year seminar (FYS) entitled "Writing for Wellness: Creating Children's Books to Support Pediatric Patients in Underserved Communities". The main objectives of the course were to practice incorporating empowering messages within stories written for a younger audience and discussing the impact of how socioeconomic disparities found in low income communities hinder children's psychological and academic growth. Combining our knowledge of and experience in writing books for pediatric patients and working in low income healthcare communities both locally and abroad, we designed weekly lectures, reading and writing assignments, discussion questions, and in-class activities that encompassed these themes. Importantly, we designed a final project that resulted in students writing and illustrating original story books with a positive messages, to be printed and distributed to low income communities locally and abroad for children in these communities to read and enjoy.

Sensors and Algorithms for CubeSat Attitude Determination

Chad Mowers
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The Remote Experimentation and Analysis of LEO Phenomena (REALOPs) is a 2U CubeSat development project focused on data acquisition for use in STEM education. The objective of the Attitude Determination and Control System (ADCS) is to develop low-cost solutions that meet mission orientation and stability requirements. This presentation discusses sensors and underlying algorithms that determine the small satellite's orientation in space and controls the magnetorquer coils and reaction wheels. Attitude, location, and angular velocities are determined using a gyroscope, accelerometer, magnetometer, sun sensors, horizon sensors, and Global Positioning System (GPS). The sensor data is given in the body frame of the CubeSat. Models are used to translate attitude and rotation in the body-frame to the inertial-frame, which is then used for attitude control. An Extended Kalman Filter is utilized to combine sensor data, mitigate sensor noise, account for external forces, and proportionally weigh inputs to achieve higher accuracy with a short computation time. This is crucial for the mission objectives, which require a high degree of angular accuracy. The REALOP mission aims to develop and integrate an accurate, precise, and low-cost network of sensors and corresponding algorithms for the current and future CubeSat missions.

Inducible Heat Hardening and Cross Tolerance in Juvenile Chinook Salmon, *Oncorhynchus tshawytscha*

Gabriella Mukai
Sponsor: Anne Todgham, Ph.D.
Animal Science

Hypoxia—low dissolved oxygen—and increasing water temperatures in the California river systems are prevalent due to anthropogenic actions. With hypoxia and thermal stress posing a threat to Chinook salmon, this study's goal was to determine if exposure to an initial mild stressor would improve a juvenile salmon's tolerance to a severe secondary stressor. We studied inducible stress tolerance through heat hardening, increased tolerance to elevated temperature after an initial exposure to heat shock, and cross-tolerance, improved tolerance to a different subsequent stressor, due to coping mechanisms activated by the preliminary stressor (e.g. hypoxia + heat). For the initial mild stressor, we decreased oxygen saturation or increased water temperature and held fish at 65% air saturation or 22°C for an hour. For the second, more severe stressor we used a critical thermal maximum test to determine if there was an improved thermal tolerance 24 or 72 hours after the mild stressor. We recorded the temperature when fish lost equilibrium during the test. We chose a mild preliminary stressor because previous work using two severe stressors did not find significant heat hardening. A mild stressor may activate stress mechanisms and allow the fish to cope with the following extreme thermal stressor.

Habitat Preferences Suggest Niche Partitioning in Northern Tanzanian Ungulates Grant's Gazelle (*Gazella granti*) and Thomson's Gazelle (Gazella thomsonii)

Miroslava Munguia Ramos
Sponsor: Dirk Van Vuren, Ph.D.
Wildlife & Fisheries Biology

Mammalian taxa have undergone millions of years of evolutionary adaptations to maximize their fitness and become superior competitors. Many have broad fundamental niches but narrow realized niches to minimize interspecific competition and coexist with stable populations. Ecosystems may limit these ranges, yet interspecific interactions may play a larger role in how these niches are revealed. In biodiversity hotspots like eastern Africa, taxa of the same trophic level may alter their behavior and their preferences to better extract critical resources. Tanzania is home to dozens of ungulate species including closely related members of the Gazella genus Grant's gazelle (Gazella granti) and Thomson's gazelle (Gazella thomsonii). Both species are commonly found across the country and undergo the same seasonal dry and wet stressors. To further examine how these species can coexist, I assisted in mammal assessment surveys across northeastern Tanzania in Tarangire National Park, Manyara Ranch, and the controlled game area of Mto wa mbu. I recorded each species, the number of individuals, and the vegetation type and season it was located. I hypothesize that each species will have distinct habitat preferences that will limit the amount of niche overlap and support niche partitioning among sympatric herbivores.

Lung Gene Expression in Rats Exposed to Freeway Emissions

Maria Munoz
Sponsor: Laura Van Winkle, Ph.D.
VM: Anat Physio & Cell Biology

Populations living near freeways have daily exposure to traffic-related emissions. These emissions include particles and gaseous vapors which have implications for development and exacerbation of respiratory diseases. This study was conducted to determine the gene expression profile in the lungs in response to these emissions following chronic exposure. Histopathology with H and E stained sections indicated regions of inflammation and possible cellular hyperplasia. Based on this result we examined genes Agr2, Col11a1, and Sostdc1 in ten six-month and nine fifteen-month old male rats with near lifetime exposures. These genes have proven to be upregulated in other lung cancer models after diesel exhaust exposures. Experimental and control rats were exposed to traffic related air pollution (TRAP) near a freeway, and filtered air (FA) respectively. Afterwards, their lungs were collected, and microdissected to separate and study gene expression in specific lung microenvironments: the proximal and distal airways, and parenchyma. We homogenized these samples and used the Rneasy mini kit to extract RNA. Then, RNA was quantified using a NanoDrop spectrophotometer. We then synthesized cDNA using a StepOne Real-Time PCR system and performed a Taqman Assay. The expression of these genes will help define how the rat lung is responding to freeway emissions.

NRAMP1 Is Critical for Neutrophil-Mediated Control of *Salmonella typhimurium*

Ariel Munoz
Sponsor: Renee Tsolis, Ph.D.
MED: Medical Microbiology & Imm

Non-typhoidal salmonellae (NTS) infection is a leading cause of gastroenteritis worldwide. High mortality rates among infants, children, and the immunocompromised have been associated with young age, malaria co-infection, and malnutrition. However, the mechanisms by which malnutrition contributes to disseminated infection are unknown. We have investigated how vitamin A deficiency (VAD), a common childhood micronutrient deficit, impairs control of systemic NTS infection in a mouse model. Preliminary evidence in the Tsolis lab suggests that natural resistance-associated macrophage protein 1 (NRAMP1), a phagosomal cation transporter, contributes to neutrophil-mediated control of intracellular bacterial pathogens. We hypothesize that vitamin A deficiency compromises systemic control of NTS infection by impairing NRAMP1-dependent neutrophils. Our studies show that VAD, NRAMP1-proficient mice were equally susceptible to systemic salmonellosis as mice with a loss-of-function mutation in the NRAMP1 encoding gene Slc11a1, suggesting that disseminated Salmonella depends on NRAMP1 expression under vitamin A replete conditions. Current studies consist of adoptive transfer of neutrophils from NRAMP1-proficient mice to VAD, NRAMP1-deficient mice after Salmonella infection to observe a shift in systemic burden. Findings from this study may translate to proposing innovative, dietary alterations for prevention against NTS infection in developing countries.

Design of Pirani furnace for measurements of melting temperatures of refractory carbides

Jun Muranaka
Sponsor: Alexandra Navrotsky, M.D.,Ph.D.
Chemical Engineering

There is an increasing number of new formulations for Ultra high temperature ceramics (UHTC) to be used as leading edges in aerodynamic surfaces of hypersonic vehicles. The main UHTC constituents are electrically conductive borides, carbides and nitrides. Melting point is critically important thermodynamic parameter which defines the maximum temperature at which material can be used, however there are no commercially available instruments to measure melting temperatures above 2500 °C. The goal of the current project is to design an instrument to enable such measurements. In the previously proposed method, the melting temperature is measured by a pyrometer aimed into blind hole bored in electrically conductive specimen heated by electric current. In our project we will design new instrument based on the same principle but using modern power supply and spectropyrometer capable of measuring the temperature up to 4000 °C. Computer assisted design using SolidWorks software and 3D printing was used to prototype parts which were machined from copper and tungsten, and the final parts are machined both by the school and outside factories.

The role of aphid vectors in suppressing plant defense responses to viruses

Maneesha Muriki
Sponsor: Clare Casteel, Ph.D.
Plant Pathology

Preliminary results have demonstrated that the expression of the viral protein NIa-Pro increases resistance to potyviruses in transgenic plants. As many plant pathogens depend on insect vectors for disease transmission, the purpose of this study was to determine whether aphid vectors inhibit NIa-Pro induction of plant defenses. To address this goal, we measured the production of reactive oxygen species (ROS) and the abundance of related transcripts. We used transgenic Arabidopsis thaliana expressing NIa-Pro or the empty expression plasmid with and without aphid feeding. ROS production was measured using luminol-based ROS assay and defense transcripts abundance was measured using quantitative RT-PCR. In our experiments, aphids inhibited ROS production, however, the abundance of the ROS related transcript RBOHD was not impacted by aphid treatment. This suggests that defense to pathogens may be compromised in the presence of aphids, however, additional experiments are required. Understanding the biomolecular impacts of aphid feeding on pathogen performance and plant defenses is crucial for implementing strategies to control diseases in agricultural systems.

Genetic Monitoring for Conservation of Snake River White Sturgeon (*Acipenser transmontanus)*

Danielle Myers
Sponsor: Andrea Schreier, Ph.D.
Animal Science

Genetic monitoring is an important tool to track trends in genetic diversity in species or populations. This project focuses on the genetic monitoring of white sturgeon in the Middle Snake River in Idaho. The Snake River is segmented by dams, isolating sturgeon populations and increasing risk of genetic diversity loss. DNA from Middle Snake River white sturgeon fin clips will be extracted and amplified via PCR using primers for 13 microsatellite loci. The PCR product fragment sizes will be analyzed at each of the loci. The program GenAlEx will be used to calculate the total number of alleles and the number of private alleles, or alleles unique to a specific reach. The mean number of alleles per locus per individual in each reach will be calculated as a proxy for heterozygosity. These genetic diversity data will then be compared to past microsatellite data from the same impounded reaches to observe any changes to genetic diversity over 5-year intervals. The data will reflect whether there is a decrease in diversity which will inform managers of whether intervention, including translocation or introducing sturgeon from aquaculture, is necessary to maintain or improve diversity of the sturgeon in each reach.

Characterizing Chemoattractant-Specific Features of CDC42 Signaling Activity in Neutrophil-Like Cells

Maya Mysore
Sponsor: Sean Collins, Ph.D.
Microbiology & Molec Genetics

Neutrophils are a type of white blood cell essential to fighting disease. Imbalances in their numbers or ability to function result in autoimmune or immunodeficiency diseases. To correctly reach sites of inflammation, neutrophils follow chemical gradients, of which there are two main classes- intermediates, or general inflammatory signals that draw neutrophils out of the vasculature, and end-targets, released by invading bacterial cells or dying tissues that guide neutrophils directly to the infection site. In the body, these chemical gradients exist simultaneously, creating competing directional cues. To successfully navigate, neutrophils prioritize end-target signals, using a relatively unknown pathway. One hypothesis about this pathway is that shared signalling molecules experience differential regulation. To test this, we focused on the shared effector protein CDC42, which is critical to cell motility, and measured its activity in response to intermediate and end-target chemoattractants. Observing CDC42 activity levels in response to stimulation showed that end-target induced activity persisted much longer. We hypothesize this activity depends on a G-protein receptor kinase (GRK). To consider the impact of GRK family proteins on prioritization, we mutated target residues in neutrophil-like cells and tested their ability to prioritize. Altogether, these experiments shed light on cellular processes underlying prioritization.

Expression of Caseins in *Kluyveromyces lactis* Towards the Synthesis of a Sustainable, Animal-free Cheese

Nina Allaine Nase
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

In recent years, products accommodating vegan and vegetarian diets have come to market as consumers are increasingly concerned about the ethical drawbacks of food production, primarily the environmental impact of animal products and the cruelty sometimes prevalent in the meat and dairy industry. Attempts to find alternatives to animal-derived proteins have resulted in products that do not always taste, smell, and feel like the traditional product. We are exploring whether some or all of these problems can be solved by using microorganisms to synthesize the proteins integral to traditional animal products. In this study, we are creating transgenic strains of Kluyveromyces lactis, an FDA-listed generally regarded as safe (GRAS) yeast used to produce food-associated products, to express the major proteins in bovine cheese: alpha-s1, alpha-s2, beta, and kappa caseins. Currently, we are cloning these genes into several expression vectors, developing an economic assessment pertaining to cost of production, and plan to explore various purification strategies. If successful, we propose that a cheese made from lab-produced proteins would be more environmentally sustainable, free of pathogens, and would also satisfy public interest in cruelty-free products that taste nearly identical to the traditional version.

Effects of Cell Senescence on HSP60 Expression in Endothelial Cells

Evelyn Navar
Sponsor: Anne Knowlton, M.D.
MED: Div Of Internal Med

Cellular senescence is characterized by the cessation of cellular proliferation- a characteristic of aging. Senescent cells release inflammatory mediators, which deleteriously effect other cells. We hypothesized that endothelial cells undergoing senescent stress will over-express heat shock protein 60 (HSP60) and increase the release of HSP60, which is potentially harmful to cells. To test this, patient-derived cardiac endothelial cells from a young male donor underwent several passages in culture until senescent. I used Western Blotting to quantify HSP60 expression within cells, ELISA to quantify HSP60 released in media, and SA-ß-gal to confirm senescence. I observed lower levels of HSP60 expression within late senescence (l-Sen) cells compared to the early passage (EP) and early senescence (e-Sen) cells. There was no difference between the l-Sen and EP HSP60 protein concentrations in the media. Within cells, l-Sen cells expressed less HSP60 than EP cells. Overall, our experiments showed l-Sen cells display lower levels of HSP60 expression compared to EP cells. A possible explanation is that the donor developed senescence at earlier passages compared to previous donors. Although no disease was noted, other diseases could have caused this. In the future, I would like to quantify HSP60 in different cell fractions compared to entire cells.

Understanding the Effects of Spinal Cord Injury on the Brain

Gloria Navarro
Sponsor: Karen Moxon, Ph.D.
Biomedical Engineering

Brain Machine Interface (BMI) technology has evolved throughout the years to help improve the lives of those with neurological injury or disease. We are trying to understand the effects of spinal cord injury on the brain by studying how neurons encode information. To generate movement in the body the brain transmits electrical impulses that send signals throughout the body. To measure how neurons encode these signals, we used an animal model subjected to tilts, while a BMI decoded each tilt type by examining patterns of neural activity recording from the brain. We examined the neural activity for each trial. To accomplish this, we used a Gaussian Process Factor Analysis (GPFA) classifier to analyze the covariance of the neurons. While analyzing our data, we hope to discover patterns in the neural trajectories that represent a specific task encoded by the brain. Our preliminary analysis of the data found a correlation between animals who were able to correctly classify a tilt and their neural trajectories while noticeable spikes indicated some neurons responded to the tilts. By understanding how neurons encode information, we hope to someday be able to control devices with our brains by encoding neural trajectories as electrical stimuli to the brain.

Effects of Catchment Land Cover on Water Chemistry in High Elevation Lakes in Sierra Nevada, California

Kelly Neal
Sponsor: Steven Sadro, Ph.D.
Environmental Science & Policy

A clear pattern of how variation in land cover impacts lake chemistry has yet to be extensively explored, especially in high elevation lakes. To assess the way different terrestrial inputs effect high elevation lake water composition, we analyzed the impact of land cover on water chemistry within 23 different lakes. These lakes were all located within the Sierra Nevada mountain range in California. Delineation of each lake's watershed was created through ArcGIS, and land cover types further categorize the area within each watershed using the 2011 National land Cover Dataset. Specifically, we want to see how each lake's catchment land cover affects chlorophyll, dissolved organic carbon, dissolved oxygen, and the ratio of particulate carbon to particulate nitrogen compositions. We expect to see a positive relationship between the ratio of particulate carbon to particulate nitrogen as the percentage of terrestrial vegetative cover increases among the 23 lake sites. Consistent relationships between lake chemistry and land cover types would allow us to predict chemical attributes of other high elevation lakes in the Sierra Nevada, and thus develop a predictive landscape model for the thousands of lakes in the Sierra Nevada that lack sampling data.

Hard Disk Drive Reaction Wheels for CubeSats

Abhay Negi
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The Remote Experimentation and Analysis of LEO Phenomena (REALOPs) is a 2U CubeSat development project focused on data acquisition for use in STEM education. The objective of the Attitude Determination and Control System (ADCS) is to develop low-cost solutions that meet mission orientation and stability requirements of the small satellite. Reaction wheels are necessary in addition to magnetorquer coils to provide full control and for precision attitude control and pointing maneuvers. This presentation discusses the hard disk drive reaction wheels of the ADCS. Commercial CubeSat reaction wheels cost on the order of 10^4 to 10^5 USD. REALOP will repurpose 30 USD hard disk drives, typically found in laptops and iPods, by utilizing them as reaction wheels. Hard disk drives have yet to be used for attitude control in space but are capable of meeting and exceeding the performance requirements of small satellite reaction wheels. In addition to being far less expensive than commercial options, hard disk drives are more reliable than in-house reaction wheels as they are mass-manufactured with high precision standards. The REALOP mission aims to be a technological demonstration of hard disk drive reaction wheels and prove its capabilities and potential for future small satellites.

The effect of ibuprofen on peroxisomal beta oxidation and oxidative stress

Joanne Newens
Sponsor: Aldrin Gomes, Ph.D.
Neuro Physio & Behavior

Ibuprofen is a common medication used to alleviate pain and is classified as a non-steroidal anti-inflammatory drug (NSAID). NSAIDs have been shown to increase Reactive Oxygen Species (ROS) in cardiovascular cells. Recent literature has suggested that this NSAID-induced oxidative stress can lead to cardiovascular diseases via this mechanism. Proteomic data suggest that ibuprofen may induce oxidative stress via peroxisomal pathways. The peroxisome, a cellular organelle essential in the liver, play an integral role in beta oxidation and regulating ROS. Previous data has indicated that enzymes involved in peroxisomal fatty acid beta oxidation are associated with fatty acid oxidation and hydrogen peroxide formation. To draw a possible connection between ibuprofen and oxidative stress, I am investigating beta fatty acid oxidation and oxidative stress by measuring three markers: acetyl-CoA, an indicator of beta oxidation; hydrogen peroxide, a key marker of oxidative stress; and catalase activity, an enzyme involved in peroxisomal hydrogen peroxide breakdown. Data thus far has indicated that some ibuprofen treated mice showed increased catalase activity in liver samples compared to vehicle treated mice. Since oxidative stress plays a role in many liver diseases, a causal link between ibuprofen and oxidative stress can impact future pharmacological practices.

Investigating the Stability of ABF1 Wild-type, Phospho-mimic, and Phospho-null Proteins

Stephanie Ng
Sponsor: Judy Callis, Ph.D.
Molecular & Cellular Bio

Abscisic acid (ABA) is a phytohormone that regulates the expression of many genes that function in multiple plant developmental processes, including seed maturation, seed desiccation, seed dormancy, germination, flowering, and fruit ripening. ABA also mediates responses to environmental stress hormones caused by drought, salinity, and cold temperature. ABA signalling involves several different protein components, including protein pumps, receptors, kinases, phosphatases, and transcription factors. bZIP-type transcription factors, such as ABRE Binding Factors (ABFs), bind to a cis-regulatory element, ABRE, which activates ABA-dependent gene expression. To better understand the mechanisms behind abiotic stress responses, we investigate the protein degradation of the transcription factor, ABF1. Our laboratory is interested in the degradation of ABF1, and we hypothesize that phosphorylation slows degradation of ABF proteins. We used agrobacterium plasmids to create Arabidopsis thaliana plants expressing mutant forms of ABF1 that have substitutions at 5 conserved, consensus phosphorylation sites. We have identified homozygous lines that express visible protein. We are currently measuring ABF1 degradation rates, and we predict that phospho-mimic proteins should degrade more slowly than ABF1 phospho-null or wild type proteins.

Complimentary Feeding and the Presence of Antimicrobial Resistant Genes in Infants

Nhu Nguyen
Sponsor: David Mills, Ph.D.
Food Science & Technology

Antimicrobial resistance (AMR) is the ability of microbes grow in the presence of antimicrobial agents. Carriage of AMR bacteria increases the risk of severe illness. This study examines if the presence of AMR genes in the microbiome changes with the introduction of complimentary food. The five included infants had pre- and post-complimentary feeding stool samples collected. DNA was extracted and sequenced using Illumina HiSeq 4000. BMTagger was used for host subtraction. Trimommatic was used for quality trimming. Reads were assembled with megaHIT and analyzed with ResFinder-3.1. Paired t-tests were used to compare the number of AMR classes and genes present pre- and post-complimentary feeding. There was no significant difference in the number of AMR classes or genes between pre- and post-complimentary feeding (classes mean pre- 3.2 (range 1-6), post- 4.2 (range 1-6), $p=0.19$) and (genes mean pre- 4.8 (range 1 to 9), post- 6.8 (range 1 to 11), $p=0.15$). Despite the non-significant finding, there was a trend towards increased AMR genes after complimentary food introduction, suggesting this study was underpowered. Sequencing samples from additional infants is needed to determine if complimentary food introduction alters infant AMR carriage.

Canine atopic dermatitis: a retrospective study of 44 cases examined at the University of California, Davis Veterinary Medical Teaching Hospital (2007-2017)

Jeffrey Nguyen
Sponsor: Stephen White, D.V.M.
VM: Medicine & Epidemiology

Atopic dermatitis is one of the most prevalent canine skin diseases but is difficult to diagnose due to its common clinical signs. This retrospective study reviewed the medical records of dogs diagnosed with atopic dermatitis between the years 2007 and 2017 by the veterinary dermatology service at the University of California, Davis. The patient cases examine signalment, presentation, and pharmacy dispensation. Forty-four dogs of 24 different breeds were surveyed with a mean age at initial presentation of 6.3 years old. Of the 44 dogs, 41 (93%) had chronic disease with a mean of 3.2 revisits, from 196 total visits. No seasonal occurrence was noted: 64 (33%) presentations in the summer, 39 (20%) in the spring, 43 (22%) in the winter, and 50 (26%) in the fall. Ninety percent of dogs had secondary infections. The drug of choice in controlling pruritus transitioned from primarily corticosteroids or antihistamines, to cyclosporine, a Janus Kinase-1 inhibitor, and more recently, monoclonal antibody therapy. Twenty-four dogs (55%) were on multiple anti-pruritic therapies concurrently. The results of this study can inform veterinarians of the common clinical signs of atopic dermatitis, plus the latest therapies and their efficacy.

Exploring Students' Interactions with Graduate and Undergraduate Teaching Assistants in Chemistry Laboratories

Angela Nguyen
Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Beginning in Fall 2017, the Chemistry Department at UC Davis started a pilot program through which undergraduate teaching assistants, formally known as Emerging Scholars (ES), have been working with graduate teaching assistants (TA) in laboratory settings. In order to observe and study the differences in student interactions with the TAs and the ESs, every TA and ES was asked to audio record their conversations during two lab sessions. After the audio data were collected, they were first transcribed, and student interactions with the lab instructors were coded using Laboratory Observation Protocol for Undergraduate STEM (LOPUS). Findings of this study will reveal whether students are more comfortable approaching TAs or ESs, and how the teaching styles may vary between the two lab instructors. Student inquiries and TA's or ES's responses will be carefully examined to better understand the instructional styles in the labs. These observations and analyses will reveal the efficacy of the Emerging Scholars program and provide the guidelines to enhance student learning experiences.

Use of Immunohistochemistry for Investigating the Role of Na^+/K^+ ATPase for Osmoregulation in Euryhaline Fish

Tina Nguyen
Sponsor: Dietmar Kueltz, Ph.D.
Animal Science

Euryhaline fishes cope with salinity stress through a variety of mechanisms, one of the more important ones being the enzyme Na^+/K^+ ATPase. Their stress response mechanism is investigated due to their wide salinity tolerance range, which is expected to play an important role in the future with increasingly extreme salinity conditions. There is limited information regarding the concentration of the enzyme under varying osmolalities; this study tested the enzyme's abundance by placing tilapia in different salinity concentrations between the fish blood (10 ppt) and its environment (0 and 30 ppt), creating two distinct concentration gradients. The tissues from each fish were collected, stained through immunohistochemistry, and compared for enzyme abundance on the microscope by observing the intensity of the fluorescent signal. It was found that there is little correlation between the intensity of the fluorescent signal and salinity due to the use of undissolved PBA (Phosphate Buffered Albumin).

Improving Menstrual Health Management in Limited-Resource Settings: Investigation of Microbial Indicator Removal Rates from Greywater Treatment

Emily Nguyen
Sponsor: Maureen Kinyua, Ph.D.
Civil & Environmental Engr

Globally, in many low- and middle-income countries, menstrual health management (MHM) poses major obstacles for female students and teachers due to lack of appropriate MHM sanitation facilities and MHM materials. This is further exacerbated by water scarcity. Reuse of greywater and improved, accessible sanitation facilities for MHM would allow female students and teachers to improve school attendance and improve overall menstrual health. The objective of this research is to develop an effective and accessible MHM washing system through intermittent filtration (IF) built with readily-available materials and reuse of greywater for resource-limited school settings. IF filters are periodically fed filters that support physical, chemical, and biological treatment processes. In our preliminary study, Phase I, we compared various filtration material: activated carbon, sand, and tire chips for removal of enteric microbes, E.coli and Enterococci, in an IF system with submerged media. In phase 2, E.coli and Enterococci removal rates are investigated under different IF operating conditions, comparing impacts of various media including sand, pumice, biochar and fabric. Further studies will compare removal of gynecological microorganisms Staphylococcus aureus and Candida albicans. Comparing media factors impacting removal of enteric and gynecological microorganisms will ultimately allow for the development of an adequate MHM washing system.

Analyzing the Effect of Wildlife Crossing Structures on Frequency of Animal-Vehicle Collisions

Tricia Nguyen
Sponsor: Fraser Shilling, Ph.D.
Environmental Science & Policy

Wildlife-vehicle conflict is a major issue due to impacts to human and wildlife safety and the associated financial costs. The Road Ecology Center at UC Davis studies wildlife movement, behavior, and highway collisions involving wildlife. We will examine the effect of wildlife crossing structures on the amount of vehicle collisions with various species grouped by size (small, medium, or large). Wildlife crossing structures include highway underpasses, culverts, and bridges, which allow animals to safely travel across a highway. We will be looking specifically at bridges over waterways. Using Road Ecology Center data, we will examine the number of collisions recorded between 2016-2018 within 100m segments of the road where wildlife crossing structures are i) present and ii) absent. We will look at a minimum of 30 crossing structures that have been identified along California highways. Crossing structures with exclusionary fencing will be omitted. We will use a t-test to analyze the quantity of wildlife-vehicle collisions on portions of highways with and without the crossing structure mitigation measure. By better understanding wildlife use of crossing structures, we can help inform Caltrans and other transportation agencies about future highway development and planning, and help reduce the amount of wildlife-vehicle collisions.

Effects of Heating Element Geometry on the Formation and Propulsion of Vapor Bubbles in a Channel Flow

Thanhhoai Nguyen
Sponsor: Vinod Narayanan, Ph.D.
Mechanical & Aerospace Engr

Heat generation in electrical components in space applications requires proper dissipation for proper operation. For high heat density, boiling of cooling fluid has been proven to be an effective means of heat removal. In terrestrial boiling, buoyancy removes vapor bubbles from the heated surface. However in space applications due to the absence of buoyancy, hot regions created as a result of vapor accumulation will lead to electronics burnout. To mitigate this accumulation, thermally-actuated vapor pumping using asymmetric heater geometry is proposed and tested to determine whether passive movement of vapor bubbles during boiling in microgravity is possible. The asymmetry in geometry is in the form of repeating millimetric-scale ratchets. In laboratory experiments, ratchet heaters mimicking actual electronics were submerged in a dielectric coolant. Selective nucleation sites are engineered into one of the faces of the ratchet. High speed videos are recorded to observe the formation, propulsion, and transport of vapor bubbles within a channel. It is demonstrated that bubbles emanate from localized nucleation sites, grow normal to, and are propelled outward perpendicular from, the ratchet face. The findings in this experiment are positive indicators that such mechanism could result in passive cooling systems for microgravity applications.

CRISPR-based Genome Editing of VEGF-A for Neovascular Age-Related Macular Degeneration

Uyen Nguyen
Sponsor: Glenn Yiu, M.D.,Ph.D.
MED: Ophthalmology

The current treatment for neovascular age-related macular degeneration (AMD) requires frequent intraocular injections of drugs that target vascular endothelial growth factor (VEGF). This therapy is a costly burden to patients. Clustered regularly interspaced palindromic repeats (CRISPR)-based genome editing has the potential to permanently suppress VEGF secretion from human retinal cells. Here, we compare the efficacy of SpCas9 and SaCas9 endonucleases to target the VEGF-A gene in NIH-3T3 cells and to suppress laser-induced CNV in mouse eyes. In vitro CRISPR activity is detected through T7 endonuclease I mismatch detection assays. Once the guide RNA with the highest indel frequencies is determined, it is packaged into AAV8 along with the corresponding Cas endonuclease and injected subretinally into mouse eyes. The insertion-deletion frequencies of both endonucleases were similar, indicating comparable cutting efficiency in vitro. However, Tracking Indels by DEcomposition (TIDE) analysis indicates that SpCas9 may be the more effective endonuclease in vivo.

SynDIG1 Expression in Purkinje Cells and its Role in Synaptic Maturation

Julia Nguyen
Sponsor: Diasynou Fioravante, Ph.D.
Neuro Physio & Behavior

Disruption of cerebellar synapse maturation is associated with neural connectivity disorders including ataxia and autism. Purkinje cells (PCs) receive thousands of excitatory synapses on their dendritic spines allowing the cerebellum to carry out important motor and non-motor functions. Maturation of excitatory synapses on PCs depends on the recruitment of AMPA receptors to their dendritic spines. However, the mechanism of dendritic spine enrichment with AMPA receptors is not well understood. SynDIG1 protein regulates excitatory synapses by interacting with AMPA receptors. Previous studies show that SynDIG1 mRNA is selectively expressed in PCs and upregulated during postnatal development. The current study investigates the role of SynDIG1 in the maturation of excitatory synapses onto Purkinje cells. Using immunohistochemistry, we found that SynDIG1 is uniformly expressed across lobules of the cerebellum. Electrophysiological recordings show that deletion of SynDIG1 disrupts maturation of excitatory synapses from climbing fibers to PCs. This finding is corroborated by immunofluorescence experiments showing deficient climbing fiber translocation to distal PC dendrites in SynDIG1 deficient mice. Based on these results, we propose that SynDIG1 plays a key role in regulating multiple climbing fiber elimination and synaptic maturity in the cerebellum, potentially through interacting with AMPA receptors and influencing glutamate release.

Cinnamaldehyde-evoked Itch and Calcium Imaging of Dorsal Root Ganglia (DRG) Neurons in Mice

Amanda Nguyen
Sponsor: Earl Carstens, Ph.D.
Neuro Physio & Behavior

Cinnamaldehyde (CA) elicits itch sensation in humans. Previous research shows that TRPV1, TRPA1, and TRPV4 channels are involved in the transduction of other itch mediators; however, the role of these channels in CA-evoked itch is not completely understood. In the current study, TRPV1 knockout, TRPA1 knockout, TRPV4 knockout, and wild type mice were used in behavioral experiments to investigate the involvement of these channels in CA-evoked itch. Hindlimb scratch bouts, forelimb wipes, and bilateral facial groom bouts following intradermal cheek injections of CA were counted. CA elicited significant dose-related increases in spontaneous scratching ($p<0.05$) but not wiping or grooming ($p>0.05$). In comparison to wildtype mice, CA-evoked scratching was significantly reduced in TRPV1 and TRPV4 knockouts ($p<0.05$) but not in TRPA1 knockouts ($p>0.05$). Acutely dissociated dorsal root ganglion (DRG) neurons from these animals were loaded with Fura-2 fluorescent dye and ratiometric calcium microfluorimetry was used to monitor responses to CA application. The number of neurons that responded to CA application was significantly reduced in TRPV4 knockouts ($p<0.05$) and significantly increased in TRPV1 knockouts ($p<0.05$). CA application did not elicit responses from DRG neurons collected from TRPA1 knockouts. Our results suggest that CA-evoked itch may involve an indirect non-neuronal sensory pathway.

Milk Osteopontin Promotes Intestinal Proliferation and Differentiation by Increasing Expression of Osteopontin Receptors

Kelly Nieh
Sponsor: Bo Lonnerdal, Ph.D.
Nutrition

Osteopontin (OPN), a highly phosphorylated glycoprotein is abundantly present in both human and mouse milk, making the mouse a good model to study functions of milk OPN. OPN is a pleiotropic protein integrated in many biological processes such as cellular proliferation and differentiation. By binding to its receptors on the surface of target cells, OPN initiates various signaling pathways to exert its multiple functions. Since both human and bovine milk OPN are relatively resistant to in vitro digestion, OPN and its fragments may play important roles in intestinal development during infancy. To investigate functions of milk OPN in the small intestine, we used an established OPN mouse model, wild-type (WT) mouse pups nursed by WT (OPN+) or OPN knock-out (KO) dams (OPN-), thus receiving milk with abundant OPN or without OPN. We are studying how milk OPN stimulates intestinal proliferation and differentiation. qRT-PCR results reveal that milk OPN increases transcription of OPN receptors, including integrin av, integrin ß3, and CD44 in duodenum and jejunum from D4 to D30 mouse pups. Immunoblotting results revealed that milk OPN increases the expression of integrin av. In summary, milk OPN promotes intestinal development by up-regulating expression of OPN receptors.

Negative Life Events and Children's Stress Responses

Adam Nissen
Sponsor: Camelia Hostinar Caudill, Ph.D.
Psychology

Negative life events have been shown to increase risk of behavioral problems in children. However, it is unclear what mediates this effect. It is theorized that sensitization of the hypothalamic-pituitary-adrenal (HPA) axis, the body's primary neuroendocrine stress-response system, might play a role. In this study, we examined the extent to which exposure to negative life events in the previous 3 months was associated with increased HPA activity as indexed by reactivity to a public speaking stressor and as reflected in hair samples. A total of 112 participants aged 9-10 years old attended a laboratory visit and completed the Trier Social Stress Test modified for use with children. Children in the study provided saliva and hair samples to measure cortisol levels. Parents completed the Child Life Events Scale to obtain an inventory of major life events the child experienced in the previous 3 months (e.g., death of a pet, problems with a teacher at school, parental separation/divorce). We predict that children who experienced more negative life events will display higher levels of cortisol in hair and saliva samples. This study can shed light on some of the pathways connecting negative life events and poor mental health in children.

Replication stress-induced nucleophagy is required for rDNA contraction

Mackenzie Noon
Sponsor: Kenneth Kaplan, Ph.D.
Molecular & Cellular Bio

Eukaryotic DNA contains repetitive sequences that serve key functions in linear chromosomes, including the rDNA array, which is difficult to replicate and is amongst the last elements to resolve in anaphase. Eukaryotes have evolved mechanisms to balance the expansion of arrays like the rDNA with the cost to cells to maintain such arrays. For example, when replication factors are limiting, budding yeast cells undergo a contraction of their rDNA arrays, an outcome that provides a growth advantage under these conditions. rDNA contraction may arise through a passive process whereby stochastic contraction is selected for, or by a mechanism that actively induces contraction. We favor the possibility that an active mechanism is induced when replication factors are limiting. Consistently, we have found that replication stress induces a form of autophagy that degrades nucleolar proteins involved in rDNA repeat stability. We hypothesize that activation of this nucleophagy program actively induces contraction of the rDNA under replication stress. To test this hypothesis, we will induce replication stress in wild-type, autophagy-defective and nucleophagy-defective cells, then quantify their rDNA copy number using a qPCR-based assay. Our prediction is that the wild-type cells will succeed in contracting their rDNA, while cells defective in nucleophagy will not.

Kinetics Study of a Scandium Dimer

Kahargyan Nugraha
Sponsor: William Casey, Ph.D.
Chemistry

Scandium's importance and use have been steadily increasing over the decades, resulting in renewed interest in the metal's recovery from industrial processes. Scandium aqueous complexes are of interest to the semi-conductor industry as precursors of metal-oxide thin films. To better understand the speciation of aqueous Sc(III), Nuclear Magnetic Resonance (NMR) has been used for solution characterization. Here, we use ^{45}Sc NMR to study Sc(III) aqueous speciation at two different conditions (pH 3.40 and 3.80) and in the temperature range of 295 – 340 K. We believe that the rates of conversion of the monomeric species to the hydroxy-bridged aqua dimer can be measured via ^{45}Sc NMR, and account for the conspicuous peaks. The resulting NMR plots suggest a coalescence between the two species, which was interpreted using the Bloch-McConnell equations for broadening of an NMR signal due to interconversion. The results of the analysis are promising but indicate that the experimental data cannot be confidently interpreted as arising solely from interconversion of the aquated monomer to the dimeric forms. Knowing the speciation and their respective environments provides insights as to how speciation occurs on Earth's surface and thus improves the metal's extraction and recovery processes.

Oomycete Effector Gene Candidates Identified Using Machine Learning and Lineage-Specificity

Munir Nur
Sponsor: Richard Michelmore, Ph.D.
Plant Sciences

Oomycetes are plant pathogens that induce a wide variety of diseases, including downy mildew, late blight, and sudden oak death. Oomycetes infect important crops by secreting “effector” proteins that can manipulate hosts to the pathogen’s advantage and suppress host defences that allow for cell death and resistance. Plant hosts combat oomycetes by evolving defenses that recognize effectors, which creates an evolutionary battle over generations of plant-microbe interactions. This evolutionary race results in effector genes that are difficult to computationally identify due to high sequence diversity. In my project, I am constructing high-confidence effector classification models using genomic sequences of experimentally validated oomycete effector genes. I have incorporated several underlying sequence properties as features, looking below the textual data to extract hidden similarities in the divergent effectors. As a model species, I will be running my machine learning classifier on Bremia lactucae (which causes Lettuce Downy Mildew) and evaluate results with another dataset I have curated comprised of lineage-specific genes in B. lactucae. This dataset consists of divergent genes in B. lactucae that share little sequence similarity with any gene in other oomycete genomes. I will evaluate overlaps between predicted effectors and lineage-specific genes to further understand traits of oomycete effectors.

Collagen Increases More Than Contractile Proteins During Muscle Hypertrophy

Jed Keenan Obra
Sponsor: Keith Baar, Ph.D.
Neuro Physio & Behavior

Collagen is the most abundant protein in the body and functions as the primary protein of connective tissues. In muscle, collagen fibrils function to hold muscle fibers together and transmit force to tendons. Functional overload (FO) is the removal of synergist muscles, which causes a significant (~70%) compensatory hypertrophy of the remaining muscle. The purpose of the study is to quantify collagen content and orientation changes resulting from FO. It is hypothesized that collagen increases in proportion to the muscle mass as a result of FO. To test this hypothesis, the content and concentration of collagen of the plantaris muscle was determined fourteen days after removal of the gastrocnemius and soleus muscles. Using a hydroxyproline assay, fourteen days of FO was shown to result in a 4-fold increase in collagen concentration and an 8.8-fold increase in collagen content. Picrosirius red staining is currently being performed to establish whether the orientation of collagen changes as the protein increases. Since collagen plays an important role in force transmission, understanding the regulation and importance of collagen within the growing tissue will provide essential information for maintaining muscle strength during rehabilitation and aging.

Phosphorylation of TIMELESS Regulates its Function in the *Drosophila* Circadian Clock

Christopher Ochoa
Sponsor: Joanna Chiu, Ph.D.
Entomology/Nematology

The circadian clock is a highly conserved molecular mechanism that generates daily rhythms in organismal physiology, biochemistry, and behavior. TIMELESS (TIM) is a core clock protein and a critical component of the circadian oscillator. TIM interacts and heterodimerizes with PERIOD (PER) in the cytoplasm, enabling PER to enter the nucleus in early night to begin repression of their own transcription and other clock-controlled genes in a time-of-day specific manner. As a light sensitive protein, TIM allows the circadian clock to synchronize with the external day-night cycle. Entrainment and/or resetting of the circadian clock relies on light-dependent TIM degradation, which is hypothesized to be regulated by phosphorylation. To investigate the specific phosphorylation events that are important in regulating this light-mediated regulation of the circadian clock, we generated transgenic Drosophila fly lines carrying mutations in TIM phosphorylation sites, mapped by Mass Spectrometry. Circadian activity assays and TIM protein analysis are underway to determine how the mutation affects clock function and TIM cycling. Preliminary data shows one of the TIM mutants has a shortened period in activity rhythm and a higher level of TIM in the day compared to WT, possibly due to decreased light sensitivity.

Spatial Navigation in Aging

Daisy Ochoa
Sponsor: Beth Ober, Ph.D.
Human Ecology

Deficits in spatial navigation and episodic memory occur in normal aging. There are two neurocognitive systems for spatial navigation: one is based on navigation learning, which shares neurological and behavioral components with episodic memory; the other is based on map learning, which seems to depend on semantic memory processes. Given elderly normals’ (ENs) deficiency in episodic, but not semantic, memory, my lab tested the hypothesis that ENs' performance on a test of spatial location memory (via judgment of relative distance - JRD) would be superior following map-based, versus navigation-based, spatial-location learning trials, whereas YNs' JRD performance wouldn’t differ between types of spatial-location learning. The study included 96 participants (48 ENs and 48 YNs), who were presented with computer-based map and navigation training, focused on learning the location of stores in virtual cities; this was followed by the JRD location-memory task. Results show significant two-way interaction of age by training condition such that ENs (not YNs) had better JRD performance following map-based versus navigation-based training; this supports our hypothesis. Ours is the first study to assess the effects of map- versus navigation training on JRD-based spatial-location memory, within-subjects. Related findings in the literature and implications for future research will be discussed.

Characterization of MAP9 and Kinesin-3 Interaction

Janah May Oclaman
Sponsor: Kassandra Ori-Mckenney, Ph.D.
Molecular & Cellular Bio

The microtubule cytoskeleton serves as the foundational track that allows proteins and signaling transport across the neuronal axon, dendrites, and cell bodies. Microtubule associated proteins or MAPs play a role in the stabilization of the microtubule cytoskeleton and the regulation of vesicular and organelle transport by motor proteins like kinesin and dynein. Thus, disruptions in activity of MAPs affect neuronal health leading to a wide array of neurological and psychological diseases. However, the mechanisms on how MAPs bind and regulate motor proteins are yet to be elucidated. The aim of this research is to characterize the interaction between MAP9 and the motor protein, kinesin-3. Through sequence analysis, we have found several possible interaction sites for MAP9 and kinesin-3. In this study, these hypothesized MAP9 interaction sites were mutated. Mutant MAP9 proteins have been bacterially expressed and purified. Purified MAP9 mutants and kinesin-3 interactions are to be observed using TIRF-microscopy and pulldown assays. In summary, these findings can potentially suggest a mechanism for interaction between MAP9-kinesin 3 that can be applied to other MAPs and used as targets for neuronal activity regulation.

Effect of Air Exposure on Thermal Tolerance in the Lined-Shore Crab, *Pachygrapsus crassipes*

Lorenzo Ray Olano
Sponsor: Anne Todgham, Ph.D.
Animal Science

Pachygrapsus crassipes, is an intertidal crab found along the western coast of North America ranging from Baja California to the coast of British Columbia. Animals living in rocky intertidal habitat are thought to be at the upper limit of their thermal tolerance, putting their survival at risk with increasing global temperatures. Previous studies on other intertidal species suggest that higher temperatures can be tolerated in air-exposed conditions than under submerged conditions. In this study, I tested whether the upper thermal tolerance of lined-shore crabs is greater when measured in air versus water. P. crassipes was subjected to thermal tolerance tests either in air-exposed or submerged conditions. To ensure that the results will be comparable, both tests started at the same temperature and ramp up at the same rate (0.3°C•min-1). Infrared sensors attached to the carapace of the crab detect its heartbeat, allowing us to measure heart rate, break point temperature, and flat line temperature. Knowing the interaction between multiple stressors, in this case desiccation stress and thermal stress, and its effect on the organism can help more accurately predict how intertidal species living in highly variable environments will respond to increasing global temperatures.

The Potential Role of Environmental Toxin Exposure in the Blood-Brain Barrier Disruption of Transgenic *l-fabp:DBP-EGFP:flk1-mCherry* Zebrafish

Darielle Ellice Oliveros
Sponsor: Lillian Cruz-Orengo, Ph.D.
VM: Anat Physio & Cell Biology

The blood-brain barrier (BBB), comprised of blood vessels, tightly regulates molecules and cells entering the central nervous system. Disrupting the BBB results in dysfunctional and degenerated neurons leading to the development of neurodegenerative disorders and other neurological diseases. Studies have shown exposure to environmental toxins, such as pesticides used in farming, can cause neurotoxicity and brain cancer among children and adults in farming communities. This project aims to determine the potential role of environmental toxin exposure in disrupting the BBB of transgenic Tg(l-fabp:DBP-EGFP:flk1-mCherry) zebrafish. Juvenile and adult zebrafish are exposed to pervasive pesticides commonly used in Central Valley. The amount of toxin concentration lethal to half of the cohort (LC_{50}) is determined and utilized in exposing succeeding groups. The LC_{50} cohorts are observed for BBB disruption through the leakage of specific proteins associated with BBB permeability. The location of endothelial cells forming the walls of BBB blood vessels is determined through the expression of fetal liver kinase 1 (flk-1) tagged with a red fluorescent protein (mCherry). BBB leakage is estimated using vitamin D-binding protein (DBP) with green fluorescent protein (EGFP). Through this study, we can potentially elucidate the relationship between environmental toxin exposure, BBB disruption, and development of neurological disorders.

Examining Maternal Mortality among African American Mothers: Using Critical Discourse Analysis to Identify Bias

Marina Olney
Sponsor: Sarah Perrault, Ph.D.
University Writing Program

Rate of maternal mortality persists as one of the most revealing markers of a country's overall health. For many U.S. obstetrics experts, maternal mortality is not a modern issue, and was eliminated with the introduction of antibiotics and asepsis. Since the 1980's, however, the rate of maternal mortality has increased among all American mothers, and, more alarmingly, black mothers are four times more likely than white mothers to die from pregnancy-related complications. Disconcertingly, this problem has been largely ignored by policymakers who instituted 'Maternal Mortality Review Boards' in each state only after considerable instigation. This study uses critical discourse analysis to examine rhetorical nuances in both the Maternal Mortality Review Boards and other independent studies. Specifically, I analyze how an interplay of discourse of condescension and manipulative silences may contribute to a dismissive stance on the issue. Taking into account omissions, concealments, and intentional ambiguities within the texts, my research aims to understand how people may be manipulated by public discourse and thus subject to misinformation. Ultimately, this research demonstrates a new perspective on a growing issue, one which might help identify, and possibly remedy, some of the biases that contribute to health outcome disparities for African American mothers.

Inhibition of the Core Binding Factor influences cellular sensitivity to chemotherapy in canine osteosarcoma

Amanda Ormonde
Sponsor: Luke Wittenburg, D.V.M.,Ph.D.
VM: Surg/Rad Science

During skeletal development, the transcription factor RUNX2 and the core-binding factor subunit beta (CBFß) form a heterodimer that allows the transcription of genes involved in cell differentiation and maturation of osteoblasts. The overexpression and dysregulation of RUNX2 and CBFß in osteosarcoma (OS) promotes a malignant phenotype and assists in DNA damage repair. Small molecule inhibitors of CBFß block heterodimer formation and subsequent activity. The chemotherapy drugs doxorubicin (DOX) and carboplatin (Carbo) induce DNA damage and, when combined with CBFß inhibitors, may have a synergistic effect through impeding RUNX2-mediated DNA damage repair. Thus, combinations with CBFß inhibitors may allow for a smaller dose of these toxic chemotherapy drugs while preserving efficacy. My project aims to quantify the effects of combinations of the CBFß inhibitor AI-10-104 with DOX and Carbo at clinically relevant drug concentrations. We hypothesized that combinations of CBFß inhibitor and chemotherapy would have a synergistic effect, possibly through inhibition of RUNX2-mediated DNA damage repair. We found synergism in the AI-10-104 and DOX combination and AI-10-104 and Carbo combinations in some cell lines at higher concentrations, and slightly antagonistic effects in other cell lines. Our results partially support the hypothesis, but demonstrate that effects are cell-line dependent.

Introduction of Glucosinolate-Myrosinase Plant Defense Pathway to *Nicotiana benthamiana*

Izaiah Ornelas
Sponsor: Patrick Shih, Ph.D.
Plant Biology

65% of all US crops are lost to pests and 3 billion kilograms of pesticides are annually applied, which have detrimental impacts as excess use of agrochemicals may have unintended effects on the surrounding environment. Glucosinolates are an organic secondary metabolite product only found in the Brassica order, which shows toxicity, growth inhibition, and feeding deterrence to a variety of potential plant enemies. These secondary metabolites upon attack of insects or pathogens are hydrolyzed by thioglucoside glucohydrolases (Myrosinases) to form a variety of compounds that include isothiocyanates, which is the toxic active compound. Using transient expression, plant metabolism will be engineered to introduce a glucosinolate pathway with particular Myrosinases (TGG2, TGG4, PEN-2, PYK10) into a heterologous system, Nicotiana benthamiana (tobacco). In the prototypical pathway from Arabidopsis thaliana, Myrosinases are compartmentalized from glucosinolates to prevent self-harm. In attempt to control the activity of isothiocyanates in tobacco, Myrosinases will be targeted to their native location and to the chloroplast. After inoculation of plant leaves, tissue samples will be collected to inspect for intended and unintended compounds using mass spectrometry. Upon simulation of maceration by a predator, mass spectrometry will determine which metabolites are formed.

Who Chooses Agriculture? Meeting the Demand for a Skilled Agricultural Workforce

Izaac Ornelas
Sponsor: J Taylor, Ph.D.
Ag & Resource Economics

Are there enough people going into agriculture occupations to meet future food demands of a growing population? Preliminary analysis using the American Community Survey (ACS) has shown since 2009 a negative trend of those receiving degrees in agriculture. The purpose of this study is to understand if individuals who are getting agricultural degrees end up in agricultural occupations. Further investigation using a probit regression model display the effect of having an agriculture degree on the probability of agricultural employment is decreasing over time; but everything else constant the probability of employment is not decreasing over time. This might be the result of a growing agricultural industry that is relying more on technology and other skills usually found in urban industries. Otherwise, those who have higher educational attainment beyond high school—as well as being female— have been predicted to have a lower probability of working in agriculture. Moreover, living and being born in certain states seem to have an effect on this probability but differ depending on the area. This may signify a demand for higher education institutions to experiment with tactics to draw more students into agricultural degrees to resolve issues in agriculture.

Gender Transitioning Through the Voice: An Acoustic Analysis of Male-to-Female Transitioning Over Time on YouTube

Divine Joyce Otico
Sponsor: Georgia Zellou, Ph.D.
Linguistics

Transgender individuals use social media platforms to blog their gender transition. YouTube is used as a platform to give a voice to their story while sharing and educating others through their own experiences. Voice is a crucial part of their new gender identity. Gender dysphoria is when one's gender assignment does not match an individual's gender identity, and this can apply to the sound of one's voice. For transgender individuals transitioning from Male-to-Female (MtF) a gender-nonconforming voice could negatively impact their sense of self-identity. MtF transgenders struggle because hormone therapy cannot reverse physical changes of the larynx that occurs after a biological male experiences' puberty. Acoustic features such as voice quality and pitch can signal a person's gender to others. MtF transgenders have been shown to manipulate voice features to match their gender identity. This research project focuses on measuring the acoustic properties of a transgender individual's speech from YouTube videos that document her gender transition over a 5-year period. We examine changes in fundamental frequency (f0), voice quality, and vowel articulation to understand how gender identity transitioning realized in voice changes and how voice features are related to gender performance and apparent gender.

Disbudding Effects on Lying and Ruminating Behaviors in Dairy Calves

Chela Owens
Sponsor: Cassandra Tucker, Ph.D.
Animal Science

Hot-iron disbudding is the practice of cauterizing horn bud tissue before it attaches to the skull to prevent horn growth in dairy calves. The resulting wounds are sensitive to touch during healing, but not much is known about whether calves experience ongoing, non-evoked pain in the weeks after disbudding. Changes in maintenance behaviors like lying and ruminating may indicate when an animal is in pain. Our objective was to observe how disbudding affects lying and ruminating patterns in dairy calves. The study consisted of a disbudded group (n=11) and a control group (n=11) that were observed in 5-min scan samples for 24 hours once a week for 3 weeks. The behaviors we recorded were lying, lying posture, and ruminating. Compared to controls, disbudded calves ruminated less in the first 2 weeks after disbudding (mean ± SE: 10 ± 1% vs 18 ± 2% of total time), tended to lie more in the third week (73 ± 1% vs 70 ± 1%), and were more likely to lie with their head down (31 ± 1% vs 26 ± 1% of total lying time). These results suggest that calves are experiencing ongoing pain in the first 3 weeks after disbudding.

Reconstructing a Lost Manuscript: The Quest for Felipe de Pamanes' *Notables del Perú*

Berenice Padilla-Vilchis
Sponsor: John Slater, Ph.D.
Spanish & Portuguese

This study reconstructs the lost manuscript Los notables del Perú by Felipe Pamanes. Pamanes traveled to Peru in the 1500s to observe nature and write about colonial life, but the manuscript he created disappeared sometime after 1620. We know of only two men in history who read Pamanes' work firsthand, both during the seventeenth century: the authors Antonio de León Pinelo and Bernardo de Cienfuegos (whose work exists only in manuscript). Both Cienfuegos and León Pinelo quote and paraphrase pieces of Pamanes' Los notables del Perú; studying these quotations systematically has allowed us to piece together and further understand Pamanes' lost manuscript. Understanding Pamanes' manuscript is important because León Pinelo's quotations of Pamanes became important source materials for nineteenth-century US historians writing about Peru. This reconstruction of Pamanes lost manuscript is an opportunity to illustrate the importance of the originality of his work for the first time in four hundred years.

An Examination of the Relationship Between Language Ability and Attention-Deficit/Hyperactivity Disorder (ADHD) Symptoms in Young Children

Marialena Palacios Lopez
Sponsor: Julie Schweitzer, Ph.D.
MED: Psychiatry & Behav Sci

For children, developing self-control is a critically important step toward success in academic settings and social relationships, yet there are few non-pharmacological approaches that successfully contribute to increased self-control. The present study focused on parent and teacher reports to help us better understand how language skills in early childhood are related to hyperactivity and inattention, symptoms often associated with a diagnosis of ADHD. Preliminary analysis focused on two screening measures: the NIH Toolbox Picture Vocabulary Test (TPVT) and ADHD Rating Scales. The TPVT is a measure of language skills and is commonly used as a brief cognitive screener. The ADHD Rating Scales are a measure of hyperactivity and inattention in children. The scores from both of these measures were analyzed to examine the relationship between hyperactivity, inattention, and language skills. Preliminary results show small negative correlations between hyperactivity and language skills as well as between inattention and language skills for males and females. These findings suggest further research could be useful to show how symptoms associated with disorders such as ADHD relate to language and cognitive abilities, and thus provide more information how to approach hyperactivity and inattention in the classroom and at home.

Electrochemical Detection of Redox Molecule Release from Nanoporous Gold Thin Films

Barath Palanisamy
Sponsor: Erkin Seker, Ph.D.
Elect & Comp Engr

Nanoporous materials have attracted significant attention for drug delivery applications. In this study, we use electrochemical means to detect release of ferricyanide coupled with ferrocyanide (FF – both small-molecule redox markers) from nanoporous gold (np-Au) thin film coatings. Previous studies have demonstrated the controlled release of fluorescein (small-molecule drug surrogate), where the quantification was performed with a fluorescence microscope and spectrometer. However, the reliance on this large instrumentation limits its translation to implantable medical devices, where a small factor is crucial. To address this shortcoming, we have investigated FF as electrochemically-active small-molecule drug surrogates, for which quantification is done by a scalable electrical monitoring modality. Using a 3-electrode system with planar gold (pl-Au), Ag/AgCl reference electrode, and platinum counter electrode, we performed square wave voltammetry (SWV) protocol to quantify concentration of FF molecules. In this quantification setup, an electrochemical current peak (characteristic to FF) is observed where the magnitude of the peak scales linearly with the FF concentration in the eluate. The results suggest that np-Au thin films retain and release FF. Our current studies focus on the release profile of FF. We expect the outcome of this research to pave the road for advanced implantable drug delivery systems.

Virtue Ethics and the Problem of Abortion

Wesley Park
Sponsor: Jan Szaif, Ph.D.
Philosophy

The problem of abortion is one of the paradigm cases in medical ethics. Traditional debates on abortion have centered around moral status and women's rights. It is an interesting question whether and to what extent a fetus has moral status, as well as how the competing rights of the woman and fetus are supposed to be judged. Rosalind Hursthouse, however, eschews both of these considerations as fundamentally irrelevant to the morality of having an abortion (sidestepping the political question of how it should be regulated). Hursthouse argues that the ethics of abortion is best explained by Aristotelian notions of virtue, practical wisdom, and eudaimonia or human flourishing. This innovation of applying virtue ethics to concrete issues in bioethics is representative of recent scholarship in modern moral philosophy; however, relatively little has been said on Hursthouse's position on abortion. In this thesis, I will set up and further the debate between Hursthouse's neo-Aristotelian virtue ethics approach to the problem of abortion and the other two approaches based on moral status and women's rights.

Nitrogen Footprint Reduction Scenarios for UC Davis

Shona Paterson
Sponsor: Benjamin Houlton, Ph.D.
Land Air & Water Resources

Nitrogen is a necessary nutrient in both human and natural ecosystems; however, excess anthropogenic reactive nitrogen can lead to declines in global human health, biodiversity, and air and drinking water quality. Building upon the Nitrogen Footprint calculated last year, we are updating our 2016-2017 baseline measurements with new and more complete information using the Sustainability Indicator Management and Analysis Platform (SIMAP). In addition, we are simulating scenarios for future emissions and developed comparisons across similar institutes. By determining which UC Davis sectors emit more reactive nitrogen than other comparable universities, we are targeting potential areas for emission reductions. To assess the effectiveness of potential reduction measures we are creating simulations that project the effect that various nitrogen reducing actions will have on the total footprint of the university. Thus, we will develop a foundation of data that can be used to help guide policy in creating a nitrogen reduction plan.

Screening for Potential Microbial Biocontrol of Fire Blight

Honey Pathak
Sponsor: Rachel Vannette, Ph.D.
Entomology/Nematology

Erwinia amylovora, the causal agent of the fire blight, is a destructive bacterium that generates damage in excess of millions of dollars for growers of pome fruits. Current control measures like antibiotic application are no longer cost-effective due to increased risk of resistance and frequent reapplication. The purpose of this study was to measure the effectiveness of novel bacteria and fungi isolated from both agricultural and native Californian flowering plants as prospective biocontrol agents of E. amylovora. Effectiveness was screened in vitro and in vivo using various competitive, growth-inhibition and freezing assays. Assays were also paired with individual growth assays of novel isolates across artificial floral nectar media that varied in resource content, to determine links between species' niche requirements and E. amylovora inhibition. Microbial antagonists that were most effective at inhibiting E. amylovora. (a) reduced its maximum growth rate, (b) lengthened its doubling time, (c) reduced its carrying capacity, and (d) decreased the time to the inflection point. Many fungi and bacteria were as or more effective than current antagonists including P. fluorescens (PfA506, Blight Ban) and that indicators of the biocontrol agents' growth can predict suppression in some cases.

Fusarium falciforme is a previously unrecognized pathogen of cowpeas, present in California

Andrea Paulk
Sponsor: Cassandra Swett, Ph.D.
Plant Pathology

Cowpea (Vigna unguiculata) is an important member of dry bean production systems for many countries, including the United States. In 2018, a fungus, F. falciforme was recovered from cowpeas suffering from root rot in a California field. This species has not been documented as a pathogen of cowpea but is known to cause root rot in lima beans, leading us to hypothesize that it is a pathogen of cowpea. To test this hypothesis we conducted Koch's postulates, evaluating four F. falciforme isolates for pathogenicity on two cowpea lines, CB46rk2 and N2, via root dip inoculation. For both lines, F. falciforme initiated symptoms one week after inoculation and by 65 days, most plants were severely stunted and yellow. Reflecting this, plant biomass was reduced from 150g in control plants to 20-70g (average) in diseased plants, and pod biomass was lower (3g average) in inoculated plants compared to non-inoculated plants (35g average). In some cases disease only developed in CB46rk2 but not in N2, suggesting that these lines may vary in susceptibility. F. falciforme was re-isolated from symptomatic plants. Our results suggest that F. falciforme is a new pathogen of cowpea. Further studies can evaluate economic impact and management options.

Analysis of Tree Stem Respiration in Distinct Environments

Janie Paz
Sponsor: Dirk Van Vuren, Ph.D.
Wildlife & Fisheries Biology

Plants not only respire through their leaves, but also their woody tissues (stems). Stem respiration is an important, but is a relative poorly understood component of ecosystem carbon cycling. To better understand the relationship between stem respiration and biological, chemical and environmental drivers, we measured stem respiration (CO_2 flux) of trees from five species, Clitoria speciosa, Melia azedarach, Ceiba speciosa, Ficus carica, and Brachychiton rupestris in two environments; the tropical rainforest biome, savanna biome, and orchard at Biosphere 2, and the arboretum at the University of Arizona campus). We hypothesized that CO_2 fluxes would be positively related to mitochondrial activity (more CO_2 production), temperature (greater respiratory activity), and wood density (higher density of mitochondria). Wood pH, on the other hand, should negatively affect CO_2 fluxes because as pH increases, more CO_2 remains in the tree sap as bicarbonate. Our results suggest a strong correlation between CO_2 flux and mitochondrial activity of stems.

UHP Mental Health Initiative

Princess Pe
Sponsor: Eva Schepeler, Ph.D.
Psychology

The state of mental health among college students is an issue that has been thoroughly studied in recent years after increased public awareness. What is lacking, however, is research specifically on honors students' mental health which we suspect is uniquely at risk because of the high expectations to succeed placed on them by themselves and others. This study aims to shed light on this issue by administering a survey to students in the University Honors Program (UHP) at UC Davis asking students about their UHP experiences, their mental state, and their knowledge of campus mental health resources. The preliminary results of this investigation suggest that honors students are stressed about honors classes, lack of support from UHP staff, and program requirements (i.e. GPA). The ultimate results of this survey will be used to produce a series of mental health workshops for honors students and will provide insight to UHP staff on how to best support students in UHP. Overall, these results will serve as a starting point for shifting the culture surrounding mental health in honors students, so that future UHP students will be better prepared to manage their stress and consistently prioritize their mental health.

Nitrogen Footprint Reduction Scenarios for UC Davis

Kami Peer
Sponsor: Benjamin Houlton, M.D.,Ph.D.
Land Air & Water Resources

Nitrogen is a necessary nutrient in both human and natural ecosystems; however, excess anthropogenic reactive nitrogen can lead to declines in global human health, biodiversity, and air and drinking water quality. Building upon the Nitrogen Footprint calculated last year, we are updating our 2016-2017 baseline measurements with new and more complete information using the Sustainability Indicator Management and Analysis Platform (SIMAP). In addition, we are simulating scenarios for future emissions and developed comparisons across similar institutes. By determining which UC Davis sectors emit more reactive nitrogen than other comparable universities, we are targeting potential areas for emission reductions. To assess the effectiveness of potential reduction measures we are creating simulations that project the effect that various nitrogen reducing actions will have on the total footprint of the university. Thus, we will develop a foundation of data that can be used to help guide policy in creating a nitrogen reduction plan.

Function-Oriented Synthesis Yields an Improved Psychoplastogenic Analog of Iboga Alkaloids

Alexander Pell
Sponsor: David Olson, Ph.D.
Chemistry

Ibogaine is a naturally occurring alkaloid that has great therapeutic potential as it has been shown to reduce drug cravings in human clinical trials. However, in addition to these medicinal effects, ibogaine is also a powerful hallucinogen that carries some health risk as a hERG inhibitor. Our group hypothesizes that ibogaine's beneficial effect of reducing relapse stems from its ability to promote neuroplasticity and facilitate change in regions of the brain relevant to drug dependence—specifically the prefrontal cortex. Not much is known about what structural features are responsible for giving ibogaine these anti-addictive properties. So, to better understand the structure-activity relationships, we synthesized a series of analogs that each maintained some of ibogaine's key structural motifs while also varying functional groups. These analogs were then tested using in vitro neuroplasticity assays which revealed that certain functional groups allowed the analogs to maintain ibogaine's neuroplasticity-promoting effects while others almost completely removed symptoms associated with hallucinations. These results allowed us to design an optimized analog of the iboga alkaloid tabernanthine. Further in vivo and in vitro assays confirmed that this analog is capable of promoting neuroplasticity while producing minimal behavioral effects associated with hallucinations.

Phenotypic Traits of *Plantago lanceolata* as Related to Population Structure and Herbivory

Sophia Pelletier
Sponsor: Jennifer Gremer, Ph.D.
Evolution & Ecology

This project is a continuation of a study on the globally-distributed perennial plant Plantago lanceolata that has been conducted annually since 2015. This study uses the protocol of Plant Pop Net, an international project, which aims to understand the factors driving the spatial dynamics of plant populations in response to climate change using data from P. lanceolata populations around the world. At our site in Davis, CA, we measured abundance and phenotypic traits of P. lanceolata for three years. Trait data included floral characteristics, phenology, morphology, and signs of herbivory. Using these data, we will compare density and herbivory experienced by different plants within our transect, as well as how how the population structure has changed over time. The results of this study can be used to further understand how plants respond to herbivory and competition, and a continuation of this study will allow us to ask questions in the future about the factors influencing these traits, including disease and climate change.

Phenotypic Traits of *Plantago lanceolata* as Related to Population Structure and Herbivory

Serra Perry
Sponsor: Jennifer Gremer, Ph.D.
Evolution & Ecology

This project is a continuation of a study on the globally-distributed perennial plant Plantago lanceolata that has been conducted annually since 2015. This study uses the protocol of Plant Pop Net, an international project, which aims to understand the factors driving the spatial dynamics of plant populations in response to climate change using data from P. lanceolata populations around the world. At our site in Davis, CA, we measured abundance and phenotypic traits of P. lanceolata for three years. Trait data included floral characteristics, phenology, morphology, and signs of herbivory. Using these data, we will compare density and herbivory experienced by different plants within our transect, as well as how how the population structure has changed over time. The results of this study can be used to further understand how plants respond to herbivory and competition, and a continuation of this study will allow us to ask questions in the future about the factors influencing these traits, including disease and climate change.

Thermogenesis Impaired by DDE as Early as Parturition in Female Mice

Evelyn Pena
Sponsor: Michele La Merrill, Ph.D.
Environmental Toxicology

Perinatal exposure to the pesticide dichlorodiphenyltrichloroethane (DDT) and its metabolite dichlorodiphenyldichloroethylene (DDE) has been associated with an increased susceptibility to diabetes and obesity. Our study focused on the onset of impaired thermogenesis as a pathway to these metabolic defects in mice perinatally exposed to DDT and DDE. We hypothesized that DDT or DDE exposure would result in defective heat generation as early as parturition, as assessed through an away from nest cold challenge. We utilized infrared thermal imaging to measure the output of brown adipose thermogenesis after a ten-minute incubation at 37°C and a nine-minute cold challenge at room temperature. The change in body temperature over the entire nine-minute interval revealed females exposed to DDE experience a loss of heat at a greater rate than the control, as measured through the slope. For females exposed to DDT, results show a similar trend ($p=0.08$) to the DDE groups. There was no significant difference in heat loss between treated and control groups in males. This is the earliest time point we have detected DDE related impaired thermogenesis in females perinatally exposed to the pesticide metabolite.

An Endowment of Justice: Examining the Dynamism of the Political Agency of the Common People in Classical Islamic Thought

Adnan Perwez
Sponsor: Mairaj Syed, Ph.D.
Religious Studies

The conceptualization of the role of the common people and their political agency within classical Islamic thought has often been seen through prominent socio-political models of the day, which drew on pre-Islamic themes of imperial hierarchy, social reciprocity, and definitions of justice to construct an ideal Community. Yet the relative rigidity of these conceptualized models were nuanced and at times even countered by reformist thinkers present within the tradition, who could present a new imagination of the role common people should play. This project specifically focuses on helping examine the imagined political agency of the common people, and thereby different conceptualizations of the ideal Community at large, by exploring the tension and alignment between prominent socio-political models present throughout Islamic history with the works of prominent classical reformist thinkers like Al-Ghazali and Ibn Taymiyyah. In addition to pursuing the core thematic idea of the common people's political agency through the lens of this framework, the project examines potential common trends that gave rise to these particular moments of reformism — raising a set of questions on the larger underlying tensions within the tradition, that can point the way for future research examining the different conceptualizations of the Community.

Structural Characterization of the Serotonin-Binding Protein L194D1 Using X-ray Crystallographic Methods

Ngoc Phuong Chi Pham
Sponsor: Andrew Fisher, Ph.D.
Chemistry

Our research looks into the production of a fluorescent serotonin sensor, named L194D1, for crystallization. The overarching aim of creating such a sensor is for optical interrogation of neural circuits. Previous work done by a collaborator included redesigning the binding pocket of an existing protein in order to recognize serotonin. Using single crystal x-ray diffraction technique, it was possible to determine the three-dimensional structure of the protein. However, no serotonin was present in the crystal structure. The goal of this project is to obtain another crystal structure with serotonin present in the binding pocket. In order for the above goal to be achieved, we grew cultures of E. coli BL21 (DE3) containing the plasmid pRSET-A-L194D1, purified the protein using a Ni^{2+}-NTA column and set up crystal trays using varied protein concentration. We are currently conducting crystallization trials using a variety of crystallization conditions and serotonin concentrations in order to obtain crystals for X-ray crystallography and ultimately observe serotonin in the binding pocket.

Political - Religious Landscape: Conditions and Patterns

Kelley Phan
Sponsor: Zeev Maoz, Ph.D.
Political Science

Each country has their own unique relationship between politics and religion. This relationship can promote a high or low level of political restrictions on religion; affecting the amount of influence a religion may have within a country's political institutions. Naturally, a country's history and number of religious groups take part in this relationship. However, countries, such as the Egypt and Mali, with similar levels of religious diversity do not have the same levels of political restrictions placed on religion, but what seems to differ between these countries are their levels of development. What then affects the level of religious influence within a country's political institutions? Using data from the Religion and State Project, the World Religion Project, and United Nations Human Development Report, I conduct a quantitative analysis that studies whether a relationship exists between a country's level of religious diversity, human development and political restrictions on religion. Initial findings suggest that countries with low development will have less political restrictions on religion if their population is less diverse. With these results, further studies in this area can more accurately predict under what conditions will a country have more or less religious presence in their political and everyday lives.

Mental Rotation Abilities in Infants

Lindsey Phillips
Sponsor: Lisa Oakes, Ph.D.
Psychology

Mental rotation is the ability to mentally manipulate a visual representation of an object. This ability develops during infancy, and may be influenced by the emergence of motor skills, such as sitting and crawling, that afford infants the opportunity to actively explore their environment. To evaluate the relationship between mental rotation abilities and motor development, we tested infants in an exact replication of a mental rotation task conducted by Lauer, Udelson, Jeon, & Lourenco (2015) and assessed motor abilities using the Alberta Infant Motor Scale (AIMS). To assess mental rotation, we presented infants with two stimulus streams, side-by-side. Both streams showed the same object rotating at different orientations, but one stream showed a mirror image of the object on every third presentation. Our group analyses did not replicate the findings reported by Lauer et al. (2015). We found that infants' preference for the impossible rotation was not significantly greater than chance. Our analyses also found no evidence that male infants perform better in the task than female infants. Ongoing analyses are examining how the onset of motor abilities, such as crawling, are related to infants' performance in the mental rotation task.

The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Gulf of Arabia" in the New York Time (1900-1909)

Hannah Phillips
Sponsor: Suad Joseph, Ph.D.
Anthropology

My research is focused on analyzing the representation of the Middle East during the decade of 1900-1900 by using textual data from the New York Times (NYT). I have used the ProQuest Historical data base as the search tool with a focus on the "Gulf of Arabia" or "Persian Gulf". The terms is primarily represented as the "Persian Gulf" with few instances where it is referred to as the "Arabian Gulf" or the "Gulf of Arabia". Through my research, I have found 54 articles which are related to my term 32 of which are critically analyzed and of relevance. From my findings the region becomes central to a growing international conversation around interests of the establishment of the Bagdad Railway and obtaining a protectorate status over the Gulf regions. I argue that the NYT's representation of this regional discourse focuses on delegitimize local authority, and position the Gulf of Arabia as symbolizing an economic axis point which would allow for European Empires to strategically position themselves to control both East and West trading lines. This research is conducted along with Dr. Suad Joseph's media project that looks at the New York Times representation of the Middle East from 1850-2016.

What Sequences Can Support Transcription Initiation in Response to Stimulatory Introns?

Alice Pierce
Sponsor: Alan Rose, Ph.D.
Molecular & Cellular Bio

The production of a functional protein is regulated at different stages and through many different mechanisms during gene expression. Intron-mediated enhancement in which certain introns lead to an increase of mRNA expression is one such method that is poorly understood. Remarkably, a 300 nucleotide promoter deletion that removes all Transcription Start Sites (TSS) of a gene construct is still expressed if it contains a stimulatory intron. The intron somehow causes transcription to start in regions that do not usually act as TSS, showing that flexibility exists in the sequences that can act as TSS. However, a larger deletion of the promoter eliminates expression, which indicates that not all sequences can act as TSS. We would like to learn about which DNA sequences can act as TSS as well as those that cannot. We will test this by inserting random genomic DNA into the larger promoter deletion in reporter gene constructs containing stimulatory introns. We will then determine what kind of sequences can allow for transcription to initiate in response to stimulatory introns.

Interactions During Shared Book Reading: Spanish-English Bilingual Children and their Parents

Cecilia Plascencia
Sponsor: Yuuko Tonkovich, Ed.D.
Education

Past studies with preschoolers and younger have shown that bilingual parents tend to read to their children in the language that is most spoken at home. Also, bilingual parents read in the language they are most comfortable reading in. Parents engaged their preschooler by pointing to illustrations that might relate to the child, providing yes/no questions, giving more descriptions, and providing positive feedback (Rodriguez, Hines,& Montiel 2009). The goal of this study is to understand how Spanish-speaking parents interact with older children, specifically with a kindergarten child while reading a bilingual book. The research questions are (1) What languages do Spanish-speaking parents use with their Spanish-English bilingual children when reading bilingual books? (2) What are some strategies Spanish-speaking parents engage in when reading to their children? A total of 12 Spanish-speaking parent-child dyads were asked to read a Spanish-English bilingual book, Radio Man by Arthur Dorros together. Preliminary results show that parents tended to read mostly in Spanish. When the parent engaged, they would ask questions about the text and point to the illustrations. Results suggest that bilingual books provide opportunities for parents and children to read in a language that they feel most comfortable in.

Should Multiethnic Adolescents Be Considered Their Own Ethnic Group?

Elise Pohlhammer
Sponsor: Adrienne Nishina, Ph.D.
Human Ecology

Multiethnic individuals (belonging to two or more ethnic groups) are projected to exceed 11% of the US population by 2060. To better understand how researchers can categorize such individuals by ethnicity, this study: (1) compared multiethnic adolescents to all other monoethnic adolescents and (2) examined them as a freestanding ethnic group similar to traditional groups (e.g White, Latinx). Tenth-graders in California and Oregon (N = 590; 50% male; 6.6% African-American, 16.9% Asian-American/Pacific Islander, 30.9% White, 25.6% Latinx, 17.5% Multiethnic) were surveyed on openness to cross-ethnic friendships and the centrality of ethnicity to one's overall identity. ANOVA results suggest that multiethnic adolescents do not differ from monoethnic adolescents overall in ethnic centrality. However, when multiethnicity was treated as its own ethnic group, multiethnic adolescents, along with ethnic minority adolescents, had higher centrality than White youth; this may suggest that multiethnic adolescents view themselves collectively as a group. Additionally, multiethnic adolescents were more open to cross-ethnic friendships than monoethnic adolescents, a difference driven by the multiethnic adolescents reporting more openness specifically than Latinx adolescents. These findings suggest that multiethnicity might be best considered an ethnic group and that greater openness to diverse friendships may be a positive aspect of multiethnic identity.

Associations Between Breastfeeding Duration and Early Language Ability

Chesna Pokharel
Sponsor: Simona Ghetti, Ph.D.
Psychology

The American Academy of Pediatrics recommends six months of exclusive breast feeding; however, according to the CDC only about 50% of US babies are breastfeed after six months of age (1). Infants that consume breastmilk for longer in early life have shown to have higher language ability in middle childhood (2). We expected that children with longer durations of breast feeding will have better vocabularies and language ability regardless of age, formula supplemental feeding, and mother's education level at age 2. We conducted an observational study of 22 children ranging from 24-35 months of age. Breast feeding and language ability data were assessed via parent-reported surveys. We conducted a multiple linear regression to predict language ability based on duration of breast feeding and child age. Our regression equation was not significant ($F(1,18) = 1.06$, $p = 0.37$, $r^2 = 0.005$). This indicates that child age and breastfeeding duration are not sufficient predictors of language ability in toddlers. Currently, the results are nonsignificant. Our sample consists of families that were primarily white, upper class, and well educated families. We anticipate with added diversity to the sample (data collection is on ongoing), that these differences may emerge.

The Population Genetic Structure of *Zostera marina* Along a Temperature Gradient in Tomales Bay, CA

Kenzie Pollard
Sponsor: John Stachowicz, Ph.D.
Evolution & Ecology

As ocean temperatures increase, organisms can either adapt, move, or die in face of the changing conditions. In these changing conditions, the genotypic diversity of a species is important to consider when predicting the long-term sustainability of the population. The seagrass Zostera marina is a marine foundation species that provides habitat for a diverse animal community as well as valuable ecosystem services. Concurrent research in the lab has shown through a reciprocal transplant experiment that seagrass populations along a temperature gradient in Tomales Bay, CA grow better in their home site than when transplanted to other sites along the temperature gradient. The objective of the current study is to assess whether these phenotypic differences correspond to genetic differences among populations. I am genotyping 45 plants from each site to describe natural genetic structure among sites. Additionally, I am genotyping 48 surviving plants from the reciprocal transplant experiment to assess the relatedness of the surviving clones to the baseline genetic diversity of their homesite. These results will help assess the links between genetic variation, adaptation, and the thermal tolerance of seagrass.

Dealing in Discounts: Second-Degree Price Discrimination and Competition in the Brazilian Rental Car Industry

Mira Pranav
Sponsor: Giovanni Peri, Ph.D.
Economics

Linear-pricing models suggest that average prices in a market fall when competition increases. But, firms have also been found to engage non-linear pricing strategies (i.e. price discrimination) to try to maximize profits. The current literature shows contradictory findings when it comes to determining competition's effect on the way firms engage in price discrimination. My study will look at this relationship between competition and price discrimination in local Brazilian rental car markets. Specifically, I study two types of second-degree price discrimination strategies: quantity discounts ('more for less' deals) and quality discounts ('upgrade for a fraction of the price' type deals). The Brazilian rental car market is a useful empirical environment because it offers both of these discount strategies, as evidenced by data collected through web-scraping. Using regression analysis and the Boik and Takahashi (2018) model as my theoretical framework, I find that as competition increases there is no effect on quantity discounting, while quality discounting increases.

Dissecting the role of callose during cell plate formation

Akaash Prasad
Sponsor: Georgia Drakakaki, Ph.D.
Plant Sciences

Cytokinesis in plants is fundamentally different from that in animals and fungi. In plants de novo formation of a cell plate occurs by fusion of vesicles, which then develops into the new cell wall, partitioning the cytoplasm of the dividing cell. Cell plate formation takes place in multiple stages that involve highly orchestrated vesicle accumulation, fusion and membrane maturation concurrent with the time-specific deposition of polysaccharides such as callose, cellulose and cross-linking glycans. Many questions about cytokinesis remain unanswered: How is the cell plate assembly regulated and coordinated? How does callose contribute to cell plate expansion?
Callose's role in cell plate formation has long been implicated but not deeply understood. Within the family callose synthase Glucan Synthase Like (GSL), GSL8 has been implicated in cytokinesis, as demonstrated by cytokinesis defects in gsl8 mutants. With the application of a variety of techniques primarily including quantitative microscopy modalities and chemical genomics, the role callose biosynthesis during cytokinesis can be elucidated.

The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Asia-Minor" in the New York Times (1900-1909)

Puja Prathi
Sponsor: Suad Joseph, Ph.D.
Anthropology

My research analyzes the representation of the Middle East using articles from the New York Times in the decade 1900-1909. Since the New York Times is considered a liberal and progressive news source my research explores how terms related to the Middle East are depicted. I specifically focused on the term Asia Minor, by reading articles on ProQuest that contain the term within the decade. My initial finding is that Asia Minor is used as an umbrella term: the writer uses it in whatever context it is required. It is also depicted as an entity separate from the Ottoman Empire, which is "open" and "vacant" to the world. Additionally, whenever there is a reference to people from Asia Minor, they are depicted as savages, uncultured, or unfortunate. This research is part of a larger project analyzing 150 years of The New York Times conducted in the lab of Dr. Suad Joseph.

RNF212B, a SUMO E3 Ligase, is Essential for Crossover Formation in Mouse Chromosomes

Rowan Prendergast
Sponsor: Neil Hunter, Ph.D.
Microbiology & Molec Genetics

Crossing-over by homologous recombination during meiosis is essential for proper chromosome segregation at the first meiotic division. We previously reported that RNF212, a SUMO E3 ligase, is essential for crossing-over and fertility in mice. RNF212B is an uncharacterized paralog of RNF212, which shares 30% homology. To investigate the function of RNF212B, we generated Rnf212b knock-out mutant mice using CRISPR-Cas9 technology. Both male and female Rnf212b mutants are infertile. Immuno-staining analysis of surface-spread chromosomes from spermatocytes and oocytes indicates that RNF212B is essential for crossover formation. To better understand how RNF212B promotes crossing-over, the events of meiotic prophase were analyzed in detail. Although the early steps of homologous recombination and chromosome synapsis occur normally in Rnf212b mutants, the ensuing recombination intermediates are destabilized, as indicated by reduced levels of markers such as TEX11 and MSH4. These observations suggest that RNF212B acts by stabilizing recombination factors that promote crossover-specific steps of recombination. Our research will serve to expand our knowledge on the plethora of genes involved in crossover regulation and the underlying causes of infertility and chromosomal disorders that cause miscarriage and birth defects.

Compartmentalized Self-Replication (CSR) Evolution of DNA Polymerases for Difficult Sequence Amplification

Phung Quan
Sponsor: Marjorie Longo, Ph.D.
Chemical Engineering

Polymerase chain reaction (PCR), a ubiquitous molecular biology technique that amplifies a targeted sequence DNA, requires a heat stable enzyme due to high reaction temperatures. Taq polymerase is commonly used in PCR. However, Taq polymerase fails to amplify the G-quadruplexes - found in genome sequencing projects. Optimizing better Taq mutants capable of amplifying G-quadruplexes results in accurate genotyping and fully resolves genomes of interest. Compartmentalized self-replication (CSR) - a simple feedback loop of a polymerase that replicates its own encoding gene, segregates each mutant polymerase into its own droplet within an emulsion, allowing polymerase genes to evolve toward more efficient replication. Droplet digital PCR (ddPCR) exploits droplets - formed in a water in oil emulsion and served as individual test tubes, allowing multiple subunit reactions of CSR in order to screen for optimal mutants. Fluorescence is used to visualize the amplification of target DNA, showing that a new vector is developed as an assay for improving difficult sequencing polymerases. Besides, a challenging template, based on the G-quadruplex structure, is also identified. The promoter needs to be modified to express protein in the plasmids to built a library of Taq mutants to screen and select better mutants using ddPCR.

Interacting with a Cat to Intertwine Virtual Reality and Physical Objects

Sonia Puertas Acosta
Sponsor: Katia Canepa Vega, Ph.D.
Design Program

In recent years, emotional support animals have shown to be effective at decreasing stress and depression as animals promote self-confidence, peace of mind, greater independence, a sense of safety, and enhanced social interaction. Japanese Neko cafés allow clients to drink coffee while petting cats, creating a stress-free environment. Similarly, Virtual Reality projects such as The Kitties in Virtual Reality app aim to relief its user by watching cats interacting with each other in a virtual world. Furthermore, cat robots such as Joy for all cats and companion pets have been created to simulate the interactions between cats and users. Through Virtual Reality and the use of haptic devices, this project intertwines the sense of presence between the virtual and physical world. Users would interact with cats by wearing Virtual Reality headsets and petting a haptic device that would reflect what the user sees, hears, and touches in the virtual world.

Evaluation of promoter/enhancer capabilities of two conserved regions associated with *SCN1A* expression

Diana Quintero
Sponsor: Alexander Nord, Ph.D.
Neuro Physio & Behavior

Dravet syndrome (DS) is a rare genetic disease that causes childhood-onset seizures. About 80% of patients have mutations in the coding region of SCN1A, a gene encoding the sodium channel Nav1.1. These loss-of-function mutations lead to haploinsufficiency (i.e., one functional copy of the gene) of Nav1.1. For the remaining 20% of DS patients the cause is unknown, but mutations in non-coding regulatory elements associated with SCN1A expression could also affect gene dosage. We are focusing on two non-coding regions of SCN1A, h1a and h1b; previous research has shown these regions have regulatory activity. However, a clear role for these regions has not been established yet. We will test h1a and h1b for enhancer and promoter capabilities using luciferase assays in HEK293 (human embryonic kidney) and SK-N-SH (human neuroblastoma) cell lines. By using plasmids containing either a minimal promoter or no promoter, we will compare the ability of h1a and h1b to drive reporter gene expression. In studying these regions we will help inform future experiments that explore the contribution of non-coding regulatory regions to Dravet syndrome, and the role of other non-coding DNA sequences in health.

Cognitive Functioning in Older Adults

Ulises Quintero
Sponsor: Tamara Swaab, Ph.D.
Psychology

As people get older many functions of the brain change. Aging is defined by a decline in several cognitive domains, however language processing remains relatively intact. In this study, we further examined cognitive functioning in older adults. We gathered data from 30 adults, who are native English speakers, ranging from 65-80 years old. We also collected data from undergraduate students for comparison purposes. Participants completed various behavioral tasks to asses language abilities (a vocabulary task, and author recognition task), working memory capacity (two tasks that required participants to remember letters while completing a secondary task). The older adults also completed a brief cognitive assessment to screen for dementia. Our results show that vocabulary knowledge remains high as people get older, and that older adults have increased recognition of published authors. Additional analysis will determine whether working memory capacity and speed of processing are affected by aging. We predicted that older adults will show impairments in both domains. The results will improve our understanding of how healthy aging affects various cognitive abilities.

Random Positroid Statistics

Sophie Quynn
Sponsor: Jesus De Loera, Ph.D.
Mathematics

The study of randomly sampled combinatorial objects has a long and rich history that has produced probabilistic models for graphs, simplexes, and matroids, to name a few. In this vein, we aim to explore the behavior of a well-behaved subclass of matroids called positroids. First introduced by Postnikov, positroids come from the arrangement of the totally nonnegative Grassmannian. They are indexed by several combinatorial objects, such as Grassman necklaces and decorated permutations. We randomly sample positroids via their decorated permutation representation, and aim to describe the distribution of various statistics such as rank, basis count, and circuit count. A conjecture for Welsh states that the sequence of rank r matroids over ground set E of size n, where 1 = r = n, is unimodel. Our data collected so far supports this conjecture for positroids. We work towards affirmatively proving Welsh's conjecture for all positroids. This is a joint work with Anastasia Chavez and Chris O'Neill.

Structure and Stability of FUS Protein Assemblies

Rebecca Rafique
Sponsor: Dylan Murray, Ph.D.
Chemistry

A main characteristic for those diagnosed with Amyotrophic Lateral Sclerosis (ALS) are aggregates of the Fused in Sarcoma (FUS) protein. The FUS protein can take two forms: a functional droplet phase where FUS is dynamic and lacks 3D structure and a pathogenic aggregated phase where FUS adopts a fibril 3D structure. In ALS, genetic mutations in FUS favor the aggregated phase by stabilizing the fibril conformation of the protein. Unlike most proteins, FUS has a reduced set of amino acids and intramolecular hydrogen bonds instead of a hydrophobic core. We hypothesize that this intramolecular hydrogen bond network stabilizes the 3D fold of FUS in fibril form. To test this hypothesis, we systematically changed amino acids in the FUS primary sequence to residues that would disrupt the hydrogen bonds. Nuclear magnetic resonance and calorimetry measurements probe changes in 3D structure and thermodynamic stability that result from these mutations. With the understanding of how these fibrils are put together, we can begin to understand how disease mutations in the FUS protein will favor the formation of fibrils, consequentially allowing us to have a better understanding of how ALS occurs.

Optimization of Analytical-Scale Sample Purification for High-Performance Liquid Chromatography-Mass Spectrometry Methods

Yancy Ram
Sponsor: Carlito Lebrilla, Ph.D.
Chemistry

In analytical chemistry, purification is an important preparative step to maximize the signal-to-noise ratio in instrumental analysis. Here, a series of experiments were performed to determine the optimal range of sample volume to introduce to solid-phase extraction (SPE) columns, prior to analysis via liquid chromatography-mass spectrometry (LC-MS) methods. As a rule of thumb, SPE columns cannot efficiently clean samples more than 15% of its loading capacity by mass. I investigated a range of volumes from 100 microliters to 5 milliliters representing a range of masses, both under and above 15% loading capacity. Furthermore, I performed oxidation/hydrolysis reactions to generate oligosaccharides from raw food materials for this work. In terms of carbohydrates, raw foods contain several types of polysaccharides, large repeating chains of sugars (sugar polymers). These reactions effectively and reproducibly cleave polysaccharides into oligosaccharides used to study gut health and infant nutrition. Current results show that the sample loads of 100 microliters provides sufficient sensitivity to properly characterize these oligosaccharides, while providing enough sample to perform both quantitative and qualitative analyses.

UC Davis REALOPs Satellite Mission

Aidan Ramey
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The Remote Experimentation and Analysis of LEO Phenomena (REALOPs) is a 2U CubeSat development project focused on data acquisition for use in STEM education. This project presents the idea of developing a thermal model, based on flight data, to predict thermal properties of a nanosatellite with respect to its onboard hardware and its orientation in orbit. There will be a secondary payload onboard (micro dosimeter) that will be used to collect data on the low Earth orbit (LEO) radiation environment as well. The resulting models and raw data collected during the life span of the satellite will be used to introduce students of all levels and disciplines to data analysis with regards to the development of scientific conclusions. Additionally, the developed models will be compared to existing software that has thermal analysis capabilities such as SolidWorks and NASTRAN/PATRAN for validation. Lessons learned from the development lifecycle of this mission will be used to create a robust and reliable base bus that can be modified to perform a multitude of future space missions.

Infant Directed Speech in Bilingual Parents

Andrea Ramirez
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Infants are exposed to rich language when parents talk to them. Infant-directed speech (IDS) or "baby talk" is characterized by simplified utterances, higher pitch, slower rate of speech and longer pauses. However, most of what is known about IDS is from studies of monolinguals; this leaves the question of whether the same holds true for those infants acquiring more than one language. The purpose of this study is to explore both infant-directed speech and adult-directed speech (ADS) in bilingual parents. Infants from 8-20 months and their parents participated in several interactive tasks. These tasks allowed us to compare how parents talk to their own child using IDS compared to speech to another adult. We predicted that there would be variations in pitch in IDS and ADS that will serve as cues for the infants to switches between languages. Preliminary data suggests that bilingual parents are consistent in both ADS and IDS, but we have to do more time sensitive analyses of word duration and pitch to test the hypothesis. It is important to better understand the role IDS plays in bilingual language acquistion and the ways it might differ from monolingual acquisition.

"They never believed I would graduate!:" Defining Culturally Competent School Counselors and Needs of Low-income Students Through Surveys

Jasmine Ramirez-Barba
Sponsor: Natalia Deeb Sossa, Ph.D.
Chicano Studies

The low graduation rates among the Latinx population in the U.S. has long been an issue. Although Latinx students are enrolling in college at a higher rate than ever before, compared to other ethnic groups they are still behind. Latinxs students from low-income communities encounter a range of challenges that negatively affect their academic success. However, counselors can take on a leadership role to help close the achievement gap among the Latinx community. The purpose of this study is to identify what might help school counselors better academically support low-income students in order to become school leaders. In addition, this project will investigate the components that make a good counselor, as well as how resilient students from low-income communities make it to a four-year institution. Data will consist of surveys conducted with recent high school graduates and first-year university students. This study will offer scholars and educators insight into what students believe to be qualities of a successful counselor mentorship. Findings from this study will identify student academic needs and support.

Sex-specific Transcriptional Changes in CRFR1 are Induced by Social Defeat Stress in California Mice

Stephanie Ramos-Maciel
Sponsor: Brian Trainor, Ph.D.
Psychology

Stress is a risk factor for mood disorders including depression. One common symptom of depression is impaired flexible thinking, which can impair treatment. Studies in humans and rodents suggest that stress effects on flexible thinking are stronger in males than in females. The frontal cortex plays a major role in cognitive processes involving flexible thinking. Interestingly, the frontal cortex has neurons that produce corticotropin-releasing factor (CRF). Aside from regulating adrenal hormone secretion, CRF impairs cognitive flexibility when released locally within the frontal cortex. Here I tested whether social stress affected CRF and CRF receptor type 1 (CRFR1) expression using real-time PCR. Male and female California mice assigned to either social defeat stress or control conditions had their frontal cortex dissected for analysis. CRHR1 expression increased after stress exposure in males but not females. Prior studies show that CRF modulates frontal cortex-dependent cognition, I will use a virus containing a CRF promoter to express excitatory DREADD receptors in the frontal cortex of California mice. I predict that activation of these neurons will reduce spontaneous alternation in a y-maze test. This result would suggest that stress-induced increases in CRFR1 in the frontal cortex may contribute to depression associated impaired flexible thinking.

An Examination of the Driving Forces Behind the Rapid Growth of China's Fintech Industry.

William Ramstein
Sponsor: Katheryn Russ, Ph.D.
Economics

Financial Technology better known as FinTech, is a financial service industry offering alternative financial solutions to end users through proprietary technology. The aim of this study is to examine the extent of Chinese government involvement in the growth of China's fintech industry.We examine changes in digitalization, demand and the macro-economic landscape in order to better understand industry growth. Our analysis on macro-economics and capital growth suggests that despite a slowing down of China's overall economy, FinTech is on the rise as one of China's most efficient industries. Overall, economic activity and demand for financial products is very strong in China, and the ecosystem of digital mobile users is growing amongst all demographics, making room for future industry growth. Lastly, our evidence suggests that while FinTech in China appears to function autonomously it is in fact heavily shadowed by government involvement in the form of preferential treatment for certain players.

Effect of Measles Booster Vaccination on CD4+ T Helper Cell Responses

Niharika Rane
Sponsor: Smita Iyer, Ph.D.
VM: Pathology, Micro, & Immun

The measles vaccine successfully eliminated measles-associated morbidity and mortality. However, instances of vaccine-induced immunosuppression, at high titers, are reported. Virus-induced immunosuppression is when a viroid, while inducing lifelong immunity, transiently suppresses immune responses, resulting in increased susceptibility to secondary infections. Immunosuppression leading in reduced lymphocyte proliferation in response to recall antigens is a hallmark of measles. In this study, we sought to understand the impact of booster measles vaccination on CD4+ T helper cells and antibody responses in rhesus macaques, which as natural hosts for the virus, are among the best models for measles studies. Flow cytometry data demonstrated that despite a transient decrease in CD4+ T cells, booster measles vaccination induced recall of antigen-specific CD4+ T cells and robust recall of measles-specific memory B cells. Examination of lymphocyte proliferation to T cell receptor ligation using anti-CD3/CD28 beads revealed that booster vaccination did not attenuate CD4+ T cell functionality ex vivo. These data indicate the immunosuppression is not a feature associated with booster immunization and suggest rapid immune recall has a role in overcoming vaccine-mediated immunosuppression. Additional studies are needed to understand mechanisms underlying immunosuppression in measles immunization.

The Role of Habitat Fragmentation and Climate Change on American Pika Metapopulation Dynamics

Charlotte Rappel
Sponsor: Alan Hastings, Ph.D.
Environmental Science & Policy

The American pika (Ochotona princeps) is native to high elevation montane environments in the northwestern region of North America. The area's climate, remoteness, and geological composition make it the ideal habitat for the species. However, there are some populations that inhabit more extreme conditions. One such metapopulation of American pikas inhabits a half-mile long stretch of area within the greater Mono-Inyo Craters mountain chain in Mono County, California. With a low elevation of roughly 9,000 ft and a terrain composed of steep taluses with minimal vegetation, the area is defined by habitat characteristics that are thought to be unsuitable for pika survival. We used a Markov-chain stochastic model to study metapopulation dynamics and forecast long-term persistence. We show that regardless of variation in parameter conditions such as mean litter size, over-winter mortality, and dispersal propensity, the metapulation is projected to go extinct within the next thirty years. To determine the cause of this metapopulations decline, we used the model to test the impacts of habitat fragmentation and connectivity. Due to the extreme conditions of the site, our results may be predictive of future conditions other pika populations could face in a warming climate.

Chromosomal localization of the breast cancer-associated protein, BRCA2, during mammalian meiosis

Marianne Rara
Sponsor: Neil Hunter, Ph.D.
Microbiology & Molec Genetics

Homologous recombination is a crucial mode of DNA repair in both germ and somatic cells. Defective recombination in somatic cells leads to genomic instability and cancer. In germ cells, defective recombination leads to infertility and birth defects. The BRCA2 (Breast Cancer Associated) gene is an essential recombination protein and mutations in the Brca2 gene cause dramatically increased risks of breast and ovarian cancers. To understand the role of BRCA2 during meiosis, we optimized commercially available antibodies to reveal a punctate localization pattern along meiotic chromosome axes from mouse spermatocytes and oocytes. Unlike related recombination factors, such as RAD51, BRCA2 was detected throughout meiotic prophase, suggesting additional functions. Immunostaining with the commercial antibodies proved to be very inconsistent, so to confirm BRCA2 localization, we generated the first viable epitope-tagged version of the native Brca2 gene in mice. The BRCA2-HA allele will allow us to unambiguously confirm BRCA2 localization and dynamics, delineate genetic requirements for its localization, and identify its meiotic binding partners.

Multiple Allyl-Glucosinolate Catabolites Independently Influence Root Growth and Development

Alycia Rasmussen
Sponsor: Daniel Kliebenstein, Ph.D.
Plant Sciences

Allyl-Glucosinolate (Allyl-GSL) is a defense metabolite found throughout the crucifers including Cabbages and Horseradish. In Arabidopsis thaliana this glucosinolate is toxic to attacking insects and bacteria. Previous work suggested that in addition to its role in plant defense, this compound has regulatory effects on plant growth. Further, natural variation suggested that this was by a link between Allyl-GSL and the key plant growth hormone, auxin. We found that this auxin interaction is likely caused not by Allyl-GSL, but instead by three different catabolic products. These catabolites, raphanusamic acid, acrylic acid and butenoic acid, were examined for their effects on auxin responses and root development. Our results suggest that while all of these molecules inhibit root growth, each one of them affects the root's development through a different pathway. Two of the Allyl-GSL's catabolites affect different sectors of auxin signaling, while the other influences the root cell's cycle. The generation of the different catabolic products are regulated by specific genes, under different environment conditions, and we propose that this allows the plant a specific response that is optimal to any given environment.

Investigating how time and level of question difficulty correlate with student problem-solving performance on open-ended genetics questions

Vijay Reddy
Sponsor: Marina Crowder, Ph.D.
Molecular & Cellular Bio

This study investigates students' comprehension and retention as related to their problem-solving process on open-ended genetics problems. By exploring the differences in thought processes between high-performing students and low-performing students during problem solving, the study aims to better understand how to assist students in improving their problem-solving abilities. During weeks 7 and 8 of the quarter, ten high-performing and ten low-performing students enrolled in an upper-division genetics course were invited to participate in one hour think-aloud interviews (TAInt) during which they solved genetic linkage problems while verbally demonstrating their thought processes. To evaluate the role of knowledge retention in the problem-solving process, the same participants were invited to complete a second round of TAInts 9 weeks after the end of the course. TAInts were coded and student problem-solving process and success was analyzed along with the amount of time taken to perform a specific sub problem and the level of sub problem difficulty according to the Blooms level of taxonomy. This data will be evaluated to better understand where in the problem-solving process high and low-performing students struggle or succeed, which will provide insights to improve instruction and better support development of problem-solving skills.

Interactions During Shared Book Reading: Spanish-English Bilingual Children and their Parents

Naomi Reeley
Sponsor: Yuuko Tonkovich, Ed.D.
Education

Past studies with preschoolers and younger, have shown that bilingual parents tend to read to their children in the language that is most spoken at home. Also, bilingual parents read in the language they are most comfortable reading in. Parents engaged their preschooler by pointing to illustrations that might relate to the child, providing yes/no questions, giving more descriptions, and providing positive feedback (Rodriguez, Hines,& Montiel 2009). The goal of this study is to understand how Spanish-speaking parents interact with older children, specifically with a kindergarten child while reading a bilingual book. The research question are (1) What languages do Spanish-speaking parents use with their Spanish-English bilingual children when reading bilingual books? (2) What are some strategies Spanish-speaking parents engage in when reading to their children? A total of 12 Spanish-speaking parent-child dyads were asked to read a Spanish-English bilingual book, Radio Man by Arthur Dorros together. Preliminary results show that parents tended to read mostly in Spanish. When the parent engaged, they would ask questions about the text and point to the illustrations. Results suggest that bilingual books provide opportunities for parents and children to read in a language that they feel most comfortable in.

The effectiveness of managed retreat and community relocation as a flood mitigation measure in riverine Midwest communities

James Rees
Sponsor: Nicholas Pinter, Ph.D.
Earth And Planetary Sciences

Global flood damages are estimated to increase 20 fold by the end of the 21st century due to climate change, structural flood protection, and continued development within flood-prone areas. In the United States, over 20 cases of managed retreat and community relocation (MRCR) have been implemented over the last century as a hazard mitigation measure for small, flood-prone communities. We have assembled a database of known MRCR cases throughout the United States. This study focuses on a subset of these towns located in the Midwest, each relocated out of FEMA designated flood zones to mitigate riverine flooding risk. We developed three quantitative metrics to assess the success of each relocation: 1) population trends before and after the relocation, compiled from US Census data, 2) trends in home sales price per square foot derived from Zillow's Transaction and Assessment dataset (ZTRAX), and 3) loss avoidance estimates for each relocation calculated using Hazus and Lisflood software applied to structure surveys mapped in the field in July of 2018. Preliminary findings show that MRCR helped retain populations in a majority of towns, while other metrics are still being assessed.

Phenotypic Traits of *Plantago lanceolata* as Related to Population Structure and Herbivory

Anna Remstedt
Sponsor: Jennifer Gremer, Ph.D.
Evolution & Ecology

This project is a continuation of a study on the globally-distributed perennial plant Plantago lanceolata that has been conducted annually since 2015. This study uses the protocol of Plant Pop Net, an international project, which aims to understand the factors driving the spatial dynamics of plant populations in response to climate change using data from P. lanceolata populations around the world. At our site in Davis, CA, we measured abundance and phenotypic traits of P. lanceolata for three years. Trait data included floral characteristics, phenology, morphology, and signs of herbivory. Using these data, we will compare density and herbivory experienced by different plants within our transect, as well as how how the population structure has changed over time. The results of this study can be used to further understand how plants respond to herbivory and competition, and a continuation of this study will allow us to ask questions in the future about the factors influencing these traits, including disease and climate change.

Effects of DDT and DDE Exposure on Sarcolipin-based Thermogenesis in Mice Skeletal Muscle

Sunny Ren
Sponsor: Michele La Merrill, Ph.D.
Environmental Toxicology

Despite its ban in the US in the 1970s, the synthetic insecticide dichlorodiphenyltrichloroethane (DDT) and its metabolite dichlorodiphenyldichloroethylene (DDE) continue to be problematic today due to its potential to impair proper metabolism and energy expenditure. Previous epidemiological research suggests DDT and DDE exposure is a risk factor for diabetes mellitus and obesity in human populations. Thermogenesis is a mechanism of interest in combating these metabolic diseases and is impaired in rodents exposed to DDT and DDE. Here we examine an alternative source of thermogenesis based off calcium cycling in the sarcoplasmic reticulum of the skeletal muscle. We hypothesize perinatal exposure to DDT and DDE will induce changes in gene expression in mice skeletal muscle that have the potential to impair sarcolipin (SLN) based thermogenesis. To test this hypothesis, female C57BL/6J mice were exposed to DDT or DDE in utero and while nursing. RT-qPCR was used to quantify expression levels of genes linked to skeletal thermogenesis in dosed animals relative to the control. Initial data suggest no significant effects on SLN based thermogenesis from DDT or DDE relative to the endogenous control of olive oil. These results continue to establish the importance of continued research in brown adipose thermogenesis.

Toward Renewable Energy Storage Using an Earth Abundant Metal Complex

Lauren Reynolds
Sponsor: Louise Berben, Ph.D.
Chemistry

The demand for renewable energy storage is only increasing as the global concentration
of CO_2 and related climate effects continue to worsen. Although wind and solar technologies are currently employed, the energy generated from these sources cannot be stored long term or in large scale, which limits their scope. With the goal of producing long-lasting, high-efficiency, and economical storage solutions, I am exploring the potential use of nonaqueous redox flow batteries (NRFBs) for harnessing renewable energy. Specifically, I am examining an aluminum complex, $[(I_2P^{1-})_2\ Al]\ [OTf]$, containing redox-active (capable of storing multiple electrons) ligands. This redox-active molecule has high solubility in acetonitrile and can store electrons over a wide potential which makes it a great candidate for producing an energy-dense NRFB. By conducting electrochemical experiments using a Galvanostat and a Potentiostat, I am able to quantify the efficiency and long-term stability of this NRFB over time. The results from these experiments will allow for the development of better NRFB systems in hopes to create a more sustainable fuel-storage option.

Optimization and Analysis of PCB Magnetorquer Coils for CubeSats

Cassandra Rillamas
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The Remote Experimentation and Analysis of LEO Phenomena (REALOPs) is a 2U CubeSat development project focused on data acquisition for use in STEM education. The objective of the Attitude Determination and Control System (ADCS) is to develop low-cost solutions that meet mission orientation and stability requirements of the small satellite. Magnetorquer coils provide active magnetic attitude control; they are responsible for detumbling maneuvers and preventing saturation of reaction wheels. This presentation discusses the embedded magnetorquer coil design of the ADCS. Embedded coils provide a similar magnetic moment but higher heat dissipation and easier integrability than air coils; they also provide more reliable control than torquerrods. The inexpensive embedded coils are produced by CNC milling PCBs. Trend analysis of magnetic and thermal behavior is conducted to ensure accurate modeling and prediction of board properties and to optimize designs for low volume interference, low energy consumption, and high heat dissipation. The REALOP mission aims to demonstrate the utility of embedded coils and their synergy with reaction wheels for effective attitude controls.

Representation of undergraduate Student-Parents of Color and its impact on student experiences

Daniel Rivas
Sponsor: Natalia Deeb Sossa, Ph.D.
Chicano Studies

As elite research institutions seek to recruit and retain an increasingly diverse student body, a dearth in the academic literature currently exists as it pertains to undergraduate student-parents (students with dependents). Drawing from statistics currently available, it is estimated that nationally, roughly 26 percent of undergraduates are parents. Additionally, birth rate data from Health and Human Services suggests a significant racial disparity exists in the age of motherhood for women of color. Approximately 16 percent of Black women and 17 percent of Latinas are estimated to give birth before the age of 20. National data sets do not currently exist for fathers of color. With national statistics showing racial disparities in the onset of parenthood, it is critical to further understand how this population is represented in the student bodies of research institutions and how (under)representation effects undergraduate student-parents of color. This study will explore the experiences and unique challenges that student-parents of color face. The intent is to highlight a significant need for more research and support for student-parents of color in institutions of higher education and to challenge prevailing notions of the idealized undergraduate student.

Differential Promoter Activity of Human Specific Duplicated Genes

Elizabeth Roberts
Sponsor: Megan Dennis, Ph.D.
MED: Biochem & Molecular Med

Genomic duplication events can lead to new gene functions. In particular, mutations of human specific duplicated(HSD) genes are associated with neurodevelopmental disorders. Different copies of a duplicated gene, called paralogs, often exhibit altered levels of of expression compared with the the original gene.We hypothesize that differences in paralog expression are a result of changes incurred within duplicated cis-acting regulatory regions. Here, we focused on promoter activity of HSD genes DUSP22, ARHGAP11, and NCF1, all of which show significantly different expression in lymphoblastoid cell lines (LCLs) between paralogs. To test this, we generated luciferase-reporter vectors carrying putative promoters of these genes from human genomic DNA via PCR amplification and Gateway and Gibson cloning. To compare promoter strengths, we will transfect vectors into LCLs and HeLa cells and compare luciferase expression between paralogous promoters. If our hypothesis is true, we expect differential promoter activity to be observed between paralogs and for this to correlate with expression results. Overall, the results of this study will provide insight into how duplicate genes diverge in expression and function through alteration of regulatory interactions.

Exploratory Factor Analysis of Differential Diagnostic Survey Data to Identify and Discriminate Running Injury Pathologies

Wyatt Robertson
Sponsor: David Hawkins, Ph.D.
Neuro Physio & Behavior

Running is the most popular sport in the U.S. but is unfortunately associated with high injury rates. Several methods have been developed to monitor injury; however, these methods: (1) cannot identify running-related pathologies, which is problematic considering each pathology may have unique causation, and (2) require medical staff, which may be unaffordable. To overcome these constraints, we are developing an easy-to-implement, cost-effective survey that can prospectively monitor running injury and discriminate between pathologies. A pool of 34 differential diagnostic questions was generated from literature review and sports medicine physician consultation. Questions were distributed to 93 runners every week for 26 weeks. Exploratory factor analysis (EFA) is being used to analyze responses from weeks when injury was reported (n= 493). We expect EFA to subdivide questions into groups that correspond to specific running pathologies. To validate these groups of questions correspond to specific pathologies, we will compare the groupings to clinician expectations. If validated, these groupings could be used to create an easy-to-use survey that can prospectively monitor running injury and discriminate between pathologies. The ability to discriminate between pathologies would provide insight into their unique causal factors, which could ultimately be used to reduce injury rates.

BRCA1/BARD1 Ubiquitin Ligase Activity Regulates DNA Repair and Meiosis in *Caenorhabditis elegans*

Foxy Robinson
Sponsor: Joanne Engebrecht, Ph.D.
Molecular & Cellular Bio

Breast and ovarian cancer are among the top fatal cancers in the United States. Germline mutations in the breast cancer 1 (brca-1) gene induce familial breast and ovarian cancer. The BRCA1 RING domain forms a heterodimer with BRCA1-associated RING domain protein 1 (BARD1) to serve as an E3 ubiquitin ligase, tagging protein substrates with ubiquitin. The BRCA1/BARD1 complex supports homology-directed DNA repair (HDR) and suppresses tumor formation. Studies have shown mutations within the BRCA1 RING domain promote tumor formation. I hypothesize that disrupted BRCA1 RING domain activity compromises BRCA1-mediated homology-directed repair and meiotic progression in Caenorhabditis elegans. To test my hypothesis, I exposed C. elegans worms with genetically nonfunctional BRCA1/BARD1 E3 ubiquitin ligase activity to DNA damage and meiotic stress and subsequently conducted embryonic lethality assays. My results suggest that worms with genetically nonfunctional BRCA1/BARD1 E3 ubiquitin ligase activity experience significantly elevated embryonic lethality in response to meiotic stress and DNA damage sensitivity. Further research is needed to cytologically investigate how BRCA1 RING domain activity regulates HDR in the presence of DNA damage and meiotic stress.

Analyzing the Efficacy of Patient-Derived Xenograft Models to Show Intra-tumor Heterogeneity in Gastric Cancer

Sienna Rocha
Sponsor: Luis Carvajal-Carmona, Ph.D.
MED: Biochem & Molecular Med

Gastric intra-tumor heterogeneity results in patterns of clonal and subclonal tumor cell populations that may develop variable levels of resistance to therapy and ultimately treatment failure. To improve our understanding of intra-tumor heterogeneity, we are using Patient-Derived Xenograft (PDX) models. The patient tumor is removed and biopsied in the center and in four areas in a clockwise direction with each section separated by at least 1 cm. Part of the biopsied tumor is engrafted into a immunosuppressed NSG mouse for passage 1 (P0) and tumor growth is monitored. The mouse is euthanized when the tumor reaches a size of 1000-1200 mm^3 and the tumor is biopsied again. Tissue from the P0 mouse is then implanted into two different strains of immunosuppressed mice (Nude and NSG) and regrown to the desired size in passage 2 (P1). The tumors from P0 and P1 are histologically examined and compared to identify adenocarcinoma gastric cancer cells. In P0 and P1, NSG mice were more prone to develop lymphoma than adenocarcinoma. However, later stages (P2 and on) the type of mouse used did not matter. Moving forward, we will use NSG in P0, Nude in P1, and NSG for later stages.

Media Coverage of Gluten-Free Diets and its Effect on Sales of Gluten and Gluten-Free Products

Olivia Rockeman
Sponsor: Kristin Kiesel, Ph.D.
Ag & Resource Economics

My study was conducted to measure the relationship between the size of the gluten-free product market and the representation of gluten-free diets in the news. While a gluten-free diet is the only known treatment for Celiac disease, an intestinal autoimmune disorder, many non-Celiac patients in the United States have adopted gluten-free eating habits for other health reasons. To assess whether news coverage and media attention was a factor in the growing gluten-free diet trend, a total of 606 newspaper articles with publication dates between 2001 and 2016 were analyzed and coded based on their portrayal of gluten-free diets. The news data was then compared to the annual dollar value of the gluten-free product market for the same time period. Results suggested that as the number of news articles about gluten-free dieting increased, the value of the gluten-free product market also rose. Contrastingly, after 2014 when news about gluten-free dieting started to decline, so too did sales of gluten-free products. This study points to the influence that information from newspapers can have on purchasing behavior and consumer lifestyle decisions, regardless of their health needs.

Depression and the Worry of Deportation in Mothers of Mexican Origin

Krystal Rodas
Sponsor: Leah Hibel, Ph.D.
Human Ecology

Previous research on Latinx children has found that the United States government is fostering a hostile environment toward Mexican-origin immigrants which has been shown to be detrimental to the children's mental health. The current study extends this work by focusing on the association between depression symptoms and the worry of deportation for Mexican-origin mothers. The data were collected during home visits with 57 Mexican origin mothers (M_{age} =21.18, SD =1.48) living in Sacramento and Woodland as part of the California Babies Project. Mothers were asked to answer how worried they were that they, or any of their loved ones, would be deported from not worried to extremely worried. They were also asked the Center for Epidemiologic Studies Depression Scale (CES-D) to measure symptoms of depression. Our results show that there is a significant difference in depression symptoms for mothers who are worried about deportation compared to mothers who are not worried about deportation [t (55)=-1.82, p <.05]. Mothers with any worry of deportation scored significantly higher on the depression scale (M =11.86, SD =1.54) than mothers who had no worry of deportation (M =7.81, SD =1.24). This research underscores the impact of immigration enforcement threat on maternal mental health.

The Coop Scoop: Searching for Antibiotic Resistance Genes from Backyard Poultry in Households Using Metagenomic Sequencing

Dennett Rodriguez
Sponsor: Jonathan Eisen, Ph.D.
Evolution & Ecology

The overuse of antibiotics, particularly associated with agriculture, has caused a worldwide health concern of increasing antimicrobial resistance. The indiscriminate usage of antimicrobials in the poultry industry has led to a growing interest in keeping backyard flocks over health and ethical concerns. The link between pet ownership and changes in the microbial composition of the home raises the question of biosecurity with this increased popularity of household chickens which could carry antimicrobial resistant microbes. In this study, metagenomics, the analysis of all genetic material in a given environmental sample, was used to search the indoor environment of households with backyard poultry for microbial antibiotic resistance genes. Swabs of kitchen counters from households with backyard chickens throughout California were collected, with half the samples coming from households that regularly used antibiotics on their chickens, and half from those that did not. The prevalence of microbial antibiotic resistance genes was compared across the samples. This study poses new questions about the biosecurity of owning backyard chickens. If antibiotic resistant microbes are being brought into the home through contact with backyard chickens, then further studies can begin to develop safer husbandry practices.

Access & Allocation of Healthcare Services in Knights Landing, CA: An Assessment of Rural Representation in Community Health Needs Assessments

Sarina Rodriguez
Sponsor: Natalia Deeb Sossa, Ph.D.
Chicano Studies

Knights Landing is an unincorporated rural town within the agriculturally-dominated Yolo County. Current health access needs of Knights Landing are not accurately represented in county research compared to larger cities in Yolo County (i.e. Woodland and Davis). Based on our Access to Care Survey conducted between 2017 and 2018 in Knights Landing, the major barriers to healthcare and the needs of this community differ from the most recent Yolo County Community Health Needs Assessment. Resource allocation and relative population sizes are likely contributors to why county-level health needs assessments are more likely to represent the needs of the wealthier and urbanized cities versus poor rural cities. This study will investigate the methods used by public health agencies and health care providers to alleviate the disparity in healthcare access on a county level, especially for rural residents. These results will be used to analyze the effectiveness of potential solutions in progress by the county compared to ongoing private, nonprofit, institutional, and community-based interventions in Knights Landing.

Individual Musician's Spontaneous Performance Rates Affect Interpersonal Synchrony in Joint Musical Performance: A Dynamical Systems Model

Adrian Roman
Sponsor: William Tavernetti, Ph.D.
Mathematics

Interpersonal synchronization occurs when two musicians play together and coordinate their actions. Research shows that interpersonal synchronization is affected by individual spontaneous performance rates (SPRs), measured when asking musicians to spontaneously tap simple melody rhythms to measure their tempo. As discrepancies between musicians' SPRs grow, the asynchronies are greater during duet performances. Interestingly, an individual's SPR remains stable after a joint performance. This suggest two phenomena: (1) short-term tempo adaptation during joint performance and (2) SPR restoration. Here we characterize SPRs and interpersonal synchronization with oscillatory dynamical systems, previously used to model periodicity of human behavior. To explain an individual's behavior, we use an oscillator with a fixed spontaneous cycling rate (SCR). The oscillator demonstrates a frequency alignment mechanism that is resilient, allowing the oscillator to return to its SCR after being stimulated. We simulated joint duet performance with two oscillators and examined whether asynchronies are influenced by the difference between their SCRs. The oscillators drove each other in two conditions: (1) with matching and (2) mismatching SCRs. The results replicated behavioral data, showing greater asynchrony for the "mismatching" condition. Ultimately, our results show that the relationship between SPRs and interpersonal synchronization can be explained with dynamical system models.

U.S. Health Disparities in Children and Adults Living in Rural Communities

Jennifer Romero
Sponsor: Lenna Ontai, Ph.D.
Human Ecology

About 60 million people in the U.S. living in rural communities tend to have higher rates of health and income disparities. For instance, rural communities have less access to health providers, fresh produce, and activities that serve to promote optimal health. These problems can be exacerbated in families with limited income. Being able to afford health care and having a physician nearby plays a considerable role in determining the well-being of families. The purpose of this study is to understand whether health care access determines the health of parents and children from low-income families living in rural communities. Parents self-reported on their health, financial status, and access to health care and other assistance. They also completed standardized questionnaires about themselves and their 5 to 12 year old child. Data was collected from rural communities in 14 states of a cooperative multi-state research project "Rural Families Speak about Health." All families had incomes 200% below the poverty line and a 5 to 12 year old child living in their home. I hypothesize that low-income families without health insurance will experience more restricted access to health care, engage in fewer healthy lifestyle behaviors, and experience more physical health problems.

Impacts of Food Waste Amendments on Agricultural Fumigant Degradation

Katerina Roth
Sponsor: Christopher Simmons, Ph.D.
Food Science & Technology

Fumigation is commonly used in agriculture to kill pests in the soil. Use of fumigants commercially involves administering them as a liquid several feet into soil where they volatilize to permeate the rest of the soil. While effective, fumigants present many environmental and health hazards, so it is useful to study what can be applied to accelerate their degradation. In particular, many soil microbes have been demonstrated to degrade fumigants. In this research project, the effect of fumigants, organic amendments, and their combination on soil microbial biomass was investigated. The fumigants chloropicrin and 1,3-dichloropropene were applied to samples of soil in bioreactors. Some reactors were also enriched with tomato pomace, a dried tomato processing waste. Microbial biomass in each reactor was estimated using a MicroOxymax respirometer. Steady-state reactors were spiked with glucose, and CO_2 production was measured over time. These data were then fitted to a kinetic respiration model to assess the microbial biomass in each treatment. Future work will involve further characterizing changes in soil microbial communities, and identifying fumigant-degrading microbes.

How Understanding University Student Challenges Can Help Facilitate College Degree Completion

Victoria Rubio
Sponsor: Michal Kurlaender, Ed.D.
Education

The purpose of this study is to identify the major challenges individuals face as students at a university. A random sample of students was taken from a large broad-access institution in California and asked to fill out a survey that consisted of closed- and open-ended questions about their college experience. One of the open-ended questions asked students: What has been your biggest challenge as a college student? Through their responses, we were able to extract five major themes: time management, academics (i.e., not getting the right classes), finances (i.e., paying for college), being away from family, and the transition to college. Many of these themes were consistent among students of all backgrounds, yet certain subcategories of these themes were identified more so by students from specific demographics. Through our findings, we hope to address institutional and policy changes that will contribute to facilitating access and completion of a college degree.

Functional Analysis of LET-99, a Protein Needed for Asymmetric Cell Division

Sara Ruch
Sponsor: Lesilee Rose, Ph.D.
Molecular & Cellular Bio

Asymmetric divisions produce daughter cells with distinct contents, which results in different fates. Such divisions are important for development in many organisms and are controlled by conserved polarity proteins. Previous work has shown that in the C. elegans embryo, LET-99 is a regulator of asymmetric division and is asymmetrically localized at the cell membrane in response to polarity proteins. There, LET-99 plays a role in the orientation and timing of embryonic division. The purpose of this study is to determine which parts of the LET-99 protein are essential for its function. To do this, versions of the LET-99 protein with specific domains deleted were introduced into C. elegans as extra copies (transgenes). We then generated C. elegans strains containing these transgenes in combination with a complete loss of the normal let-99 gene. We are examining the localization of LET-99 in embryos expressing these transgenes, compared to wild type, to determine which domains are important for asymmetry or membrane targeting. We will also determine if a given domain is required for normal orientation or timing of division. Through the analysis of these lines, we will gain a better understanding of the LET-99 protein in asymmetric cell division.

The Putative Roles of Geosmin Synthase and Cyclase in *Myxococcus xanthus* Predation and Development

Eduardo Ruiz
Sponsor: Mitchell Singer, Ph.D.
Microbiology & Molec Genetics

The facultatively predacious soil bacterium, Myxococcus xanthus, situationally implements a wide array of enzymes in response to fluctuating resource availability. In nutrient-rich environments, M. xanthus participates in highly social forms of group predation, sharing both the absorbed nutrients and the intracellular stress of producing the necessary prey degrading enzymes. Much is still unknown about their specific hunting methods but current research proposes that chemoattractants in conjunction with motility play a key role. One potential chemoattractant used by M. xanthus might be the diterpene geosmin, which is produced by the enzyme Geosmin Synthase using farnesyl diphosphate as a precursor. In times of limited nutrient availability, M. xanthus initiates a developmental program in which the colony forms a multicellular fruiting body as a means of prolonging survival until conditions improve. Previous studies have shown that cyclic molecules produced by cyclases are present in varying concentrations throughout specific stages of the developmental program, suggesting a correlation between cyclase products and fruiting body development. Knockouts of the Geosmin Synthase gene and various cyclase genes will be used to determine the necessity of their products in nutrient acquisition and survival under differing conditions.

Investigation of Aromatase Expression in Bovine Preantral Ovarian Follicles

Brenda Ruiz Anaya
Sponsor: Anna Denicol, D.V.M.,Ph.D.
Animal Science

Follicle stimulating hormone (FSH) has a critical role in development of preovulatory ovarian follicles, but little is known about its possible roles in early (preantral) follicles during primary and secondary stages of development. Current research from our laboratory shows that bovine preantral follicles express receptors for FSH (FSHR) as early as the primary stage of development. One of the roles of FSH in preovulatory follicles is to stimulate aromatase, the enzyme responsible for conversion of androgens to estrogens. Our hypothesis is that the FSHR found in preantral follicles is active, and binding of FSH elicits downstream signaling including increased expression of aromatase. Our objective is to evaluate whether expression of aromatase increases in response to FSH signaling in preantral follicles. To accomplish this, we will perform immunolocalization of aromatase in histological sections of bovine ovarian cortex exposed to FSH in vitro for 2 days; controls will be sections of ovarian tissue exposed to a vehicle control. We are currently optimizing the protocol for cryosectioning ovarian tissue and will next start optimizing the immunostaining protocol using an antibody known to react with bovine aromatase. These results will be important to improve our understanding of FSH in regulating ovarian follicle development.

Mental and Emotional Health Care Accessibility and the Intersectionality of Smoking in Knights Landing California

Juan Carlos Ruiz Malagon
Sponsor: Natalia Deeb Sossa, Ph.D.
Chicano Studies

Knights Landing (KL) is an agricultural town in Yolo County including a population of seasonal/ migrant farm workers. Residents experience challenges accessing mental/emotional healthcare due to socioeconomic and political barriers. Within rural communities, levels of anxiety and depression are typically higher due to factors such as work demands, no transportation, exploitation, and poverty. This project collected data regarding mental health conditions in KL, to find better strategies to bring forth mental/emotional health care. An interdisciplinary follow-up health survey was validated with KL promotoras (health promoters) and administered door to door. Two scales were used to assess mental health: PHQ-9 scale for depression and GAD-7 scale for anxiety. The results of this survey will be compared to a similar survey conducted 5 years ago and will be contextualized with qualitative data. The data collected showed a link between smoking behaviors and depression/anxiety. Our survey documented a smoking rate in KL that is about 3 times higher than the county rate. A follow up interview was conducted with smokers and non-smokers in the community in order to identify distinctive social, economic, or political factors that could be contributing to the high smoking rate and our participants' emotional wellbeing.

Field Variation in Lettuce Downy Mildew

Xylina Rusit
Sponsor: Richard Michelmore, Ph.D.
Plant Sciences

Lettuce downy mildew is a major disease worldwide threatening ~$3 billion worth of crops in the US alone. The disease is caused by the biotrophic oomycete Bremia lactucae. B. lactucae's great adaptability has resulted in an evolutionary war between resistance in lettuce and virulence in the pathogen. This has produced highly variable defense responses and spectrums of infection. This project involves collecting field samples of downy mildew in California and Arizona and performing several phenotypic tests on these isolates of B. lactucae. These include tests for fungicide sensitivity, pathotypes (virulence phenotype), and mating type. We are also developing and will associate genetic markers to monitor relatedness between the isolates as well as observe rates of evolution. Development of genetic markers will facilitate quicker classification of the isolates and let us survey larger portions of B. lactucae populations. This will also allow us to keep growers updated in real-time. Our goal is to track the population dynamics of B. lactucae so that growers can understand the probability of infection based on which varieties they are growing and plan fungicide applications accordingly.

How do Spanish-English and Cantonese-English Bilingual Children Differ in Their Development of English Narrative Skills?

Jodie Sakazaki
Sponsor: Yuuko Tonkovich, Ed.D.
Education

This longitudinal study investigated the differences in macro-level components of English oral narratives among a total of 40 bilingual children (16 Spanish-English and 24 Cantonese-English) who were enrolled in transitional bilingual educational programs. Children's English narratives were collected by having them tell a story using Frog, Where are You?, a wordless picture book. The narrative quality was assessed using the Narrative Scoring Scheme (NSS), which measures children's narratives along seven elements (introduction, character development, mental states, referencing, conflict resolution, cohesion, conclusion), each of which is scored holistically on a scale of 1–5. Scores from each category of the NSS were compared between Spanish-English and Cantonese-English children. Results showed that on average, narratives scores developed over the three years. Results also showed that Spanish-English children scored higher than Cantonese-English children on character development, cohesion, conclusion and significantly higher on mental states. Cantonese-English children scored higher than Spanish-English children on the introduction elements. The conclusions from this study may help inform educational strategies to best support language development among different groups of bilingual children.

Student Farm Market Garden Production & Teaching Facility

Abraham Salinas
Sponsor: David de laPena, Ph.D.
Landscape Architecture and Sustainable Environmental Design

The Student Farm Market Garden at the University of California Davis runs a Community Supported Agriculture (CSA) program, donates to campus organizations, sells to the Dining Commons/Coho, and provides experiential learning opportunities to students, but lacks a physical building space to support the growth and improvement of these initiatives. In order to increase production, efficiency, and learning in the Student Farm Market Garden, our team partnered with the Student Farm community to design a Production and Teaching Facility. This facility would (1) provide space and equipment to wash, package, and store produce, (2) act as a student gathering area, and (3) support community engagement and youth education programs. The design reflects the inclusive, creative, and productive Student Farm community and aims to provide a sustainable solution to the community's needs. In this presentation, we will present our design deliverables including documents, drawings, and models of the facility intended to inspire private funding.

OCT-based Measurements of Cartilage Quality in a Non-surgical rat Model of Osteoarthritis.

Lucila Sanchez Ortega
Sponsor: Laura Marcu, Ph.D.
Biomedical Engineering

Evaluating the effectiveness of current and emerging therapies to treat osteoarthritis (OA) relies heavily on destructive testing methods. The need for non-destructive methods to measure the quality and health of articular cartilage requires reducing sample numbers and allowing longitudinal studies. We developed a non-destructive, label-free, multimodal imaging system capable of identifying biochemical and structural changes of cartilage degradation in early OA by combining Fluorescence Lifetime Imaging (FLIm) and Optical Coherence Tomography (OCT). We used a non-surgical rat model of OA and compared an injured joint (right) to its contra-lateral control joint (left). After imaging, bone samples were processed and stained with safranin-O for histological analysis. The goal of this study was to quantify and validate OCT-based cartilage thickness measurements (n=40) against histological-based measurements (n=40) using an automated tracing and sectioning method in Matlab v2018b. Statistical analysis was performed on measurements using linear regression with significance set at $p<0.05$ and using Pearson's concordance correlation (r) to determine the agreement between the two measurement techniques. Quantitative relationships between destructive and non-destructive measurements validate the FLIm-OCT system as a high-quality method to determine cartilage thickness and potentially guide future therapeutic interventions of cartilage repair in OA patients.

Talking About Thinking: Associations Between Parental Mental State Language and Toddlers' Uncertainty Monitoring

Aidan Sandhoefner
Sponsor: Simona Ghetti, Ph.D.
Psychology

Uncertainty monitoring, a form of introspection, involves the ability to experience uncertainty when making inaccurate decisions. Parental use of mental state language (MSL) may be relevant for early development of this capacity. MSL includes reference to relevant concepts such as thinking, knowing, certainty and guessing. Despite its apparent relevance, little research has explored connections between parental MSL usage and children's uncertainty monitoring. This study aims to discover whether exposure to parental MSL contributes to toddlers' ability to report stronger uncertainty for their inaccurate compared to their accurate responses. In this experiment, 111 2-year-olds were narrated a wordless storybook by their parent whose speech was transcribed and coded for MSL terms. The toddlers returned at age 3 and performed a perceptual discrimination task requiring them to identify a target image from two partially degraded images and explicitly remark on their confidence. We predict higher levels of parental MSL at age 2 to predict children's uncertainty monitoring at age 3 (i.e., higher uncertainty for incorrect compared to correct responses on the perceptual task). This study impacts the fields of Psychology and Linguistics by contributing further insight into the effects of parental language on child cognitive development.

Glioblastoma Multiforme (GBM) Stem Cell Killing Using mTORC1 Inhibitors

Jose Sandoval
Sponsor: Gino Cortopassi, Ph.D.
VM: Molecular Bio Sciences

Glioblastoma Multiforme (GBM) is a rare and highly aggressive heterogeneous brain tumor, with an average post-diagnosis life expectancy of 15 months. Conventional therapy for GBM is surgery, followed by radiation and adjuvant therapy with the drug temozolomide. GBM's lethality is thought to result from temozolomide-resistant GBM stem cells (GBMSC). Thus, our goal was to identify drugs to selectively kill GBMSC. Because mTORC1 is under expressed in GBMSC, I tested the stem cell killing effectiveness of meclizine, an mTORC1 inhibitor recently identified in our lab that is already FDA-approved to treat nausea and motion sickness, in comparison to temozolomide and rapamycin, a well-known mTORC1 inhibitor. I also tested meclizine's effect on phosphorylation of S6K and 4EBP1, downstream targets of mTORC1. My results show that meclizine is a superior killer of GBMSC than temozolomide, which failed to produce significant killing across two GBMSC lines of increasing tumorigenicity. Additionally, meclizine inhibited the phosphorylation of 4EBP1 and S6K less than did rapamycin, which has severe side effects. This may result from meclizine's different inhibitory specificity and contribute to its high safety rating. Taken together, my results could be relevant to novel therapeutic strategies for GBM.

Hard Disk Drive Reaction Wheels for CubeSats

Jose Sandoval Espinoza
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The Remote Experimentation and Analysis of LEO Phenomena (REALOPs) is a 2U CubeSat development project focused on data acquisition for use in STEM education. The objective of the Attitude Determination and Control System (ADCS) is to develop low-cost solutions that meet mission orientation and stability requirements of the small satellite. Reaction wheels are necessary in addition to magnetorquer coils to provide full control and for precision attitude control and pointing maneuvers. This presentation discusses the hard disk drive reaction wheels of the ADCS. Commercial CubeSat reaction wheels cost on the order of 10^4 to 10^5 USD. REALOP will repurpose 30 USD hard disk drives, typically found in laptops and iPods, by utilizing them as reaction wheels. Hard disk drives have yet to be used for attitude control in space but are capable of meeting and exceeding the performance requirements of small satellite reaction wheels. In addition to being far less expensive than commercial options, hard disk drives are more reliable than in-house reaction wheels as they are mass-manufactured with high precision standards. The REALOP mission aims to be a technological demonstration of hard disk drive reaction wheels and prove its capabilities and potential for future small satellites.

Development of Optimism Across the Lifespan

Priyanka Sanghavi
Sponsor: Richard Robins, Ph.D.
Psychology

In this research, we examine the developmental trajectory of optimism in young adulthood to old age. We are comparing the trajectories of men and women, single parents and married parents, and U.S.-born and Mexican-born adults. We are also examining how positive and negative life events affect the development of optimism. Additionally, we want to know if there are any similarities or differences between the trajectories of the two facets of optimism: expecting positive things in the future (positive optimism), and an absence of expecting negative things in the future (pessimism). We are using data from an optimism questionnaire in the California Families Project, which is a longitudinal data collection project focusing on Mexican-American families. For both men and women, we found inverted U-shaped curves in their optimism trajectories, and we found that positive life events have a stronger effect on optimism than negative life events. We found that positive optimism follows an inverted U-shaped curve, whereas pessimism declines over time.

Optimization of Aerobic Suspended Growth System Technology for Aquaculture Waste Management and Application as a Solid and Liquid Fertilizer

Darren Santos
Sponsor: Jason Gross, Ph.D.
Animal Science

With the anticipated sharp, continual increase of the human population in the future, advancements in food production need to become more efficient and sustainable in terms of resource utilization. Experimentation to repurpose aquaculture effluents into solid and liquid fertilizers will allow for farmers to utilize an undesirable waste product into a commodity. By investigating the optimal conditions for aerobic digestion of fish waste, it can help reduce a bottleneck of aquaculture expansion. Disposing of fish waste has been costly for farmers and proven harsh on the environment. Previous research has shown that when fish waste is aerobically processed it allows the solids to solubilize. This concept demonstrated greater plant yields than unamended recirculation water. By testing the effects of precise water chemistry manipulation, varying the water to solids ratios, and using various temperatures can permit the optimization of aerobic digestion. This experiment will measure the rate of solubilized nitrogen in the form of nitrate, total bioavailable phosphorus, and dissolved oxygen consumption. Ideally the results display conditions that allow for digestion to occur at the highest rate and produce the highest amount of nutrients back into viable forms. The goal is to increase the economic and ecological sustainability in aquaculture production.

Bilingualism and Executive Functioning: Emerging Bilinguals in Head Start

Diana Santoyo
Sponsor: Yuuko Tonkovich, Ed.D.
Education

The relationship between bilingualism and executive function has shown mixed results. Children's metalinguistic awareness has been displayed as an advantage of bilingualism, which serves as indicators of executive function (EF) systems (Bialystok, 2015). Yet, others have found no bilingual advantage in EF (Paap, Johnson, & Sawi, 2015). The aim of this study is to examine the association between language proficiency in the dominant and nondominant languages of Spanish and English and the EF components of inhibitory control and cognitive flexibility with emerging Spanish-English bilingual preschoolers enrolled in Head Start programs. In this study, bilingualism will be defined by performance on the Woodcock Johnson Picture Vocabulary, Oral Comprehension, and Understanding Directions, while EF will be measured with the NIH Tool Box and Head-Toes-Knees-Shoulders Task. Data is being collected from Mexican-American preschoolers attending Head Start programs in Northern California. Data will be analyzed to examine the relationship between bilingualism and executive function tasks. The findings from this study can help us understand the role of bilingualism on cognition. Implications for home literacy practices and classroom instruction will be discussed.

Investigating the Maturation Potential of Virgin Beta Cells Within Mouse Pancreatic Islets

Supraja Saravanakumar
Sponsor: Mark Huising, Ph.D.
Neuro Physio & Behavior

Type 1 diabetes (T1D) is an autoimmune disease that results in the destruction of insulin-secreting beta cells. Although T1D can be managed by daily administration of exogenous insulin, significant research is aimed towards restoring beta cell mass for endogenous insulin secretion in diabetic patients. Our lab discovered a novel population of functionally immature beta cells, named "virgin" beta cells, which derive from non-beta progenitors at a neogenic niche near the islet periphery. Little is known about the ability of virgin beta cells to mature over time. Therefore, we seek to examine the potential for virgin beta cells to differentiate into functionally mature beta cells. We hypothesize that virgin beta cells develop into functionally mature beta cells. To test our hypothesis, we used bi-transgenic mice that allowed inducible expression of a fluorescent reporter to selectively lineage-label all beta cells. We then followed the fate of these cells over time. By counting changes in the number of lineage-labeled virgin and mature beta cells, we can determine if virgin beta cells mature over time. The outcome of our experiment will inform on the maturation capacity of virgin beta cells, which could potentially be targeted for beta cell regeneration as a treatment for T1D.

Imitation of a "Neutral" or "Expressive" Human Versus a Digital Device

Melina Sarian
Sponsor: Georgia Zellou, Ph.D.
Linguistics

This study aims to explore the cognitive-social mechanisms underlying vocal alignment, or the convergence of speakers' vocal characteristics in conversation. In this project we ask two questions: 1) how does "expressiveness" of voice and 2) "humanity" of interlocutor shape the degree of humans' vocal alignment? METHODS: Subjects (n=25) participate in a shadowing experiment where they will repeat 24 words produced in "neutral" and "expressive" manners by Amazon's Alexa and a real human female voice, collecting their baseline productions of these same words at the beginning of the experiment. ANALYSIS: In each of participants' repetitions of "neutral" and "expressive" words, we will measure degree of pitch fluctuation (i.e., standard deviation of fundamental frequency, f0), an index of "expressiveness", and compare it to their baseline production and the model talker's production. We will analyze this difference measure with a linear mixed effects model. EXPECTED OUTCOMES: We hypothesize that subjects will show greater imitation towards the "expressive" human voice due to the importance of imitation and emotional expressiveness in human communication. This work is relevant for models of human vocal alignment, and has important implications for our understanding of human responses to new types of non-human interlocutors, such as digital devices.

The Performance of UNITE, dITSy, and dITSy-UNITE Hybrid Classifiers on Yeast Taxonomic Assignment in Ecological Studies Savita Sastry, Diana Taft, David Mills, Kyria Boundy-Mills

Savita Sastry
Sponsor: David Mills, Ph.D.
Food Science & Technology

Yeasts are single-celled Fungi with important roles in food fermentation, biofuel production, and as biological model systems. With the advent of next generation sequencing approaches, accurate yeast classification from internal transcribed spacer (ITS) sequences is a growing need. Fungal databases often contain out of date yeast taxonomic strings and partial ITS sequences, posing limitations for yeast classification. The Davis ITS Yeast database (dITSy) contains updated taxonomy and full ITS yeast sequences. The effectiveness of taxonomic classifiers constructed from dITSy, UNITE, and dITSy-UNITE hybrid databases were tested on mock communities composed of yeast strains from the Phaff Yeast Culture Collection. The hybrid dITSy-UNITE database was made by removing yeast sequences from UNITE and substituting the dITSy sequences. The dITSy, UNITE, and hybrid databases were formatted for use as QIIME2 (2018.11) classifiers. Mock communities were denoised using Deblur, and taxonomic assignment was performed using each of the three classifiers. Ongoing precision and accuracy analysis of taxonomic assignment will include using Jaccard and Bray-Curtis distance to compare the distance between the expected mock community and database-detected compositions. Understanding strengths and limitations of the dITSy classifier compared to other databases will improve our ability to explore complex yeast communities.

Butcher's Crossing: An Examination of the Demythologized West

Adam Savage
Sponsor: Hsueh Chiang, Ph.D.
History

In 1872, William Andrews, fictional character created by John Williams in his novel, 'Butchers Crossing,' left his harvard studies to explore the American West. Inspired by lofty Emersonian Idealism and a yearning to find self meaning in labor, Andrews fully embraced the transcendental optimism that motivated his travel west. But as the story progresses, Andrews instead found himself feigned by a sobering account of labor and the exploitative demands of the West. In my forthcoming paper, I will be examining the 'husks and shells,' (as Emerson coined) of American westward exploration and its dire consequence, ecological exploitation. With a focus on ecological disaster and emerson rhetoric, this paper will be examining how the classic American notion of 'traveling to the frontier' culturally and physically affected the environment of the American West. Along with this, I hope to look at Western Fiction in comparison with Thoreau and Emerson's language and thought, looking to examine the demythologized accounts of life in the West - investigating and arguing that the correspondence of individualism and nature negatively affected the Western landscape.

The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Middle East" in the New York Times (1900-1909)

Dalal Scarbrough
Sponsor: Suad Joseph, Ph.D.
Anthropology

This research is part of a larger project, conducted in the lab of Doctor Suad Joseph, that analyzes the portrayal of the Middle East, Arabs, Muslims and Islam in The New York Times over a 150-year period. I have researched the ProQuest New York Times Newspaper database for the term "Middle East" from January 1st, 1900 to December 31st, 1909, and the total number of 10,849 results. Thus far, I have examined 369 articles from January to April 5th, 1900, and I have found two relevant article that also has appeared under the term "Orient." Both articles do not use the term directly although they discuss the people of the region, their moral categorizations, and the mixed feelings of outsiders towards their social and cultural norms. To do so, I pay close attention to certain etymological and linguistic markers used in the articles to portray the people of the Middle East in terms of physical and mental strengths and traits (behaviors).

Bad to the Stone: Impacts of Deformed Ear Stones on Salmon Survival in Nature

Krista Schmidt
Sponsor: Rachel Johnson, Ph.D.
Center For Watershed Sciences

Fish contain three pairs of ear stones called otoliths that help them balance and detect sound. Otoliths are composed of calcium carbonate and protein. The calcium carbonate structure can be expressed in two crystalline forms: aragonite (common) and vaterite (rare). Vaterite forms when aragonite is altered into a less dense, more brittle structure. Studies have shown that vateritic otoliths are more common in farmed fish than wild fish, potentially due to the stressful rearing environment. Vateritic otoliths negatively affect the hearing of fish, yet their impacts on overall survival rates are unknown. In this study, we aim to determine if the presence of vateritic otoliths in a Chinook salmon hatchery cohort decreased their chances of surviving to adulthood. We compared the presence and extent of vaterite formation in otoliths from juvenile late-fall Chinook salmon from Coleman National Fish Hatchery released in 2009 versus the 2011 adult returns. We hypothesized that if vaterite negatively impacts salmon survival, we would find a lower percentage of vateritic otoliths in surviving adults than in juveniles, suggesting greater mortality in fish with vateritic otoliths. These data are important for quantifying the need to alter hatchery practices to improve mitigation goals and support the salmon fishery.

Sex-Biased Dispersal in a Model Organism, *Tribolium confusum*

Reece Schweibold
Sponsor: Alan Hastings, Ph.D.
Environmental Science & Policy

Understanding the movement of individuals across space and time is an important concept in ecology, with applications in the management of biological invasions. Multiple factors, such as sex-biased dispersal, have the potential to alter the rate of spatial spread of a population. Sex-biased dispersal occurs when one sex disperses farther than the other and can be used to avoid inbreeding or kin competition. For our research, we are using confused flour beetles, Tribolium confusum, to determine whether sex-biased dispersal is present and to assess its effects on polyandrous organisms. T. confusum are widely used to model population dynamics and dispersal due to their high reproductive rate and fast generation time. In a pilot experiment, we did not find a strong bias when the two sexes were put together. However, we did find that 50% of the males dispersed in the absence of females, and no females dispersed in the absence of males. We are currently conducting a full-scale experiment, where we expect T. confusum to demonstrate a male-biased dispersal. Sex-biased dispersal in polyandrous species may be an important consideration for those who study these types of model organisms and for larger-scale management policies.

Effect of Diabetic Retinopathy microRNA Biomarkers on Vascular Endothelial Tube Formation Assay *in vitro*

Hannah Schmitz
Sponsor: Zeljka Mcbride, Ph.D.
MED: Ophthalmology

Neovascularization occurs in the eyes of individuals with proliferative diabetic retinopathy and can lead to impairments in eyesight and eventually blindness. We are investigating the activity of microRNAs, identified as upregulated from ocular fluids of patients with diabetic retinopathy, in regulating neovascularization. We are modeling this process using an in vitro assay of endothelial tube formation by human umbilical vascular endothelial cells (HUVECs). Human adult retinal epithelium (ARPE-19) cells were transfected with microRNA mimics miR-320b and miR-486 at 0nmol, 10nmol, and 25nmol concentrations for periods of 12, 24, and 48 hours. The conditioned media from the ARPE-19 assays was collected and then plated with HUVECs. After 12 hour incubation, cells were labeled with dye and imaged to obtain tube formation images. Total tube formation length was shown to be stimulated by miR-486 at 25nmol after 48 hours when compared to ARPE-0nM ($p<0.05$). No statistically significant effect by miR-320b on total tube length was observed. This data suggests that miR-486 has a stimulatory effect on endothelial tube formation and may be linked to increased VEGF secretion by ARPE-19. Further, this data has implications for future therapies for diabetic retinopathy using microRNAs.

Characterization of Mating and Parental Behavior in the Endangered Amargosa Vole (*Microtus californicus scirpensis*)

Alexandria Scott
Sponsor: Karen Bales, Ph.D.
Psychology

The Amargosa vole is an arvicoline rodent native to the Amargosa River basin in the Mojave Desert. This species is critically endangered as a result of habitat loss due to climate change, human encroachment, and predation by invasive species (e.g. house cats). Amargosa vole reproductive behavior has remained uncharacterized; however, this information is invaluable for species rehabilitation. In this series of studies, we considered two aspects of Amargosa vole reproductive behavior. In Study 1, we characterized the Amargosa vole mating system, i.e. whether they demonstrate monogamous or promiscuous behavior. We find some evidence for differential behavioral response to mates versus strangers. In Studies 2a and 2b, we aimed to determine if Amargosa voles demonstrate bi-parental care. In Study 2a we considered the time it takes for parents to retrieve an infant in a novel environment. In Study 2b, we considered what parental care parents demonstrate toward infant stimuli. In both Studies 2a and 2b we find evidence for both maternal and paternal behavior with significant sexual dimorphism. Future studies will expand upon this work through cross species behavioral comparison (i.e. with prairie voles), and we will consider the neuroendocrine substrates of Amargosa vole behavior.

Blackness at the Intersections: Immigration, Blackness, and Criminalization in the United States

Valencia Scott
Sponsor: Bettina Ngweno, Ph.D.
African American African Stds

The U.S. hosts the largest prison population globally, with over 21% of the world's prisoners. Black Americans in particular, while making up only 12% of the adult population, made up 33% of the total incarcerated population in 2016 (Sentencing Project) (Pew Research). Research also addresses systemic racial bias, with Blacks facing higher rates of arrest, prison sentencing, and policing (Sentencing Project). Economically, this prison-industrial system annually expends $182 billion, with private prisons comprising $3.9 billion of those costs and $374 million in profit (Prison Policy). I suggest that the discussion of mass incarceration's economic and racial implications for Blacks should include Black immigrants. In 2017, over 73% of all immigrant detainees were held in private prisons (Sentencing Project). In this context, I analyzed the overall use of privatized prisons and detention center investment in contingency with an increasingly detained immigrant population by tracking political lobbying, economic revenues, and monetary expenditures of two major ICE-contracted corporations: GEO Group and CoreCivic. I also consider that Black immigrants are more likely to be detained and deported for criminal convictions than the overall immigrant population, and how this can breed an additional and parallel discourse on mass incarceration systems in the U.S. (Libscombe, et.al).

Analyzing the Effect of Wildlife Crossing Structures on Frequency of Animal-Vehicle Collisions

Jeffrey Scott
Sponsor: Fraser Shilling, Ph.D.
Environmental Science & Policy

Wildlife-vehicle conflict is a major issue due to impacts to human and wildlife safety and the associated financial costs. The Road Ecology Center at UC Davis studies wildlife movement, behavior, and highway collisions involving wildlife. We will examine the effect of wildlife crossing structures on the amount of vehicle collisions with various species grouped by size (small, medium, or large). Wildlife crossing structures include highway underpasses, culverts, and bridges, which allow animals to safely travel across a highway. We will be looking specifically at bridges over waterways. Using Road Ecology Center data, we will examine the number of collisions recorded between 2016-2018 within 100m segments of the road where wildlife crossing structures are i) present and ii) absent. We will look at a minimum of 30 crossing structures that have been identified along California highways. Crossing structures with exclusionary fencing will be omitted. We will use a t-test to analyze the quantity of wildlife-vehicle collisions on portions of highways with and without the crossing structure mitigation measure. By better understanding wildlife use of crossing structures, we can help inform Caltrans and other transportation agencies about future highway development and planning, and help reduce the amount of wildlife-vehicle collisions.

Cryopreservation of Santa Cruz Island Horse Fibroblasts for Cloning and Conservation

Breanna Scranton
Sponsor: James Murray, Ph.D.
Animal Science

The Santa Cruz Island (SCI) horse breed, thought to be a descendant of Spanish colonial horses, is currently represented by less than fifty horses. Low population size leads to a higher prevalence of inbreeding, which may cause higher frequencies of medical issues such as degenerative suspensory ligament desmitis. In order to preserve the genetics of this small, docile breed of horse, our goal is to establish cell lines isolated from biopsied dermal tissue of all SCI horses followed by cryopreservation of the cells. A comparative study between growth kinetics of cells from older SCI horses and those of younger horses will show the effects of age in genetic preservation. The rationale for establishing a frozen cell bank is to preserve the cells for research and applications, which may include future cloning, maintenance of genetic material, and the potential to differentiate primordial germ cells. Downstream cloning of horses can be performed to increase the population size, which when coupled with selective outcrossing, may improve the genetic health of the SCI horse. Fibroblast cells have been established from two SCI horses and are proliferating quickly. These studies will contribute to the conservation of an endangered and genetically distinct breed of horse.

The Threshold of Influence: Social Media & Music

Samuel Seaver
Sponsor: Laramie Taylor, Ph.D.
Communication

Since 2015, online streaming services and social media platforms have taken over as the predominant mode of music consumption. This medium is abound with social information in the form of streams, likes, and shares, each contributing toward the perception of song success. Because there are prominent companies that deal with social media marketing, it is imperative to understand if higher quantities of likes are in and of themselves influential. In an online experiment, I examined social media "likes" as a factor predicting perception and selection of new music online. Participants were presented with a series of social media posts, each of which proffered a new song with a manipulated quantity of likes; a participant might see a song endorsed by dozens, hundreds, or thousands of peers before indicating interest in listening to that song. Results are discussed in terms of theoretical and practical implications of the effects of perceived social endorsement. The implication of this could lead to an unfair marketplace in which success can be manipulated by those who have power to increase a song's quantity of likes.

Weak Lensing 2.0: The Velocity Field

Matthew Self
Sponsor: David Wittman, Ph.D.
Physics

Traditional weak gravitational lensing is a powerful cosmological probe, but suffers both from the mass sheet degeneracy and from intrinsic shape noise due to galactic orientation uncertainty. Consequently, studies are forced to combine numerous observations in order to achieve accurate measurement of lensing parameters. One proposed method seeks to overcome both challenges, utilizing spectroscopy in conjunction with imaging and applying the Tully-Fisher Relation to determine the galaxies' pre-lensing state. We find that a parameter degeneracy persists in the method, preventing unique determination of lensing parameters from a single source galaxy. We utilize an alternative method to determine magnification along a line of sight using the Fundamental Plane for early-types which is known to break the mass-sheet degeneracy. We conduct a Fisher Matrix analysis to determine idealized lensing constraints achievable by this combined method and obtain promising results, providing an improvement of up to two orders of magnitude compared to traditional methods. This improved precision along with the method's unprecedented ability to probe lens substructure show significant promise in astrophysical applications. As we have relied on idealized models, we plan to use simulated and archival data to validate the method by testing its robustness in realistic scenarios.

Altered Metabolism in High Amylose Wheat Mutants Permits Maintenance of Early Growth Under Stress

Erlin Serrano
Sponsor: Diane Beckles, Ph.D.
Plant Sciences

Germinating seeds use starch stored in the endosperm for early growth and metabolism. The two different structures of starch, amylose and amylopectin, have varying digestibility. A mutation in the starch branching enzyme (SBE) yields a higher proportion of amylose. High amylose starch is less digestible, and is likely to inhibit plant growth. The purpose of this study was to examine how four different growing conditions (no light, room temperature, cold temperature, and salinity) affected seedling growth and metabolism, especially carbon partitioning, in wild type vs. SBE mutant (abAB) wheat seeds that have been bioengineered to induce a higher amylose-to-amylopectin ratio. Preliminary results show that the environmental stressors have a greater detrimental impact on the growth rate of the mutant genotype than the wild type. However, both genotypes eventually attained the same degree of growth. We therefore conclude that the abAB genotype developed a compensatory metabolic strategy to cope with high levels of amylose.

Effects of Excess Iron on Cognition in a Suckling Rat-Pup Model

Momna Shahbaz
Sponsor: Bo Lonnerdal, Ph.D.
Nutrition

There have been several recent reports suggesting excess supplemental iron is detrimental to infant brain development. Little is known about the mechanisms underlying these effects. To learn more, we are investigating the cognitive outcomes of excess postnatal iron supplementation in a suckling rat-pup model, through behavior tests, gene expression, and iron status assessment. Pups were supplemented with ferrous sulfate, an iron chelate (Ferrochel), or sucrose vehicle control beginning postnatal day (PD) 2. Some pups were euthanized at PD 15, while others were supplemented until weaning and underwent behavioral testing at PD 50. By PD 15, hemoglobin and hematocrit increased significantly in the iron-supplemented groups, as well as liver and spleen iron stores. This suggests that iron absorption is under-regulated during the postnatal period. Two cognitive tests were performed: T-Maze spontaneous alternation and Passive Avoidance. Spontaneous alternation results showed no significant difference among groups for males or females. However, males who received Ferrochel had a significant increase in latency compared to those given ferrous sulfate or control, indicating improved cognitive function. Although more studies are needed to explain these results, effects of iron excess are likely form-dependent. These findings are relevant for health professionals giving advice on infant nutrition.

Use of Metabolomics for Prognostication of Renal Cancer Response to Type 1 Inhibitors

Avneet Shaheed
Sponsor: Robert Weiss, M.D.
MED: Div Of Internal Med

Human clear cell renal carcinoma (ccRCC) is the most prevalent form of kidney cancer amongst adults, with prognosis influenced by the reprogramming of two immune-relevant metabolic pathways: glutamineGSH/GSSG and tryptophan/kynurenine. In our study, anonymized slides containing sections of cancerous kidney biopsies were obtained from RCC patients prior to treatment with checkpoint inhibitors (CPIs). We then processed these sections by removing the cancer tissue from the slides, solubilizing and subjecting it to LC/MS in order to separate and identify metabolites and lipids in a non-targeted fashion. Lipidomics were correlated using bioinformatics techniques with patient outcome to CPI treatment (whether they responded to CPI treatment or not) with the goal of predicting which patients are most likely to respond to the therapy. We hypothesize that we can find a biomarker of a metabolic signature (possibly glutamine or tryptophan reprogramming) which correlates with response to CPIs in order to stratify RCC patients into responders and nonresponders. Once identified, such a biomarker will be useful to predict responses of patients to immunotherapies targeted for ccRCC and will assist physicians in developing specific novel therapies for kidney cancer and to limit potentially toxic treatments to those patients most likely to respond.

Sex and Chromosome Specific Meiotic Crossover Regulation in *Caenorhabditis elegans*

Tara Shahrvini
Sponsor: Joanne Engebrecht, Ph.D.
Molecular & Cellular Bio

Human breast cancer susceptibility gene, BRCA1, and its binding partner BARD1, function in homologous recombination and DNA damage repair. During meiosis, homologous crossover recombination is essential for chromosome segregation. We investigated the role of the C. elegansorthologs, BRC-1 and BRD-1, on crossover formation under instances of meiotic dysfunction. We dissected germ lines of various mutant strains, each with a unique pattern of improper pairing and synapsis of chromosomes, and examined these gonads using deconvolution microscopy. In C. elegans wild-type oogenesis, each of the six homologous chromosome pairs forms a crossover that can be tagged with the crossover precursor marker COSA-1. Surprisingly, our preliminary data suggested that under these conditions more crossovers were occurring, as there was an increase in COSA-1 foci. Removal of BRC-1 led to fewer COSA-1 marked events, suggesting that BRC-1-BRD-1 alters the crossover landscape under meiotic dysfunction. During spermatogenesis, brc-1mutants had more COSA-1 foci suggesting differences in regulation of crossover formation under meiotic dysfunction in oogenesis versus spermatogenesis. Demystifying the role of BRC-1 and BRD-1 on crossover formation may clarify the role that BRC-1 and the human ortholog BRCA1 play in meiosis.

Evaluating the developmental toxicity of tetrabromopyrrole in zebrafish

Talin Shamun Darbrudy
Sponsor: Pamela Lein, Ph.D.
VM: Molecular Bio Sciences

Anthropogenic halogenated pyrroles, or halopyrroles, are detected in wastewater and drinking water. Currently an unregulated class of disinfection by-products, halopyrroles are generating public health concern due to recent findings indicating that these compounds are cytotoxic and interfere with development in invertebrates. Anthropogenic halopyrroles were recently shown to dysregulate calcium dynamics in microsomes by sensitizing ryanodine receptors (RyRs), which are important in vertebrate development. These observations raise the question of whether halopyrroles affect vertebrate development. To answer this question, we assessed the teratogenic and photomotor response in developing zebrafish (Danio rerio) exposed to tetrabromopyrrole (0.1 µM to 1 µM). Zebrafish embryos were dechorionated and statically exposed beginning at either 24, 48, or 72 hours post fertilization (hpf) through 5 days post fertilization (dpf). Morphologic malformations and mortality were evaluated daily. Photomotor behavior was assessed using automated technology at 4 and 5 dpf. Tetrabromopyrrole was lethal at 0.7 µM and 1 µM at all time points. Photomotor response was significantly altered at lower concentrations in a non-monotonic concentration-effect-related manner. Given the potential for human exposure to anthropogenic halopyrroles, these observations suggest that further evaluation of the developmental neurotoxicity of this class of compounds in vertebrate species is warranted.

Ctrip: China's Online Travel Platform—Local Giant or Global Competitor?

Tianyi Shao
Sponsor: Martin Kenney, Ph.D.
Human Ecology

This research project investigates the formation and growth of the largest Chinese travel and tourism platform, Ctrip, within the context to the changing Chinese economy. We explore Ctrip's recent globalization strategies suggesting that it intends to expand beyond just serving the Chinese market or Chinese tourists in global markets. The globalization strategy appears to have two prongs: The first prong has been using its enormous cash flow to acquire or co-invest in rapidly expanding local firms dominating other developing country markets. The second prong is investing or acquiring firms/websites in developed nation markets that can either service the enormous flow of Chinese tourists or provide services to Western travelers. For these investments, Ctrip can provide infrastructural and capital support enabling operations to expand more quickly. We cannot assume Ctrip's initiatives in international markets will succeed. However, given that Chinese tourism may continue to its rapid growth and that Ctrip monopolizes this market, it has significant financial resources in directing this flow of tourists for strategic advantage, and a rapidly developing capability in analyzing the enormous inflow of data. For these reasons, Ctrip tends to be an increasingly formidable competitor to the US global travel and tourism platform giants.

An N-terminal Flag-tag Impairs TPP1 Regulation of Telomerase Function

Madhav Sharma
Sponsor: Lifeng Xu, Ph.D.
Microbiology & Molec Genetics

The shelterin protein complex binds to telomeres and protects chromosome ends from being recognized as damaged DNA. Shelterin also regulates telomerase, an enzyme which adds telomeric sequences to the ends of DNA. Dysfunction of the shelterin complex can lead to health issues such as premature aging syndromes and cancer. One subunit of the shelterin complex, TPP1, has been shown to directly interact with telomerase and is essential in promoting extension of telomeric sequences. Although TPP1 protein has been extensively studied through the use of epitope tags, the cellular effects of tagging have not been characterized adequately. To study this, we examined the effects of placing a 3x Flag tag to the N- or C-terminus of TPP1 in human cells. Molecular and cellular analyses showed a difference between the two tags. While the position of the tag did not affect TPP1's interaction within the shelterin complex, it affected TPP1's regulation of telomerase function. Specifically, the N-terminal tag impaired telomerase processivity, which resulted in a failure to stimulate telomere elongation in vivo. In contrast, the C-terminal tag functioned in a similar capacity to the untagged version of TPP1. These findings suggest that caution should be taken when using tags to study TPP1.

SUMO Modification of Msh4 Regulates Meiotic Crossing Over

Shashank Shastry
Sponsor: Neil Hunter, Ph.D.
Microbiology & Molec Genetics

Meiosis produces haploid gametes (sperms and eggs) from diploid precursor cells through two successive rounds of chromosome segregation. Accurate segregation of homologous chromosomes at the first meiotic division requires chromosome pairing, synapsis and crossing over. Defects in meiosis are a leading cause of infertility, pregnancy loss and congenital disease in humans. SUMOylation is a post-translational modification involved in the regulation of many aspects of nuclear dynamics and chromosome metabolism. Recent studies have demonstrated a critical role of SUMOylation in the regulation of meiosis. Our long-term goals are to discover specific targets of SUMOylation during meiosis and understand how SUMO regulates their function. The Msh4 and Msh5 proteins form a heterodimer that facilitates meiotic crossing over by stabilizing the DNA joint-molecule intermediates. In this study, we identify budding yeast Msh4 as a SUMO target and show that SUMOylation is important for the crossover function of the Msh4/5 complex. Insights into how SUMOylation modulates the function of Msh4 will also be presented.

Infants' Scene Perception: Exploring the Dynamic Influence of Meaning and Saliency

Nikita Shetty
Sponsor: Lisa Oakes, Ph.D.
Psychology

Attention is a critical component in learning, especially for infants who learn about the world by visually inspecting it. Research has shown that young infants are likely to focus on salient, or eye-catching, stimuli. As they grow, infants begin to ignore salient stimuli and attend to more meaningful stimuli, such as faces. This pattern has been shown both in visual search arrays (Kwon et al., 2016) and complex scenes (Frank et al., 2009). However, in past experiments, "meaning" has often been in the form of face-like stimuli, despite the fact that many other aspects of visual scenes are meaningful (e.g., familiar, recognizable objects). For our study, we examined how infants' visual gaze is related to this kind of meaning in natural scenes. We used photographs of everyday scenes that had been evaluated by adults for the meaningfulness of each region (Henderson & Hayes, 2018). We used eye tracking to record the gaze of infants ranging from 4 to 12 months of age. Using computational models, we compared infants' gaze to areas high in meaning and high in saliency to see which factor had a stronger influence over infants' attention, as well as how this relationship changed with age.

Ectopic Expression of Orthologous *CBF1* Genes on Chilling Tolerance in Transgenic Solanum lycopersicum L.

Megan Shih
Sponsor: Diane Beckles, Ph.D.
Plant Sciences

Subtropical species like tomato experience Postharvest Chilling Injury (PCI) when transfered to room temperature after being refrigerated (0-12.5°C). PCI accelerates fruit spoilage leading to post-harvest waste. CBF1 is a transcription factor that has been shown in previous studies to increase chilling tolerance when overexpressed in transgenic tomato plants. No studies have been conducted on fruit post-harvest, thus leading to our hypothesis that CBF1 upregulation in chilled fruit could reduce PCI. This was tested in transgenic tomato lines engineered with cold or chemical-inducible regulatory systems of native and orthologous CBF1 genes. Transgenic fruit were harvested, cold-stored, and PCI development was monitored based on phenotypic characteristics such as objective color and surface pitting. CBF1 transgenic expression was confirmed by qRT-PCR. Results revealed an amplification of PCI symptoms and accelerated senescence of transgenic fruit. If CBF provides an advantage to plants under cold stress, it is possible that the fruit phenotype may be advantageous to plant fitness. Therefore, the physiological effect of CBF1 overexpression on seed germination and seedling growth was assessed under chilling and control temperatures. This study allowed for more insight into understanding the regulatory mechanisms of fruit cold response.

Examining the stress-buffering effects of social contact in pre-weaning piglets

Ashley Shuen
Sponsor: Kristina Horback, Ph.D.
Animal Science

Human-animal interactions in swine production often occur during stress-inducing contexts, such as handling and processing. How successfully the animal copes with this stress, through behavioral and physiological changes, has been shown to impact animal health and meat quality. According to the stress buffering theory, animals which engage in social contact will cope with stress better than animals which are isolated after stressful events. The aim of this study was to (1) evaluate consistency in behavioral stress-response in 25 pre-weaning piglets, and, (2) examine the relationship between active coping behavior and acute post-stress behavior. Twenty-five pre-weaning piglets were filmed while restrained in the arms of a human for 50 seconds. The resistance to this restraint was defined as the duration of physical struggling and vocalizing. The piglets were also filmed for 3 minutes upon return to their farrowing pen after a low-arousal (restraint) and high-arousal (processing) stressful event. Post-stress behaviors recorded included time spent being social, nosing, resting, and suckling. We hypothesize that pigs which resist restraint the strongest will actively seek social contact upon return to the pen. This study highlights the importance of social housing for pre-weaning piglets as it can help pigs to alleviate symptoms of chronic stress.

The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Mohammedan" in the New York Times (1900-1909)

Sabrina Shupp
Sponsor: Suad Joseph, M.D.,Ph.D.
Anthropology

My research is focused on the representation and characterization of the Middle East within the New York Times from 1900-1909. The New York Times is considered to be the leading progressive and liberal newspaper nation-wide. I specifically focused on articles relevant to the term "Mohammedan" through the Proquest Historical Newspaper Database. My research will highlight a window of time from January to April of 1900 because of the extensive relevance of articles at the time. The term was used to describe both the ethnicity and the religious state of individuals and groups of people. I found that the term often associates the Middle East and the "Mohammedan" people as foreign and in need of modifications in order to be seen as socially and culturally acceptable. The term is also associated as being inferior to contrasting people groups and religions. This research coincides with a larger project analyzing 150 years of The New York Times.

Studying CENH3 mediated haploid induction utilizing CAS9 genome elimination in crop plant *Solanum tuberosum*.

Mohamed Hisham Siddeek
Sponsor: Anne Britt, Ph.D.
Plant Biology

It was shown by Ravi & Chan that mutations in the CENH3 gene, which codes for a centromere specific histone 3 variant, can lead to genome elimination when crossed to a plant carrying the wild type allele. This can result in the formation of viable uniparental progeny carrying only a single set of chromosomes. Our purpose in this project is to create haploid inducers in potato (Solanum tuberosum var Desiree). A vector plasmid that carried a point mutation in CENH3 was transformed into Desiree along with the site-specific endonuclease Cas9 targeting the endogenous CENH3 locus. Since Desiree is an autotetraploid, Cas9-mediated genome elimination was required to remove the active endogenous copies of CENH3. If we successfully create a haploid inducing line, breeders would be able to obtain 100% homozygosity in a single generation as opposed to multiple generations of inbreeding, as is used in classical approaches. We have received several independent T0 events from a plant transformation facility, each T0 plant carrying one of three different versions of CENH3 (Wild-type, M4 and M14 mutations). Currently we are characterizing these lines and the updated results will be discussed.

Female Representation in Executive Management and Board Positions in Emerging Growth Initial Public Offerings

Selena Silva
Sponsor: Martin Kenney, Ph.D.
Human Ecology

Companies with more equal levels of gender representation tend to have stronger short-term performance and higher levels of innovation compared to male dominated firms. However, female representation in executive management and board positions remains quite low. This research provides an up to date descriptive analysis of gender representations in all firms that went public from 1990 to 2015 using Kenney & Patton's Emerging Growth IPO Management and Director Database. Roughly one half of firms did not include any woman executive at the time of their IPO. Despite this, the number of women involved increases over time indicating more equal representation over generational shifts. These women most commonly occupy vice president and director positions. When we examine industry, women have the largest percentage of representation in retail trade, services, and finance. However, when we compare the women involved in the IPO, we see that most are in the manufacturing and services industry. Having a woman in a position of power does not appear to be related to the hiring of additional women in other management roles or board positions. Detailed data describing gender dynamics can motivate firms to address gender disparities and contribute to increased female representation in positions of power.

Optimization and Analysis of PCB Magnetorquer Coils for CubeSats

Ryan Silva
Sponsor: Stephen Robinson, Ph.D.
Mechanical & Aerospace Engr

The Remote Experimentation and Analysis of LEO Phenomena (REALOPs) is a 2U CubeSat development project focused on data acquisition for use in STEM education. The objective of the Attitude Determination and Control System (ADCS) is to develop low-cost solutions that meet mission orientation and stability requirements of the small satellite. Magnetorquer coils provide active magnetic attitude control; they are responsible for detumbling maneuvers and preventing saturation of reaction wheels. This presentation discusses the embedded magnetorquer coil design of the ADCS. Embedded coils provide a similar magnetic moment but higher heat dissipation and easier integrability than air coils; they also provide more reliable control than torquerrods. The inexpensive embedded coils are produced by CNC milling PCBs. Trend analysis of magnetic and thermal behavior is conducted to ensure accurate modeling and prediction of board properties and to optimize designs for low volume interference, low energy consumption, and high heat dissipation. The REALOP mission aims to demonstrate the utility of embedded coils and their synergy with reaction wheels for effective attitude controls.

Optimization of Tobacco Rattle Virus-based Gene Silencing in *Arabidopsis thaliana*

Loreena Sims
Sponsor: Savithramma Dinesh-Kumar, Ph.D.
Plant Biology

Plants use nucleotide-binding leucine-rich repeat (NLR) class of immune receptors to defend against a pathogen's infection. NLR-mediated signaling often leads to localized cell death to contain a pathogen to the infection site. However, researchers know very little about components involved in the induction of cell death and containment of pathogen to the infection site. Here, we optimized Tobacco Rattle Virus (TRV)-based gene silencing approach in Arabidopsis thaliana wild-type Col.0 plant that could be used for screening to identify cell death regulators. I will present this project's results by using phytoene desaturase (PDS), brassinosteroid insensitive 1-associated receptor kinase 1 (BAK1), and somatic embryogenesis receptor kinase 4 (SERK4) as reporters to optimize TRV-based gene silencing in Arabidopsis thaliana. By having a thorough understanding of how the signaling components behave in the downstream defense responses of pathogen recognition by NLR immune receptors, we will be able to design strategies for crop protection and address emerging as well as current plant diseases.

The potential for a strawberry pathogen to grow on residue of a broccoli crop

Christine Singh
Sponsor: Thomas Gordon, Ph.D.
Plant Pathology

Fusarium wilt of strawberry is caused by the fungal pathogen Fusarium oxysporum f. sp. fragariae (Fof). This pathogen is also able to colonize other crops that are grown in rotation with strawberries, which demonstrates that it is able to survive in the absence of a host. The present study seeks to understand the behavior of the pathogen when strawberry is grown in rotation with broccoli, by assessing its ability to colonize residue of this crop de novo in soil. This will be accomplished by burying broccoli leaf disks in a soil and sand mixture infused with the pathogen. After five days, leaf tissue will be removed from soil and placed on a selective growth medium. Growth on this medium will indicate if any Fusarium species have colonized the leaf tissue. Fungal growth will be transferred to a medium amended with hygromycin B. Growth on this medium will indicate if the pathogen is present. While Fusarium species are normally sensitive to hygromycin, genetic modification of the GL1080-K strain of the pathogen confers resistance to this antibiotic. The results of this study will help to characterize the risk posed by growing broccoli in rotation with strawberry.

The Effects of Endocannabinoid Agonism and Antagonism on Partner Preference Formation in Prairie Voles (*Microtus ochrogaster*)

Alexis Singh
Sponsor: Karen Bales, Ph.D.
Psychology

The endocannabinoid system—composed of G protein-coupled receptors, CB1 and CB2, and their lipid-derived agonists, 2-AG and anandamide—is involved in social anxiety and social reward. Research has shown that increased anandamide activity, through activation of oxytocin receptors or anandamide hydrolysis inhibition, enhances social reward and reduces social anxiety. This has important clinical implications for the social deficits seen in psychiatric disorders like schizophrenia and autism spectrum disorder. The purpose of our study is to determine the effects of endocannabinoid agonism and antagonism on partner preference formation in prairie voles (Microtus ochrogaster). In our antagonism experiment, we administered AM4113 (a brain permeable CB1 antagonist) to four treatment groups: 0 mg/kg, 4 mg/kg, 8 mg/kg, and 16 mg/kg. In our agonism experiment, we administered URB597 (a brain permeable anandamide hydrolysis inhibitor) to four treatment groups: 0 mg/kg, 5 mg/kg, 10 mg/kg, and 20 mg/kg. We hypothesize that the CB1 antagonist will block partner preference formation and the anandamide hydrolysis inhibitor will facilitate it. Our findings will provide the foundation for further explorations into the relationship between endocannabinoid signaling and social bonding.

Establishing Functional and Accessible Field Epidemiological Capacities at the Local Public Health Level: A Case Study on a Multischool Norovirus Outbreak in Yolo County

Jason Robert Singson
Sponsor: Karen Shapiro, D.V.M.,Ph.D.
VM: Pathology, Micro, & Immun

A countywide outbreak of norovirus impacted nearly 4,000 students across Yolo County's school districts from late April to mid-June of 2017. Public health measures focused on controlling norovirus transmission by excluding and isolating patients, conducting proper environmental disinfection, and promoting proper hand hygiene. However, these measures proved difficult to implement during the outbreak due to the norovirus strain's emergent nature and the county's large geographic region. An 11-year literature review (2008-2018) identified 303 articles for literature documenting past norovirus outbreak investigations. Nine relevant articles were included in the present review due to the use of descriptive and analytical epidemiology in outbreak investigations involving K-12 schools. The findings of past outbreak investigations will inform a critical analysis of the outbreak investigation in Yolo County. Since norovirus is not usually a disease with mandated reporting, outbreak investigation articles were difficult to find. The implications of this study provide insight into how smaller local health departments respond to outbreaks, shifting to a more focused and active approach involving proactive public health surveillance and intervention.

Using Machine Learning to Accurately Diagnose Type II Diabetes Mellitus

Sankalp Sinha
Sponsor: Shuai Chen, Ph.D.
MED: Public Health Sciences

According to CDC Statistics (2017), over 30.2 million individuals over the age of 18 have diabetes. Of these individuals, 95% of them have type 2 diabetes. Nearly 1 in 4 of these individuals did not know they had the condition, and 11.6% of individuals with prediabetes knew they had it.Diagnosed diabetes costs $327 billion in expenditures annually, via inpatient care, emergency department visits, and productivity burden.Consequently, the early and accurate diagnosis of diabetes is essential to preventing the development of comorbidities and reducing healthcare costs.The International Expert Committee supports using the hemoglobin A1c test (HbA1c) to diagnose Type II Diabetes Mellitus (T2D) because of its high specificity value.This test, however, has relatively low sensitivity values.Additionally, attaining a HbA1c test result is not as convenient as using noninvasive clinical measures, which resultantly forms an obstacle to an early diagnosis.I compare binary classification learning algorithms to optimize the predictive ability to clinical-level diagnosis accuracy. Cross validation techniques were used to find the best classifier, and the algorithms were optimized to compete with HbA1c sensitivity and specificity values. This research suggests a scalable ability to use noninvasive, easy-to-attain clinical measures to make a preliminary prediction of T2D.

Exploring the Plant Glycome Through Its Monosaccharide Composition Using UHPLC-QqQ MS

Tarik Siniora
Sponsor: Carlito Lebrilla, Ph.D.
Chemistry

It is known that nature has over 391,000 species of plants with only 20,000 of them being edible to humans. Previously, our lab developed the first carbohydrate encyclopedia which included the monosaccharide and glycosidic linkage compositions of a variety of foods. Now our focus is on the remaining 95 % of the plants that are currently overlooked and not characterized. Understanding the monosaccharide composition of the inedible plants can allow for the potential creation of dietary fiber supplements and prebiotic applications. We acquired, dried, powdered, and homogenized 74 plant samples. Using the rapid-throughput method for determining the monosaccharide composition of polysaccharides developed by our lab, we performed a 96-well plate hydrolysis and derivation procedure. Data was acquired over a 10 min run on a UHPLC-QqQ MS operated in the dynamic multiple reaction monitoring (dMRM) mode. In this manner, we were able to identify and successfully quantitate 14 unique plant monosaccharides. Knowing that diet plays a major role in the overall health of humans, employing our monosaccharide analysis method can allow us to characterize plants and potentially utilize the results to create products that more suitable and efficient for maintaining proper gut health.

Analysis of dietary patterns in a 2000-year old site in Sunol, Ca using stable isotpe analalysis

Ian Slack
Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

The evolution of the human diet has been a long standing research problem in archaeology. Recent methods promote the use of stable isotope signatures in bone and teeth as a way for archaeologists to better understand the diet of an individual. This study focuses on dietary patterns among hunter gatherer peoples, ancestors of the modern-day Ohlone, at the “Sunol Yard” site in the East Bay region of Central California, in the modern day city of Sunol, California. With support from descendant communities, bone collagen from the remains of approximately 25 individuals dating between 2000 and 1500 years ago were analyzed for carbon and nitrogen isotope signatures. Results suggest a diet focused on terrestrial resources amongst the cohort, which is interesting given the proximity of the site to the San Francisco Bay. The study will compare the relation between adult male and female diets, and contrast the diets of adults and children. The aim of this study is to shed light on the distribution of food resources within this ancient population, and provide information on social structure.

The Potential of Interdisciplinary Humanities, Ethics, and Social Science Courses to Fill Academic and Skill Based Gaps in Undergraduate Pre-medical Education

Caroline Smith
Sponsor: Meaghan O'Keefe, Ph.D.
Religious Studies

In 2015, the Association of American Medical Colleges restructured the MCAT exam to address incoming medical students’ lack of academic experience in humanities, ethics, and social science subjects. Additionally, medical schools now want their applicants to demonstrate critical analysis and problem solving skills that are founded in medically-relevant areas outside of traditional STEM subjects. While these events have encouraged undergraduate institutions to provide a more comprehensive education for pre-med students, science-focused majors have been slow to give students credit towards their degree for humanities, ethics, and social science courses. Furthermore, the variety of interdisciplinary courses remains low for pre-med students. This study will examine the perspectives of undergraduate students regarding the interdisciplinary course options available to them. We hope to learn about students’ likelihood of enrolling in interdisciplinary courses based on whether they get credit towards their degree. Additionally, the study will collect students’ opinions about the academic preparedness of those going into pre-health fields through surveys distributed to students of the UC Davis Honors Program and College of Biological Sciences. This study will help determine which avenues of curriculum development are practical to pursue in pre-med education at UC Davis.

Antagonist Muscle Atrophy Model: A Novel Model for Studying Frailty

Tayler Smith
Sponsor: Keith Baar, Ph.D.
Neuro Physio & Behavior

Inactivity, age, and disease lead to decreased skeletal muscle mass, otherwise known as muscle wasting. Muscle wasting limits quality of life and contributes to premature death. We aspire to develop a minimally invasive model of muscle wasting to investigate the underlying molecular mechanisms. Since the gastrocnemius (GTN) and soleus muscles are antagonists of the tibialis anterior (TA) muscle, we hypothesized that removing the GTN and soleus muscles would decrease the load on the TA to produce physiological muscle wasting. To test this, the GTN and soleus muscles of six 3-month Female Sprague Dawley rats were removed and the contralateral limb served as a the sham surgery control. Following two weeks of unloading, strength, muscle mass, and muscle fiber type specific cross-sectional area were measured. Initial results show that, the unloaded TA muscle mass decreased significantly by 8.68±2.27% compared to sham TA. Although unloading the TA induces a mild decrease in mass, strength and fiber size do not decrease. Therefore, this model is not ideal for studying the mechanisms of muscle wasting in aging communities. Further protein analysis of the mild muscle wasting via western blot may provide insight to develop another model to study frailty.

Arrhythmogenic cardiac alternans can be amplified by locations of pacing

Michael Smolkin
Sponsor: Daisuke Sato, Ph.D.
MED: Pharmacology

Sudden cardiac death (SCD) is a leading cause of death in the world. The main cause of SCD is
arrhythmia, which is defined by spatiotemporally disordered electrical patterns. Electrical alternans is a precursor of arrhythmias. However, the mechanisms of alternans are not well-understood. In this study, we analyzed the mechanism of alternans due to irregular pacing locations in tissue using the computational model of the heart. The cardiac tissue was modeled as a two-dimensional sheet. The action potential model is based on the simplified ventricular myocyte model by Echebarria and Karma. The tissue was paced from two sites. We measured electrical alternans, which is defined as an alternating sequence of the action potential duration (or occasionally height). We found that alternans was significantly amplified when the tissue was paced alternatively from two sites. We varied parameters in the model, such as the distance between two sites, pacing cycle length, and ion channel properties, to identify critical parameters controlling the dynamics of alternans as the theoretical bases for novel therapeutic strategies. The findings in this study provide a potential dynamical mechanism for tissue scale alternans.

SOFA CONNECT - Bloom

Madison Smith
Sponsor: Jiayi Young, M.F.A.
Design Program

The UC Davis submission for the Sculptural Objects Functional Art & Design CONNECT competition is an immersive installation titled, BLOOM. Our Design Department emphasizes social responsibility, human-centered practice and sustainability. We are uniquely poised with a biodesign program which gives us the opportunity to work with innovative and sustainable materials. Given the opportunity to build an exhibit for an international audience, we dedicated BLOOM to tackling the negative environmental impact of consumerism by providing a comfortable, desirable and modern lounge space, with everything except the electronics composed completely of biodegradable materials. We provided the audience with an environment in which they could connect with the environment through materials like mycelium –a unique biomaterial grown from root-like strings that extend from underneath mushrooms. They were able to experience an immersive exhibit in which they could engage in social activity and feel comfortable in a lounge space that was 97% biodegradable. They were also given the opportunity to interact with a coded projection that moved as they did. BLOOM proves that products aren't limited by their life spans.

What are the Quality Indicators of Journal Articles?

Paige Snelgrove
Sponsor: Simine Vazire, Ph.D.
Psychology

The quality of journal articles can vary substantially even within peer-reviewed journals. Therefore, it is important to understand what the quality indicators of articles are so that consumers of research can better assess articles. Additionally, identifying which aspects of an article that are not related to quality, even if commonly thought to be, is useful so that consumers can adjust their evaluative standards accordingly. To study these indicators and aspects, the sample size, article title, and the prestige of the authors' institutions were collected for 687 articles published within a psychology journal. These articles were also ran through Statcheck, a program that identifies inconsistencies in statistical reporting. Further, the Altmetric scores, a score that indicates how much attention an article has received online, were collected. With these data, we can investigate whether indicators at times thought to be related to quality, such as Altmetric scores and the prestige of the authors' institutions, are related to other indicators of quality such as sample size and consistency in statistical reporting. The current study's findings will help inform scientists about which indicators to prioritize to produce high quality articles and may provide journals with information that can help them better evaluate manuscripts.

Phonetic Imitation of Digital Devices and Human Voices Correlated With "Autistic" Traits

Cathryn Snyder
Sponsor: Georgia Zellou, Ph.D.
Linguistics

Research shows people often vocally align with, or imitate, the fine-grained speech characteristics of each other's voices while talking. The reason for phonetic imitation has been empirically associated with individual differences across people (i.e., personality and cognitive processing style), and people's natural tendency to promote successful social communication through implicitly matching their speech with the other speaker. Although there is research exploring human-to-human interaction and imitation, there is relatively very little research conducted to examine human-to-digital device interactions. The present study explores how individual differences, detected by the Autism-Spectrum Quotient questionnaire, influence the way humans interact with digital devices. In the current study, subjects performed a word shadowing task. We then assessed the degree of vocal alignment between the participants and four distinct interlocutors: two digital devices (i.e., Apple's SIRI) and two human voices. Subjects then filled out the self-administered Autism-Spectrum Quotient questionnaire. The results of the word shadowing task were then correlated with the results of the Autism-Spectrum Quotient questionnaire. The findings can yield new insight to the way humans interact with digital devices.

Effect of Rdh54 on mitotic recombination in *Saccharomyces cerevisiae*

Vanessa Som
Sponsor: Wolf Heyer, Ph.D.
Microbiology & Molec Genetics

Double-strand breaks (DSB) are among the most lethal types of DNA damage and a source of genome instability that may lead to cancer. It is crucial to understand the mechanisms of DSB repair pathways, especially high-fidelity repair by homologous recombination (HR). Rdh54, an ATP-dependent DNA translocase, is well known for its importance in yeast meiotic recombination. However, a recent study also suggests that Rdh54 plays a role in somatic HR. The current investigation aims to address this novel role of Rdh54 by examining the effect of mutations in RDH54 on the crossover and non-crossover frequencies during somatic DSB repair using an established assay (Mazon & Symington 2013 Mol. Cell) that allows for analysis of these events between markers positioned on allelic positions of homologous chromosomes. A chromosome that has undergone DSB repair will have a MET22 or URA3 marker upstream of its DSB site, and a hygromycin or cloNAT marker downstream. Quantification and characterization of crossover events in rdh54 mutant and wild type strains can be determined through observing which markers are present in these chromosomes. The expected results will illuminate the extent of Rdh54's impact on DSB repair in somatic cells.

Association Between Lipid Metabolism and Copper Regulation from the Wilson Disease Mouse Model

Bokyoung Son
Sponsor: Valentina Medici, M.D.
MED: Div Of Internal Med

Wilson Disease (WD) is an autosomal recessive genetic disease which is caused by mutations affecting the ATP7B gene. The ATP7B protein acts as a copper transporter and disease-causing mutations are associated with copper accumulation in various organs including the liver and brain. Hepatic copper accumulation causes hepatic steatosis, progressive inflammation, and fibrosis and ultimately cirrhosis and liver failure if left untreated. The mouse model, C3He-Atp7b^{tx-J}(tx-J) strain, has a spontaneous mutation affecting the Atp7b gene with consequent hepatic copper accumulation similar to what is observed in humans. Liver, gastrocnemius, mesenteric white adipose tissue (MWAT) were collected from both tx-J and the wild type mice (C3HeB/FeJ). Total RNA was isolated and cDNA synthesized to perform qRT-PCR for expression analysis. Hepatic transcripts of fatty acid uptake (Cd36, Lipoprotein lipase) and lipogenesis related genes (Acetyl-CoA carboxylase1) were up-regulated in tx-J compared to the wild type group. In MWAT samples, Lpl was up-regulated and Cd36 was down-regulated, respectively, in tx-j mice. No significant changes in gene expression were observed in the gastrocnemius tissue. Copper accumulation appears to be associated with dysregulation of lipogenesis and fatty acid uptake in the liver and MWAT tissues of the tx-J mouse.

Impact of Milk Osteopontin on the Development of the Intestinal Mucosal System

Zehan Song
Sponsor: Bo Lonnerdal, Ph.D.
Nutrition

Osteopontin (OPN), a highly acidic phosphorylated glycoprotein present in high concentrations in human and mouse milk, is involved in various biological activities, including antibacterial and immune modulatory functions through interactions with OPN receptors, including integrin avß3 and CD44, on the surface of target cells. Effects of milk OPN on intestinal mucosal development remain unclear. Therefore, we used an established OPN mouse model infected with Citrobacter rodentium to evaluate the effects of milk OPN on intestinal mucosal development. Weaned wild-type (WT) mouse pups (day 22-24) nursed by WT dams (OPN+) or OPN knock-out (KO) dams (OPN-), thus receiving milk with abundant milk OPN or without OPN, were given C. rodentium by oral gavage, and colon samples were collected after 7, 14, and 21 days. The OPN+ group had a higher survival rate than did the OPN- group. IgA concentrations in cecum contents and expression of OPN receptors were examined by an ELISA kit and qRT-PCR, respectively. Higher concentrations of cecal IgA and OPN receptor transcripts were seen in the OPN+ group. In summary, milk OPN promotes intestinal mucosal development thus protecting against infection by increasing IgA secretion and up-regulating expression of OPN receptors.

Blood Stained Sugar and the Burning Island: Turmoil, Power and Slave Resistance in 18th Century Jamaica

Clifton Sorrell
Sponsor: Justin Leroy, Ph.D.
History

The struggle to seize the black body against constant slave resistance defined 18th-century Jamaican slave society: a colony beset with instability and turmoil. Numerous records chronicle the brandishing of slave-owning power, attesting to the violent punishment and seizure of enslaved people. While these colonial biases of archival material perpetuate a notion of black dispossession due to the lack of records produced by enslaved people, writing historiography that demurs the representation of disembodiment is vital. Slave resistance and acts of rebellion occurred day to day as a quotidian reality thus suggesting that enslaved people played a more significant role in shaping the trajectory of Jamaican slave society. The relationship between the spectacular flaunt of slave-holding power, and slave resistance brings into question: how does the colonial state deal with the threat of insurrection and the insubordination of enslaved people as a means of reinforcing captivity––and how can we understand enslaved resistance as an activation of power against being violently dispossessed? The pursuance of this question, scrutinizes court trial cases, slave revolt reports, and Jamaican assembly records from the U.K Archives to examine the contestation of power over the seizure and liberation of the black body.

Exploring the Role of LOG2 in the Ubiquitin Pathway Using Various Stresses

Alisha Sousa
Sponsor: Judy Callis, Ph.D.
Molecular & Cellular Bio

The ubiquitin pathway is an ATP dependent pathway that requires three classes of enzymes to target proteins for degradation. These enzymes collectively serve as shuttles to transfer the protein ubiquitin onto other proteins. E3s, the third class of enzymes also called ubiquitin ligases, interact with the proteins to catalyze ubiquitin transfer. One Arabidopsis thaliana E3, called LOG2, interacts with Glutamine Dumper 1 (GDU1). Addition of certain amino acids to growth media inhibits seedling greening and development for unknown reasons. When overexpressed, GDU1 increases amino acid export activity and seedlings grow on normally toxic levels of added amino acids. Both of these properties unexpectedly require LOG2. Previous research associated LOG2 with response to the stress hormone, abscisic acid (ABA) with the loss-of-function log2 mutant showing hyposensitivity to ABA. To further understand LOG2's physiological roles, we are investigating the effects of different stresses, added amino acids, ABA, or heat shock, on the growth of log2 mutants and determining whether the four E3s closely relate to LOG2 function in the same stress response pathways. The goals of these experiments are to understand the roles of LOG2, its family members and the ubiquitin pathway in stress responses.

Defective Meiotic Recombination in Mutant Mice Lacking Breast Cancer Susceptibility Gene *Brca2*

Christopher Soto
Sponsor: Neil Hunter, Ph.D.
Microbiology & Molec Genetics

DNA damage repair through the process of homologous recombination is essential for preventing harmful chromosomal abnormalities and maintaining genomic integrity. BRCA2, a tumor suppressor gene, plays an essential role in recombination by loading the DNA pairing and strand-exchange protein RAD51 onto single-stranded DNA at sites of damage. In germ cells undergoing meiosis, recombination is critical for proper chromosome pairing and segregation, and defects cause infertility, pregnancy miscarriage and congenic disease. Our understanding of how BRCA2 regulates recombination during mammalian meiosis is still obscure. This study aims to elucidate the meiotic functions of BRCA2, focusing specifically on its relationship with two DNA strand-exchange factors, RAD51 and DMC1. To mutate the essential Brca2 gene specifically in meiotic cells, we employed a conditional knockout approach using a flox'd allele of Brca2 exon 11 and the Cre recombinase expressed under the control of the meiosis-specific STRA8 promoter. In mutant mice, we observed a dramatic decrease in the chromosomal loading of RAD51 and DMC1, revealing that BRCA2 plays an essential role in the assembly of recombination complexes during meiosis. Detailed phenotypic analysis of Brca2 conditional mutant mice will be presented.

Identifying Movement Properties of Animal Leaders Using Machine Learning

Samvardhini Sridharan
Sponsor: Margaret Crofoot, Ph.D.
Anthropology

What makes a good leader? Ask any two people and you are likely to get different answers, but we may be able to look to group-living animals to understand the fundamentals of leadership. For this purpose, we define leadership as the ability to get members of a group with divergent goals to make collective decisions. In this study, we investigate if machine learning can predict leadership in the context of an individual agent's motion and will be leveraging an existing simulation-based approach to model movement patterns. The motion of each agent will be determined by its distance to the center of the group and k neighboring animals. One or two agents in a group (leaders) will also bias their movement toward independently selected destinations, ultimately influencing the entire group to move in that direction. Our machine-learning model will classify individual movement tracks as leader or non-leader by applying support vector machines and/or random forest methods to the semi-variograms of each agents' velocity and turning angles over time. If successful, our algorithm will remove the need for simultaneous tracking data to identify leaders in animal groups and thus provide a valuable tool for recognizing and studying animal leaders.

Morphological Characterization of Autism Spectrum Disorder Mutations in Zebrafish

Aditya Sriram
Sponsor: Megan Dennis, Ph.D.
MED: Biochem & Molecular Med

Autism-spectrum disorder (ASD) is a complex neurological disorder with a significant phenotypic and genetic heterogeneity. Generating disease models is challenging since hundreds of genes and thousands of mutations are ASD-associated. We premise that impacts of patient mutations can be assayed in zebrafish, mimicking mouse and human mutant phenotypes. For these higher-throughput studies, we use zebrafish because their larvae have transparent bodies, permitting high-quality imaging. Furthermore, zebrafish embryos develop externally; this enables introducing mutations in larvae without euthanizing mothers. We focused on two genes with protein-altering mutations resulting in ASD and brain size phenotypes: WDFY3, which encodes a macrophage protein, results in macrocephaly in patients carrying de novo loss-of-function mutations; and SLC7A5, which encodes a large amino acid transporter protein, results in microcephaly in patients carrying homozygous missense mutations. F_0 mosaic zebrafish mutant larvae were created using CRISPR-Cas9. Morphological characterizations, including head and eye sizes, were performed using bright-field microscopy at five days post-fertilization. Compared to mock-injected controls, our preliminary results show a significant decrease in eye size for wdfy3 mutants and reduced brain size for slc7a5 mutants. In the latter case, brain defects resemble that of humans and rodents. Future mutant characterizations should offer insights into the underlying ASD-contributing mechanism.

"The little O, the earth": Theatrical Land and Shakespeare's Tragedies

Emily Stack
Sponsor: Gina Bloom, Ph.D.
English

From Richard II's "teeming womb of royal kings" (II.i.51) to Richard III's "lawful earth/ Unlawfully made drunk with innocents' blood" (IV.iv.31-32), from the "sure and firm-set earth" (II.i.69) of Macbeth to the "gaping hollow" (II.iii.250) of Titus Andronicus, the earth is a central structuring motif in Shakespeare's tragedies, one that suggests immediate material connections between the dramatic narrative and the earthly performance space. While ecocriticism has paid vital attention to the environmental dimensions of literary texts, existing scholarship has paid significantly less attention to the ecologies of the spaces in which audiences receive those texts. My research intervenes in this critical gap by situating several of Shakespeare's tragedies and tragic histories in the context of the theater space to investigate the interfaces between the earth as it appears in the drama and the earth as it is in the ground and space of the theater. I argue that the theater was a space where early modern viewers developed conceptions of land, nation, and gender, and that the figurations of land that arise in the tragedies — of mother and monster, producer and consumer, heaven and hell — are key to understanding early modern perceptions of the world.

An Analysis of Expenditures Under the Endangered Species Act: How Your Taxes are Divided Between the Bakersfield Cactus and the Fresno Kangaroo Rat

Arianna Stokes
Sponsor: Frances Moore, Ph.D.
Environmental Science & Policy

The Endangered Species Act (ESA) offers the most rigorous protection of American biodiversity available under US law. The ESA, however, is chronically underfunded; few species of the over 1000 species listed as threatened or endangered by the ESA receive adequate funds for recovery. The allocation of resources to conservation efforts that benefit individual species reflects a decision of prioritization among species with competing needs. Using data extracted from publicly accessible US Fish and Wildlife Service (USFWS) reports, two decades of annual government expenditures on recovery efforts for individual species will be analyzed to determine how government agencies allocate resources among species. Patterns in species expenditures will be assessed with respect to species attributes that are constant or variable over time. The analysis will identify attributes that increase a listed species' likelihood of receiving funding under the ESA. Additionally, the results will allow for an evaluation of government adherence to the ESA's stated priorities.

Structural and Thermodynamic Differences of TIA1 Mutant RNA Granule and Fibril States

Rachelle Stowell
Sponsor: Dylan Murray, Ph.D.
Chemistry

Amyotrophic lateral sclerosis (ALS) and frontotemporal dementia (FTD) are devastating neurodegenerative diseases which have no known cure and are poorly understood. The T cell-restricted intracellular antigen-1 protein (TIA1) is a RNA-binding protein that is essential for the formation of RNA granules, which protect cells in stress or disease conditions. Recent studies show that RNA granules behave as liquid-liquid phase separations of protein molecules or liquid droplets. Mutations in TIA1 have been linked to ALS and FTD and speed up the transition of the liquid droplet to pathogenic fibrillar aggregates. In this study, we employ calorimetry to measure the thermodynamic stability of wild-type and mutant TIA1 in liquid droplet and fibril form. We also use nuclear magnetic resonance to characterize the fibril structure. We anticipate the results of the measurements will help explain the elevated rate of aggregation in patients with the mutated TIA1 gene. Understanding the thermodynamic and structural basis for the transition of TIA1 from functional liquid droplets to pathogenic fibrils will allow a better understanding of these devastating diseases and will guide the design of new treatments and early detection imaging agents.

Constraining thermal histories of the 25ka Oruanui super-eruption, Taupo Volcanic Centre, NZ

Sophia Stuart
Sponsor: Kari Cooper, Ph.D.
Earth And Planetary Sciences

Super-eruptions are among the most catastrophic events known to occur on Earth. Eruptions of this magnitude occur approximately every 105 years, however, the timescales and processes involved in generating large volumes of mobile magma remain poorly constrained. Understanding the evolution of silicic volcanic systems requires evaluating the thermal and chemical histories of magma reservoirs underlying these systems. We apply radiometric dating techniques and diffusion modeling to plagioclase crystals from the ~25ka Oruanui eruption from the Taupo Volcanic Center (TVC), New Zealand to better constrain these conditions. Comparing diffusion timescales with calculated crystal residence times, we constrain how long the magma reservoir experienced high temperatures necessary to facilitate eruption. Initial 238U-230Th ages for Oruanui plagioclase suggest these crystals grew within ~5000 yrs prior to eruption. In contrast, zircon ages yield much longer residence times (>100 ka), suggesting they were extracted from a different part of the system than plagioclase. Diffusion timescales for plagioclase suggest magmas spend <1000 years above 700 °C, indicating crystals are stored at high temperatures for a relatively long period of time prior to eruption. This contrasts with the interpretation that magmatic systems feeding smaller volume volcanoes are stored at low temperatures prior to eruption.

Mobile Air Sampling Reveals Potential Exposure Hazards in Indoor and Outdoor Environments of a Socioeconomically Disadvantaged Community in the San Joaquin Valley

Debbie Sulca
Sponsor: Clare Cannon, Ph.D.
Human Ecology

California's Kettleman City is surrounded by agriculture, landfills, benzene treatment plants and an aqueduct—industries that can emit volatile organic compounds (VOCs) into the air, which pose severe environmental threats to residents. This research aims to examine air quality in this community and understand the perceptions its predominantly Spanish-speaking residents have about their environment. To measure air quality, a custom built, micro-gas preconcentrator (μPC) sampler was used to adsorb VOCs in the air. Samples were collected in multiple locations: a bathroom with running water to identify potential dissolved VOCs released into the indoor air; other indoor locations in a residence; outdoor locations near a potentially polluted intersection. All samples were returned to the lab for analysis. Gas chromatography-mass spectrometry (GC-MS) was used to putatively identify and quantify the presence of VOCs from the samples. Interim chemical analysis revealed potential toluene, xylene and benzene derivatives in the outdoor air samples, and potential tribromomethane in the indoor bathroom air sample. The environmental health survey was deployed door to door. Findings will include residents' concerns related to air quality, water quality, and pesticides. This study demonstrates how chemistry can be used to quantify environmental injustices of socioeconomically disadvantaged communities.

Exploring Students' Interactions with Graduate and Undergraduate Teaching Assistants in Chemistry Laboratories

Muhammad Sulman
Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Beginning in Fall 2017, the Chemistry Department at UC Davis started a pilot program through which undergraduate teaching assistants, formally known as Emerging Scholars (ES), have been working with graduate teaching assistants (TA) in laboratory settings. In order to observe and study the differences in student interactions with the TAs and the ESs, every TA and ES was asked to audio record their conversations during two lab sessions. After the audio data were collected, they were first transcribed, and student interactions with the lab instructors were coded using Laboratory Observation Protocol for Undergraduate STEM (LOPUS). Findings of this study will reveal whether students are more comfortable approaching TAs or ESs, and how the teaching styles may vary between the two lab instructors. Student inquiries and TA's or ES's responses will be carefully examined to better understand the instructional styles in the labs. These observations and analyses will reveal the efficacy of the Emerging Scholars program and provide the guidelines to enhance student learning experiences.

Investigation of the Influence of Problem Construction on Chemistry Students' Success with Stoichiometry Problems

Xianzheng Sun
Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Chemistry students struggle with interpreting given information in problems and separating relevant information from distractors, causing failures in generating successful solutions. Chemistry educators have implemented different methods such as using solution maps to teach their students how to approach problems and successfully tackle them. However, the effectiveness of problem construction by utilizing given solutions on students' problem-solving achievement has not been studied yet. In this study, a group of chemistry students (N=45) participated in three think-aloud sessions. The group was divided into a control group (N=15) and an experimental group (N=30). During the pre-intervention session, all the students were asked to solve five stoichiometry problems while thinking aloud. After two weeks, the intervention session was conducted in which the experimental group was asked to construct eleven chemistry problems by examining the given detailed solutions. In the post-intervention session, both groups solved slightly modified versions of the pre-intervention questions in order to observe changes in their strategy, knowledge, and accuracy. The goal of this study is to better identify students' struggles with solving chemistry problems, and to examine the effects of problem construction as a potential method to increase students' success with problem solving in chemistry and other subjects.

Metabolomic analysis of plasma from relapsing-remitting multiple sclerosis patients reveals changes in metabolites associated with neurocognitive and structural changes in brain

Duncan Sylvestre
Sponsor: Ameer Taha, Ph.D.
Food Science & Technology

Changes in peripheral blood amino acids and other metabolites have been noted in Relapse Remitting Multiple Sclerosis (RRMS), suggesting their potential diagnostic value in anticipating disease progression. The present study sought to quantify changes in the plasma metabolome of RRMS patients to identify potential biomarkers of disease pathogenesis. This study performed untargeted NMR metabolomics on plasma from 30 RRMS patients and 17 unaffected controls to test the hypothesis that metabolomic markers are altered in RRMS patients in association with lesion load, brain atrophy, and cognitive performance. There were no significant differences between RRMS and controls in age, sex and total brain volume. Brain tissue volumes and nine metabolites (arginine, isoleucine, citrate, serine, phenylalanine, methionine, asparagine, histidine, myo-inositol) were significantly lower in RRMS patients compared to controls. Plasma arginine concentrations were correlated inversely with volume of the basal ganglia and thalamus, and total grey matter volume. Histidine was correlated inversely with basal ganglia volume. Arginine and histidine were positively associated with performance on tests of executive function. The identified disturbances in metabolite concentrations might be developed as markers of neuroanatomical and cognitive vulnerability in RRMS, should the findings be reproduced in larger cohort studies.

Infants' Misinterpretation of Native Language Speech Sounds

Carolyn Ta
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Language development in infants is a phenomenon still not fully understood. We are studying how infants interpret words with endings that are acoustically different, but belong to the same phoneme category in order to understand the development of phoneme representations—how infants know what sounds are the same and which are different. In English, when the word “hat” occurs with a pronounced “t” sound or a light “t” sound, the word is still interpreted as “hat” because they are allophones of the same phoneme category. However, in other languages, the released-t versus reduced-t sounds are distinct phonemes. We are testing how infants interpret sounds that are allophones in their native language. In this study, monolingual English 14-month-olds view one object on a screen while hearing a novel word with a pronounced “t.” After many repetitions, the ending changes to a lighter “t” sound, while still playing the same object. If the infants look longer after the change, it signals that they notice the difference and think the two variations are actually different words. Thus far, infants seem to interpret lighter “t” and pronounced “t” signal two different words, indicating that they are incorrectly categorizing these allophones as two distinct words.

Pathogen Recognition in the Olfactory Neuroepithelium

Ashley Takeshita
Sponsor: Qizhi Gong, Ph.D.
MED: Cell Biology & Human Anat

Olfactory epithelium (OE) is constantly exposed to environmental pathogens. Olfactory sensory neurons (OSNs) in OE project their axons into the brain, providing a direct route for pathogen invasion. Whether or not OE has the ability to recognize and respond to environmental insult remains unknown. Our lab used RNA-sequencing to identify gene expression changes in OE after vesicular stomatitis virus (VSV) exposure and regulation of selected cytokine expression. To test the hypothesis that sus cells, a layer of supporting cells at the surface of OE, can recognize pathogens, we examined the expression and cellular localization of the key pathogen recognition signaling factor, myeloid differentiation primary response protein (Myd88). RNA-sequencing data and qRT-PCR validated upregulation of the Myd88 gene in OE at 24 hours after VSV exposure. Immunohistochemistry shows Myd88 signal in the microvillar layer of sus cells. Double labeling with the OSN marker, Olfactory Marker Protein (OMP), and a transgenic reporter mouse line that labels sus cells will confirm cell-type specific expression. Future in situ hybridization experiments will further define Myd88 expression. Localizing Myd88 expression will provide insights into the innate immune responsive capacity in OE and aid in preventative strategies against pathogen spread into the brain via the olfactory nerve.

Roles of Small-Conductance Ca^{2+}-Activated and Two-Pore Domain K^+ Currents in Atrial Electrophysiology and Arrhythmogenesis: a Simulation Study

Allison Tam
Sponsor: Eleonora Grandi, Ph.D.
MED: Pharmacology

Recent studies have suggested potential roles of the small-conductance Ca^{2+}-activated and the two-pore domain K^+ currents (I_{SK} and I_{K2P}) in the arrhythmic mechanisms of atrial fibrillation (AF), the most common cardiac arrhythmia. Since the ion channels carrying these currents are predominantly expressed in atrial vs. ventricular myocytes, they represent ideal targets for an atrial-selective pharmacological approach against AF – whereby current treatments have potentially harmful ventricular side effects. Indeed, I_{SK} and I_{K2P} are upregulated in AF, but the consequences of I_{SK} and I_{K2P} modulation for atrial electrophysiology are not fully understood. Here, we utilized a mathematical model of human atrial myocyte electrophysiology to investigate how I_{SK} and I_{K2P} alter atrial electrophysiologic properties in normal sinus rhythm (control), and how their augmentation affects chronic AF condition. To this end, we compared the effects of partial or complete block of I_{SK} and I_{K2P} on action potentials and Ca^{2+} transients in health and disease. Furthermore, we applied a population-based approach to quantify the sensitivity of cellular biomarkers to changes in the density of the main ion currents and transporters. Our analysis quantifies the role of I_{SK} and I_{K2P} in atrial electrophysiology, providing potentially useful information to inform anti-arrhythmic strategies against AF.

Testing Pathogen Perception in Diverse Citrus Varieties and Citrus Relatives to Develop Disease Management Strategies

Andrea Tang
Sponsor: Gitta Coaker, Ph.D.
Plant Pathology

Plant immunity is critical for preventing disease caused by pathogens through an arsenal of receptor proteins and downstream immune signaling. Pathogen recognition receptors (PRRs) recognize components uniquely found in pathogens termed pathogen-associated molecular patterns (PAMPs). PAMPs represent conserved microbial features such as lipids and proteins. After PAMP perception, reactive oxygen species (ROS) are produced to trigger immune responses that result in disease resistance. Currently, the citrus industry is plagued by devastating diseases such as Huanglongbing and citrus canker. Despite their economic importance, the characterization of citrus PAMP perception remains unknown. Wild Australian citrus relatives display heightened disease resistance to many bacterial diseases. Understanding perception differences between susceptible commercial citrus and disease resistant genotypes will provide insight to combat these diseases. To test the difference in PAMP perception between different citrus varieties, a microplate assay was used to assess/quantify ROS production after exposure to a small fragment of bacterial flagellin required for bacterial motility. Results showed that sweet oranges were the least responsive, while lemons responded the most. A deeper understanding of citrus PAMP perception and their corresponding PRRs will lead to targeted disease management by transferring resistance. Data will be presented on perception of diverse PAMPs in citrus genotypes.

Photochemical Methods for Building Organic Solar Cells

Yu Ching Tang
Sponsor: Annaliese Franz, Ph.D.
Chemistry

Solar energy has recently grown to popularity as a major source of sustainable energy. Research has shown that commercially available silicon-based solar cells are only 15% efficient in converting sunlight to electricity while carbon-based organic photovoltaics promise better efficiency. Diketopyrrolopyrrole (DPP) based materials are ubiquitous among semiconducting low-cost organic solar cells. A major synthetic challenge in developing new DPP-based materials is adding solubilizing alkyl side-chains at the DPP nitrogen. The current method is ineffective for branched alkyl chains, resulting in low product yields, presumably due to a competing O-alkylation side reaction. Here, I propose to develop a high-yielding copper photocatalyzed method for N-alkylation of DPP. Investigating initial condition showed that conjugated heterocyclic nitrogen-containing compounds can absorb fluorescence that may interfere with reaction progress. To address the challenges for reaction development, different wavelengths of light and different ligands for photocatalysts will be screened as additives to help promote the reaction. The success of this project will enhance the efficiency, reduce environmental impact, and lower the cost of producing organic semiconducting materials for applications in organic solar cells and other consumer electronics, as well as open up new avenues for N-alkylation in synthetic strategies.

Intranasal Delivery of an Artificial Transcription Factor for Angelman Syndrome

Isabelle Tankka
Sponsor: David Segal, Ph.D.
MED: Biochem & Molecular Med

Angelman Syndrome (AS) is a neurological genetic disorder that is caused by the loss of Ube3A. Ube3A is important in nervous system development and provides instructions to target proteins for degradation to maintain normal cell function. The lack of maternal Ube3a is associated with intellectual and physical disability, speech impairment, and seizures. In previous work, an artificial transcription factor (ATF): Zinc Finger-Based protein was injected subcutaneously and showed to pass the Blood-Brain Barrier and unsilence the paternal Ube3a in an AS mouse model. However, the huge amount of protein needed raised questions if there are other safe delivery routes and forms of the zinc finger that give similar effects. Therefore, intranasal administration of the protein and adeno-associated virus (AAV) coding the ATF was tested in a YFP-Ube3a mice model. The ATF protein and vehicle buffer were delivered for two weeks daily, whereas the AAV was delivered intranasally once. At the end of the study, one hemisphere was stained for microscope analysis, and the other half was used for Western Blot analysis. We expect that one of the delivery approaches will reduce costs and amount of protein needed, and move the therapeutic closer to translation into clinics.

Metal-catalyzed Silane Insertion Reactions to Synthesize Novel Silsesquioxane Building Blocks for Nanomaterial Applications

Karina Targos
Sponsor: Annaliese Franz, Ph.D.
Chemistry

Polyhedral oligomeric silsesquioxane (POSS) molecules are hybrid nanostructures that consist of an inorganic silicon and oxygen cube-like core surrounded by organic functional groups. POSS molecules have numerous applications in material science and biomedical engineering because they serve as a foundation for the construction of more complex nanomaterials. However, current synthetic methods limit the organic functional groups that can be installed on POSS molecules. Transition-metal catalyzed insertion of a diazo compound into the Si-H bond of various silanes is a powerful organic transformation that has not been applied to POSS silanes. Herein, I demonstrate metal-catalyzed Si-H insertion reactions on the POSS scaffold. Incompletely condensed POSS silanol molecules were capped using chlorosilanes to synthesize POSS silanes. A dirhodium(II) acetate catalyst was utilized to insert a diazocarbonyl into the constructed POSS Si-H bonds to afford novel ester- and aryl-functionalized POSS molecules. Other dirhodium and copper(I) catalysts were also explored but did not result in as high yields. Polar, noncoordinating solvents are observed to be optimal to promote the reaction of the POSS silane. Further derivatization of the novel POSS molecules resulting from this methodology will be explored to enable access to diverse POSS building blocks and expand the potential applications of POSS nanomaterials.

Testing Efficacy of Baits for Fungus Gnat Traps in a Greenhouse Environment

Kathryn Tarver
Sponsor: Jennifer Mullin, Ph.D.
Biological & Ag Engineering

Fungus gnats (Bradysia species) are small, black flies whose larvae feed on roots and leaves resting on the surface of soil. Gnat-damaged plants may wilt or die from resulting exposure to pathogens. Seedling flats and greenhouses are particularly vulnerable to fungus gnat infestations. Most existing pest management solutions target eggs and larvae. Though adult gnats pose no direct threat to plants, each female can lay 200-300 eggs. Single-use sticky tape, the only major pest management solution targeting adult gnats, produces plastic waste. To address this dearth of solutions, our team utilized rapid prototyping techniques to design reusable, modular testing devices (i.e. traps) targeting adult gnats. Each prototype trap featured a conical lid tapering to a small aperture, a glass body with opaque sides and a transparent base, and a bottom compartment to house electronics. Traps were used to test the efficacy of baits such as apple cider vinegar and short-wavelength light to attract and trap gnats in liquid media. Preliminary field testing demonstrated the importance of environmental conditions on gnat populations, prompting further trials in order to collect statistically significant sample sizes.

Dogs and Demographics: Neuter Status and Vaccine History in Canine Patients from Underserved Communities

Tahmina Tasmim
Sponsor: Jonathan Dear, D.V.M.
VM: Medicine & Epidemiology

Veterinary care is an important aspect of animal welfare and pet ownership. However, not all pet owners have access to veterinary care or utilize certain resources. There is a lack of research on health issues in pets from underserved communities, which puts veterinary professionals at a disadvantage to serve them. This study examines whether dogs in medically underserved communities and dogs from well-served communities have differences in health status and population dynamics. We will compare data from patient files of dogs examined at a no-cost wellness clinic servicing a low-income rural community to dogs examined at a private practice clinic in a suburban setting. We hypothesize that the most significant differences between the two demographics will be in neuter status and vaccination record. We expect dogs from the underserved community to be less likely to be neutered, and less likely to be up to date on vaccines. These findings can potentially be used to improve resource allocation at the Knights Landing One Health Veterinary Clinic (KLOHC), a no-cost clinic hosted by the veterinary school at the University of California, Davis, or other clinics serving similarly underserved communities.

The Effects of Cyanotoxins on Fish Embryos in the Sacramento–San Joaquin River Delta

Marcella Tea
Sponsor: Tomofumi Kurobe, Ph.D.
VM: Anat Physio & Cell Biology

Intense blooms of cyanobacteria were reported in the Sacramento–San Joaquin River Delta (the Delta) during the recent drought years, resulting in the elevated concentrations of cyanotoxins, such as microcystins, anatoxin-a, and saxitoxin. Because microcystins are hepatotoxins and anatoxin-a and saxitoxin are neurotoxins, these cyanotoxins can threaten water quality and adversely affect the health of aquatic organisms. However, it is currently unknown as to whether these cyanotoxins directly cause mortality on aquatic organisms in the field. This study was performed to determine a relationship between fish mortality and cyanotoxins in ambient water. The California Department of Water Resources collected water samples monthly from June to December 2018 at 10 sampling stations located in the Delta. Cyanotoxin concentrations were measured by commercially available assays. Fish embryos (Medaka, Oryzias latipes) were incubated in the ambient water samples for up to 14 days and mortality were recorded during the tests. We found that the month of December showed the highest mortality rate (20%). In addition, sites near Mackenson (D16) and Stockton (P8) had higher mortality rates than the other sites (17% mortality rate) across the seasons. Data were further used for correlation analysis to assess how cyanotoxins affected fish mortality.

Perceived Wealth, Gender Differences and how They Relate to Adolescent Well-being

Emily Templin
Sponsor: Adrienne Nishina, Ph.D.
Human Ecology

This study looks into how wealth in adolescence (having money to do the things adolescents need to and want to) relates to aggressive behaviors (gossiped, picked on, hit or punched another student, called another student a bad name). In the literature, there is a clear association between adolescents having lower wealth and displaying aggressive traits. As wealth inequality continues to rise in America, we wanted to determine if this association was still accurate. We predicted that it would be. The participants in this study were 988 sixth grade students from ethnically diverse schools (31.4% Caucasian/White, 30.1% Latinx, 13.9% Black/African-American, 13.5% Multiethnic, 11.2% Asian/PI) who were given self-report surveys (one general survey and 5 daily surveys) where they reported on their perceived wealth and whether they displayed any aggressive behaviors on each of the five school days. Overall, wealth was not correlated with aggression. However, this was most likely due to an observed gender difference. Girls that had less perceived wealth exhibited more aggressive behaviors (?= -.17, p = .001), whereas there was no association for boys (? = .003, p = .96). Further analyses will be conducted to determine what factors might explain these differences.

Defining Human Neutrophil Spreading on Different Substrates

Lay Heng Teng
Sponsor: Volkmar Heinrich, Ph.D.
Biomedical Engineering

The neutrophil is a type of highly motile white blood cell that locates sites of infection, migrates through tissue, and then consumes pathogens via phagocytosis. Our research aims to better understand how surfaces coated with different densities of IgG antibody or coated with lipopolysaccharide (LPS) affect the probability and rate of neutrophil phagocytic spreading. In our experiments, we prepare coverslips with varying densities of IgG or immobilized LPS membranes. We then mount a functionalized coverslip under a specially designed rectangular chamber with wells in which we deposit our samples of isolated primary human neutrophils. Cell spreading is observed using reflection interference microscopy (RICM), a high-resolution interferometry technique which allows us to clearly see regions of cell-substrate contact as dark patches. We use automated analysis of recorded video images to quantify the probability and speed of cell spreading. Our results show that the rate of phagocytic spreading is not affected by changing IgG density, but the probability of spreading does increase at higher IgG densities. We are currently investigating if there is a difference in the probability and rate of spreading on LPS compared to IgG.

Comparison of Mechanical and Biocompatible Properties of Alginate-based Bioinks for the 3D Printing of Osteogenic Grafts

Alejandro Tenorio
Sponsor: Jonathan Leach, Ph.D.
Biomedical Engineering

The use of biocompatible materials in combination with stem cells and bioactive cues has become a promising method for repairing damaged bone tissues. One such material is alginate, an FDA-approved natural polysaccharide that, upon cell encapsulation, can be used as a bioink for the 3D printing of anatomically accurate bone scaffolds. In order to be printed, alginate's rheological properties must be modified by either cross-linking or the addition of thickening agents which allow for its extrusion as a filament capable of retaining its own form. The main objective of this project is to assess and compare the effect of this alteration on the printability of four different alginate-based bioinks widely used in 3D bioprinting. To do so, filament collapse and filament fusion tests were optimized for an Allevi 2 bioprinter to assess the degree to which the alginate formulations expand and lose structural integrity when printed. The rheological properties of the different bioinks were as well analyzed to quantify the yield stress and viscosity threshold of each bioink. These studies will result in an index of the expected tendencies of alginate-based bioinks and will serve as a starting point for future studies assessing their biocompatibility and bone-forming capacities.

Exploring the European Union's Trade Strategy With Developing Countries

Eric Thai
Sponsor: Heather Mckibben, Ph.D.
Political Science

The European Union's recent concessions on multilateral and bilateral trade agreements with transitioning and developing countries prompted curiosity in its strategy against the popular notion of the utilization of its market power to win concessions from other states as well as its exportation of human and labor rights standards. Understanding the European Union's strategy to trade not only provides a door to understand its external affairs but also its approach to stabilizing its internal structure amidst the mobilization of anti-European sentiments. This research will explore the EU's bilateral and multilateral trade agreements and all associated press releases within the past decade to understand the general trend of the EU trade strategy. As such, this research will analyze the EU's attitude toward trade by quantitatively comparing tariff and custom reduction schedules between developed and developing countries the EU has negotiated with. This research and its preliminary findings hope to illuminate a trend that would contribute to the discussion on the motivations of the European Union and the future of their international relations approaches.

Olfactory Enrichment for Captive Jaguars (*Pathera Onca*)

Katherina Thiesen
Sponsor: Kristina Horback, Ph.D.
Animal Science

Often due to a lack of sensory or cognitive stimulation, captive animals are prone to develop stereotypic behaviors, which are repeated, purposeless behaviors like pacing in captive felids. To decrease the performance of stereotypic behaviors, captive animals are given species appropriate, environmental enrichment as sensory stimulation to promote behavioral diversity. Because felids rely on olfaction to locate food, mates and as a communication tool (e.g., pheromones), captive felids are given enrichment which has a strong odor component. In this study, nine captive jaguars were assessed for preference to interact with a wooden object that is either sprayed with a natural (urine) or synthetic (perfume) odor. Each jaguar was given 12-24 hours of access alone with each object across 26 days. Behaviors recorded include groom, spray mark, rest, roll in dirt, and, interact with object. The jaguars were observed to interact with the object significantly more frequently ($P<0.05$) when it was sprayed with the synthetic scent as opposed to the natural scent. Identifying the odor preference for captive felid enrichment can help caretakers provide the animals with an appropriately stimulating environment to encourage natural behavior while decreasing stereotypic behaviors to benefit the animal's welfare.

Gender Crisis: Bio-Necro Collaboration in the Governance of Gender

Russell Thomas
Sponsor: Rana Jaleel, Ph.D.
Gendersexuality Womensstudies

Numerous pieces of legislation have passed across the U.S. attempting to reconcile the difference between how a trans person self-identifies and the gender listed on their identity documents assigned at birth. This paper looks at the passage of California's SB-179, the Gender Recognition Act, which allows for the creation of a non-binary gender category on state documentation. The Obama Administration's attitudes toward LGBT populations were by and large positive, allowing for numerous assimilatory measures to be passed. Yet after a polarizing election season, the new Trump Administration has quickly moved to rollback protections for transgender people. The proliferation of transgender identity, particularly non-binary identities, has created a crisis of governance for the United States. In this paper I will look at how recognition produces varying affective responses within the non-binary community and how recognition itself is tied into biopolitics. Reading through Grace Hong's understanding of neoliberalism, I trace what it means to be assimilated and disavowed at different sites of governance, revealing the simultaneous, contradictory, and collaborative public and private workings of necro and biopolitical regimes of power.

Dairy Cattle use of Areas Within Their Housing is Based on More Than Just Microclimate

Melissa Thurston
Sponsor: Cassandra Tucker, Ph.D.
Animal Science

Behavior of dairy cattle can be influenced by factors such as temperature, stocking density, feeding schedule, and more. How cows alter their behavior in response to specific microclimates within a particular area of their home environment is not yet understood. Our objective was to assess variation in microclimate of the feeding and lying areas, the usage of these areas by lactating dairy cows, and if a relationship exists among the two variables. Sensors collected temperatures within the feeding and lying areas while 24 hour video surveillance was used to record cow position and determine housing area usage. Mixed models were used to evaluate variation in temperature and cow use of the lying and feeding areas. We expected cows to spend more time in the cooler areas of their environment, however, even though variation in temperature and housing area usage were present, cows did not use these areas more than warmer ones. Variables other than or in addition to microclimate temperature likely influenced the differences seen in how cows use their environment and this merits further research.

Droplet Conductivity Strongly Influences Bump and Crater Formation on Electrodes During Charge Transfer

Yash Tibrewala
Sponsor: William Ristenpart, Ph.D.
Chemical Engineering

Aqueous droplets in oil acquire charge when they contact an electrode in a high voltage electric field. Past work revealed that the electrode becomes physically pitted during the charge transfer event; however, the mechanism of the charge transfer is not well understood. The pits are believed to result when a dielectric breakdown arc occurs as a droplet approaches the electrode and the associated high current density transiently melts the electrode, leaving distinct crater-like deformations on the electrode surface. Here we show that the droplet conductivity strongly influences the pitting morphology but has little effect on the amount of charge transferred. De-ionized water does not produce observable deformations; however, as we increase the salt concentrations the deformations become increasing large and observable by electron and atomic force microscopy. These results suggest that the energy transferred during dielectric breakdown is primarily responsible for electrode pitting rather than the total amount of energy released during charge transfer.

Targeted Activation to Correct Angelman Syndrome in the Mouse Brain

Emma Tilley
Sponsor: David Segal, Ph.D.
MED: Biochem & Molecular Med

Angelman Syndrome (AS) is a rare genetic disorder that causes learning disabilities, balance issues, speech impediments, abnormal gait, epilepsy, and other symptoms. AS is caused by a mutation on the maternal copy of chromosome 15 that codes for UBE3A, which targets proteins for degradation. In a healthy brain the paternal copy of the UBE3A gene is silenced by a long noncoding RNA so that UBE3A is only expressed from the maternal copy. AS is caused when the maternal copy of the gene is nonfunctional or deleted, which leads to a lack of UBE3A in the brain. We employed targeted re-activation in an attempt to reinstate production of UBE3A in an AS mouse model. We plan to unsilence the paternal copy of the UBE3A gene by treatment with artificial transcription factors (ATF) targeted to the UBE3A promoter. The ATFs are fused to VP64 or VPR activation domains which act to increase UBE3A expression. We will monitor the upregulation of UBE3A in both cell culture and the mouse models. This will allow us to better understand our ability to regulate gene expression and has implications for developing future treatments for Angelman Syndrome.

Abalone on Acid: Does Ocean Acidification Alter Antipredatory Behavior of Red Abalone *Haliotis rufescens*?

Evan Tjeerdema
Sponsor: Brian Gaylord, Ph.D.
Evolution & Ecology

Red abalone (Haliotis rufescens) are an ecologically and culturally important species inhabiting the North Pacific and exhibit strong antipredatory behaviors towards carnivorous sea stars. Marine gastropods have been shown to have their antipredatory behaviors disrupted by ocean acidification. We investigated the potential for projected ocean acidification conditions to alter these antipredatory responses in H. rufescens. Eight abalone were placed evenly into water with either ambient or ocean acidification conditions and held in stagnant tanks for 6 days, undergoing daily water changes. Projected ocean acidification conditions of 0.5 and 0.6 pH units lower than ambient water were obtained by daily equimolar additions of HCl and $NaHCO_3$ following water changes. Of each water condition, two of these were exposed to Pisaster ochraceus waterborne and mechanical cues, while two went unexposed (n = 2). Abalone exposed to ocean acidification conditions displayed more antipredatory behaviors than the controls, with waterborne cue generating 50% more mantle activity and mechanical cues generating 50% more body movement and 50% more shell twisting than the controls. This heightened level of response could cause adverse effects on abalone energy budgets, due to more frequent and stronger antipredatory reactions, in addition to decreasing time spent by an individual on feeding.

Bmp Receptor 2a and 2b do not Contribute to Left-Right Asymmetry in Zebrafish Embryos

Eugene Toh
Sponsor: Bruce Draper, Ph.D.
Molecular & Cellular Bio

Bone morphogenetic proteins (Bmps) are important cell signaling ligands that regulate many embryonic development processes. Prior studies suggested two Bmp receptors, bmpr2a and bmpr2b, were required for establishing left-right asymmetry. In wild-type zebrafish embryos, the receptors were required to position heart development in the left-side and knockdown of these genes using morpholino oligos (MOs) caused hearts to develop on either the right-side or in the center. However, MOs have produced off target effects during embryonic development. I wanted to see if the heart develops normally in bmpr2a and/or bmpr2b genetic null mutants. The Draper lab previously created bmpr2a and bmpr2b null mutants using CRISPR/Cas9. I in-crossed fish that were heterozygous for bmpr2a and bmpr2b to obtain embryos that were mutant or wild-type for these receptors. I fixed the embryos at 32 hours post fertilization and performed in situ hybridization of myl7 to observe heart position. Out of the 415 embryos I observed, 411 developed the heart correctly and four developed it in the center. I genotyped the zebrafish that displayed a center heart jog and did not find any genotype bias. I concluded that loss of bmpr2a and/or bmpr2b does not affect left-right asymmetry in zygotic mutants.

Small-Scale Bioprinter Used in Production and Purification of Protein-Based Pharmaceuticals

Derek Tong
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

Existing technologies for the production and purification of protein-based pharmaceuticals, such as bioreactors, centrifuges, and filtration systems are large and not considered suitable by NASA for use in early outposts on the Moon or Mars. This project addresses whether small-scale bioprinting can be a component of space exploration and support production of protein-based drugs. To test this concept we modified a Monoprice MP Select Mini 3D Printer and designed a syringe extruder attachment that prints hydrogel instead of plastic. We have made changes to the hardware code using Arduino IDE, which lets us program settings for the 3D Printer. The bioprinter will eject hydrogel with transgenic rice cells that have been engineered to produce enzyme butyrylcholinesterase (BChE). BChE has detoxifying properties for organophosphate nerve agents, pesticides and the metabolism of cocaine, heroin and aspirin. We have demonstrated that rice cells can live immobilized in hydrogel for over 30 days after being extruded from the bioprinter and maintained in growth media. We are working on formulating hydrogel of optimal pore size that both suspends cells and maximizes enzyme secretion from the gel.

Inexpensive Microfluidics Controller for RNA Sequencing

Ares Torres
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

RNA-sequencing enables the relatively low-cost transcriptional profiling of biological samples. Heterogeneous samples, like complex tissues or environmental samples, can be sequenced to identify the different patterns of transcriptional activity present within. This type of profiling can be important in the various contexts, from medical diagnostics to environmental sampling. However, the sequencing of mixed samples does not easily allow one to associate specific patterns of gene expression to individual cells. For this single-cell sequencing is required. However, commercial tools for generating single celled sequencing libraries are expensive and therefore not readily accessible. Our project seeks to make single-cell sequencing more accessible by building a less expensive, quick, and reliable microfluidics droplet controller device. The device we are building contains micrometer-sized channels that enable the co-sorting of single cells and DNA barcoded beads into individual aqueous droplets from which uniquely-tagged sequencing libraries can be constructed. Built from inexpensive, commercially available components, this controller is under $550, easy to assemble, and user-friendly. We are in the process of validating the performance of our device using a variety of “simple” microfluidic designs. When finished, we hope that our work will provide greater access to single-celled transcriptomics for researchers both on and off campus.

Exploring Students' Interactions with Graduate and Undergraduate Teaching Assistants in Chemistry Laboratories

Linh Tra
Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Beginning in Fall 2017, the Chemistry Department at UC Davis started a pilot program through which undergraduate teaching assistants, formally known as Emerging Scholars (ES), have been working with graduate teaching assistants (TA) in laboratory settings. In order to observe and study the differences in student interactions with the TAs and the ESs, every TA and ES was asked to audio record their conversations during two lab sessions. After the audio data were collected, they were first transcribed, and student interactions with the lab instructors were coded using Laboratory Observation Protocol for Undergraduate STEM (LOPUS). Findings of this study will reveal whether students are more comfortable approaching TAs or ESs, and how the teaching styles may vary between the two lab instructors. Student inquiries and TA's or ES's responses will be carefully examined to better understand the instructional styles in the labs. These observations and analyses will reveal the efficacy of the Emerging Scholars program and provide the guidelines to enhance student learning experiences.

Investigation of Impact of California Rice Field Water Components on Hydrolysis of Chlorantraniliprole

Kathy Tran
Sponsor: Ronald Tjeerdema, Ph.D.
Environmental Toxicology

Chlorantraniliprole (3-bromo-N-[4-chloro-2-methyl-6-(methylcarbamoyl)phenyl]-1-(3-chloro-2-pyridine-2-yl)1H-pyrazole-5-carboxamide) is an anthranilic diamide insecticide registered for use in California rice fields and other crops in the United States. Chlorantraniliprole targets rice water weevil larvae, the primary pest in California rice production, and is also highly toxic to aquatic invertebrate species. The flooding and draining of rice fields can potentially cause runoff as chlorantraniliprole was frequently detected in surface water samples collected in California. To prevent surface water contamination and protect aquatic species, factors in natural waters that may catalyze or inhibit chlorantraniliprole hydrolysis should be studied. A previous study showed that the chlorantraniliprole hydrolysis is pH dependent. Furthermore, previous work has shown that metal ions can catalyze hydroxide mediated amide hydrolysis. Therefore, metal ions present in natural waters may impact chlorantraniliprole hydrolysis. Chlorantraniliprole and its degradation products were isolated using liquid-liquid extraction and analyzed by APCI-LC-MS/MS. The rate of hydrolysis of chlorantraniliprole in natural water, collected from the California Rice Experiment Station, is compared to the rate in sterile buffer solutions at pH 7 and pH 9 with and without Cu^{2+} and Zn^{2+}. The differences observed between treatments will provide insight on the effect of natural water components on the hydrolysis mechanism of CAP.

Chromosome translocation modulates patterns of pairing and recombination during meiosis.

Ngoc Han Tran
Sponsor: Neil Hunter, Ph.D.
Microbiology & Molec Genetics

Meiosis is the cellular division process that forms gametes in sexually reproducing organisms. Through two successive rounds of chromosome segregation, meiosis ensures that gametes contain a haploid set of chromosomes. Defects in meiosis lead to chromosomal aneuploidy causing birth defects and spontaneous pregnancy loss. The incidence of aneuploidy has been linked to defects in chromosome pairing and recombination that occur prior to the first meiotic division. Here we analyzed the effects of a heterozygous chromosome translocation on meiosis and its associated reproductive defects in mice. Comparison of mouse spermatocyte and oocytes revealed distinct pairing patterns between the translocated chromosomes and their homologous partners. In spermatocytes, secondary chromosomes frequently engaged in abnormal pairing interactions, while in oocytes, only the translocated chromosomes were aberrantly paired. Unexpectedly, translocation points were invariably associated with crossovers suggesting that homology boundaries can locally stimulate recombination. Although translocated chromosomes were associated with persistent DNA damage during prophase and aberrant connections during metaphase, they appeared to go undetected by meiotic checkpoint machinery, leading to a high incidence of aneuploidy in gametes. Our data point to local effects of translocations on recombination and a limited ability of quality control processes to prevent the propagation of defective chromosomes.

Sex-Biased Dispersal in a Model Organism, *Tribolium confusum*

Reed Tran
Sponsor: Alan Hastings, Ph.D.
Environmental Science & Policy

Understanding the movement of individuals across space and time is an important concept in ecology, with applications in the management of biological invasions. Multiple factors, such as sex-biased dispersal, have the potential to alter the rate of spatial spread of a population. Sex-biased dispersal occurs when one sex disperses farther than the other and can be used to avoid inbreeding or kin competition. For our research, we are using confused flour beetles, Tribolium confusum, to determine whether sex-biased dispersal is present and to assess its effects on polyandrous organisms. T. confusum are widely used to model population dynamics and dispersal due to their high reproductive rate and fast generation time. In a pilot experiment, we did not find a strong bias when the two sexes were put together. However, we did find that 50% of the males dispersed in the absence of females, and no females dispersed in the absence of males. We are currently conducting a full-scale experiment, where we expect T. confusum to demonstrate a male-biased dispersal. Sex-biased dispersal in polyandrous species may be an important consideration for those who study these types of model organisms and for larger-scale management policies.

Agrobacterium-lettuce interactions during transient protein expression

Allisa Tran
Sponsor: Richard Michelmore, Ph.D.
Plant Sciences

Nicotiana benthamiana is a plant model organism frequently used in biotechnology and molecular biology due to its high receptiveness to foreign gene expression. Unlike N. benthamiana, lettuce is unable to simultaneously express foreign genes that have been introduced via multiple agroinfiltrations, a method commonly used in plant biology to induce expression of a desired gene. In this project, I investigate if this is due to pattern-triggered immunity (PTI), an innate defense response to common microbial features. In the first experiment to test this, I will co-express a fluorescent protein with an immune suppressor. In the second experiment, I will coat the plant leaves with an immune inducer (bacterial flagellin) and then express a fluorescent protein. If activation of pattern-triggered immunity is the mechanism that prevents its expression, then I expect to observe expressed fluorescence after the immune system has been suppressed, while I also expect to observe no fluorescence after the immune inducer has coated the plant. These results will help enable molecular biology assays in lettuce and will show how the host immune system interacts with microbes during agroinfiltration assays.

Excitation-Contraction Coupling Proteins Expression in a Feline Hypertrophic Cardiomyopathy Model

Elaine Tran
Sponsor: Julie Bossuyt, D.V.M.,Ph.D.
MED: Pharmacology

Human hypertrophic cardiomyopathy (HCM) is a heart muscle disease caused by mutations in sarcomeric genes which encode components of the contractile apparatus of the heart. The clinical manifestation of HCM varies widely but includes symptoms of cardiac hypertrophy, heart failure, arrhythmia and sudden cardiac death. Among the most prevalent mutations causing HCM are those affecting thick filament binding proteins including myosin essential and regulatory light chains and cardiac myosin binding protein C (cMyBPC). Despite the frequency of the mutations and prevalence of the disease their functional consequences and molecular disease mechanisms are poorly understood and require further investigation. Interestingly HCM is the most common heart disease in cats. Two naturally occurring cMyBPC mutations have been identified including an A31P substititution in the Maine Coon breed and R820W in the Ragdoll breed. These models more closely resemble the human disease manifestation including its prevalence in heterozygous animals. Here we assess the impact of the A31P cMyBPC mutation on excitation-contraction coupling (ECC) by examining key ECC protein expression and phosphorylation: ryanodine receptor, L-type Ca channel, SR calcium pump and its regulatory protein phospholamban. These experiments should advance our understanding of the mechanisms by which cMyBPC mutations induce cardiac dysfunction.

Shaping Conversations: Creating Mental Health Resources for Asian American Youth

Thuy-Linh Tran
Sponsor: Sarah Perrault, Ph.D.
University Writing Program

Mental health concerns are prevalent among young adults, and they must be discussed in order to ease their burden on an individual. Most materials that discuss mental health are catered towards a general audience, however, audiences of different backgrounds have different needs. Starting discussions on mental health is challenging when the audience are Asian American young adults who are labeled the model minority and face barriers to mental health treatments because of their background. Therefore, there is a need for culturally competent resources that would inform this specific audience. The purpose of this research is to develop guidelines for culturally competent education materials that would help educators inform specific groups on mental health. This research will analyze papers on cultural competence to create a criteria and apply it to existing resources written about mental health. Research is in progress; the materials for researching the cultural competency criteria are gathered and existing resources on mental health are being collected. Eventually, this research will provide an example for how educators can integrate cultural competency into resources for Asian American youth. Organizations that focus on educating these groups, such as the Vietnamese Cancer Awareness Research and Education Society, will benefit from this research.

Evaluating Type II Diabetes Mellitus Status and Severity Among Patients at Paul Hom Asian Clinic at UC Davis

Daphne Tran
Sponsor: Ronald Jan, M.D.
MED: Surgery

Type II Diabetes Mellitus (DMII) is a highly prevalent disease in the United States, and in 2015 30.3 million Americans had the disease, including 8.0% of all Asian-Americans. At Paul Hom Asian Clinic (PHAC), a student-run free clinic that primarily serves members of the Asian-American population in Sacramento, 16% of patients present with DMII. The disproportionate number of PHAC patients with DMII reflects health disparities and barriers to healthcare access. To better address the impact of DMII on clinic patients, the PHAC team compiled DMII-related patient laboratory data throughout 15 years of patient visits. We compared the average vital signs, HbA1C levels, and lipid panel values between patients without DMII, patients with pre-diabetes, and patients with DMII. We calculated the changes in HbA1C and lipid panel values before and after treatment at PHAC. We are using these findings to develop a nutrition- and lifestyle- based educational intervention for PHAC patients with DMII, and in the future, we will evaluate the effectiveness of the intervention in improving measures of DMII status and severity.

Studies Toward Chiral-at-Silicon Oxazoline Ligands

Emma Tribble
Sponsor: Annaliese Franz, Ph.D.
Chemistry

Oxazoline-containing ligands are prominent in the field of asymmetric catalysis due to their effectiveness in a wide range of reactions, especially ones forming carbon-carbon bonds. The goal of this study is to synthesize oxazoline structures and incorporate chiral silyl groups in order to explore the effectiveness of chiral-at-silicon oxazoline ligands in catalysis. We chose an amino-indanol oxazoline to start our investigation due to prior results showing favorable activity using this ligand. Fluoro-containing aryl rings were chosen based on prior demonstration and due to the electron-withdrawing ability. I performed a synthesis of the target oxazoline molecule in two steps to replicate prior successful results that will be applied to the novel silyl-oxazoline ligands. The structures of the ligands are characterized using ^{1}H, ^{13}C, and ^{19}F NMR spectroscopy. We are currently optimizing conditions to generate an enantioenriched silane to incorporate into our ligand architecture. The variety of oxazoline structures synthesized here will give insight into the amount and type of functional groups needed to optimize the catalytic capabilities of the future chiral-at-silicon oxazoline ligands.

UNC5CL as a Possible Mediator of Sertoli Cell Proliferation

Maxine Lien Tu
Sponsor: Trish Berger, Ph.D.
Animal Science

A possible role of UNC5CL in the letrozole-induced proliferation of Sertoli cells was investigated due to preliminary RNAseq data on 2, 3, and 5-week-old pigs. Five-week-old boars treated with letrozole had more than three-fold greater expression of UNC5CL than littermates treated with vehicle. This treatment led to approximately 25% more Sertoli cells than present in vehicle-treated littermates leading to the possibility that UNC5CL is a possible mediator of Sertoli cell proliferation. Immunohistochemical staining using an anti-UNC5CL primary antibody was performed on tissue samples of testes from boars at 5, 6, and 6.5 weeks of age. Results yielded localization primarily within the seminiferous tubules and interstitial space. ANOVA was performed on the staining intensity scores and supported an age-dependent relationship in protein expression with $p < .01$, but no difference between expression in testes from letrozole-treated boars and vehicle-treated littermates. Multiple comparisons tests showed that intensity at 5 weeks is significantly lower than 6 weeks at $p < 0.05$ in both tubules and interstitial space; 6 weeks is significantly higher than 6.5 weeks at $p < 0.0001$; however, 5 weeks was marginally higher than 6.5 weeks with $p = 0.054$.

Optimization of CRISPR Gene Editing in GeneX through Hairy Root Transformation

Oliver Tucher
Sponsor: Anne Britt, Ph.D.
Plant Biology

The effects of downregulation in GeneX have been previously observed in the tomato plant to produce positive pleiotropic effects, including both higher crop yield, improved tolerance to disease, and a longer shelf-life. Our goal is to optimize a CRISPR gene editing method for the creation of various GeneX alleles in the tomato plant to find favorable alleles that will produce these positive pleiotropic effects. CRISPR technology is a powerful tool that can generate new alleles through knockouts, small inframe deletions, and knock-ins by homologous recombination. Hairy Root Transformation has previously been shown to be an effective method to investigate CRISPR efficiency and gene function in vivo. Therefore, we will use Hairy Root Transformation as a surrogate screen to test different guide RNAs as well as template DNAs to optimize our CRISPR mutagenesis of GeneX. Successful approaches found in our tests with Hairy Root Transformation will be applied to our stable whole-plant transformation of tomato with new GeneX alleles.

Online Text Processing by Poor Comprehenders: An Interdisciplinary Approach

Elizabeth Tune
Sponsor: Tamara Swaab, Ph.D.
Psychology

One of the primary questions in psycholinguistic research is to understand which skills aid in the comprehension of linguistic input and how these processes occur. Poor comprehension despite adequate decoding has generally been understudied although the prevalence and deficits are as significant as other learning disorders like dyslexia. The purpose of the current study is to investigate how early poor comprehension deficits come into play during the semantic processing of linguistic input. The current study uses electrophysiological methods to measure comprehension processes by examining the N400 component, an event related potential that is a response to the semantic processing of words in contexts. Ongoing data collection involves comparing poor comprehenders with typically developed decoding-matched controls on several discourse comprehension processes (e.g., forward prediction, expectations updating, backward integration). I predict that typically developed comprehenders will have a higher amplitude (i.e., a reduced N400) and shorter latency in their components than poor comprehenders at the onset of target words appeared within short passages. These results will contribute to a better understanding of low-level deficits in word-to-text integration processing, and this line of investigation has implications for the accessibility of educational and training materials in the classroom.

Investigation of the Influence of Problem Construction on Chemistry Students' Success with Stoichiometry Problems

Annanya Tyagi
Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Chemistry students struggle with interpreting given information in problems and separating relevant information from distractors, causing failures in generating successful solutions. Chemistry educators have implemented different methods such as using solution maps to teach their students how to approach problems and successfully tackle them. However, the effectiveness of problem construction by utilizing given solutions on students' problem-solving achievement has not been studied yet. In this study, a group of chemistry students (N=45) participated in three think-aloud sessions. The group was divided into a control group (N=15) and an experimental group (N=30). During the pre-intervention session, all the students were asked to solve five stoichiometry problems while thinking aloud. After two weeks, the intervention session was conducted in which the experimental group was asked to construct eleven chemistry problems by examining the given detailed solutions. In the post-intervention session, both groups solved slightly modified versions of the pre-intervention questions in order to observe changes in their strategy, knowledge, and accuracy. The goal of this study is to better identify students' struggles with solving chemistry problems, and to examine the effects of problem construction as a potential method to increase students' success with problem solving in chemistry and other subjects.

SOFA CONNECT - Bloom

Margot Uchicua Huaman
Sponsor: Jiayi Young, M.F.A.
Design Program

The UC Davis submission for the Sculptural Objects Functional Art & Design CONNECT competition is an immersive installation titled, BLOOM. Our Design Department emphasizes social responsibility, human-centered practice and sustainability. We are uniquely poised with a biodesign program which gives us the opportunity to work with innovative and sustainable materials. Given the opportunity to build an exhibit for an international audience, we dedicated BLOOM to tackling the negative environmental impact of consumerism by providing a comfortable, desirable and modern lounge space, with everything except the electronics composed completely of biodegradable materials. We provided the audience with an environment in which they could connect with the environment through materials like mycelium –a unique biomaterial grown from root-like strings that extend from underneath mushrooms. They were able to experience an immersive exhibit in which they could engage in social activity and feel comfortable in a lounge space that was 97% biodegradable. They were also given the opportunity to interact with a coded projection that moved as they did. BLOOM proves that products aren't limited by their life spans.

Hosting or Boasting? Mega-Sporting Events and Globalization

Ivan Urena-Valdes
Sponsor: Heather Mckibben, Ph.D.
Political Science

International sporting events, like the Olympic Games and FIFA World Cup, are some of the largest gatherings of international citizens in the world. After securing the right to host, countries often undertake infrastructure projects, face pressure from the international community, and engage in multi-billion dollar business deals with corporations. In my research, I continue to explore the relationship between international sport and globalization by asking whether these events influence the extent to which a host nation is globalized, and whether globalization within a country has an influence on a country's decision to host. Looking at host countries from 1970 - 2016 for the Summer and Winter Olympics and FIFA Men's World Cup, I calculate the average values and changes in the KOF globalization index ten years before a host country is selected, six years leading up to an event, and in the six years following an event. I also do this for countries who attempted to host and countries within the host's region, using t-tests to compare the groups across different timeframes. By making these comparisons, I assess whether host countries are fundamentally different in their levels of globalization surrounding these mega-sporting events in comparison to these other groups.

Multiple Variables Constrain Crossover Rate During Meiosis

Pranjali Vadlaputi
Sponsor: Neil Hunter, Ph.D.
Microbiology & Molec Genetics

Chromosomal crossing over during meiosis is required for accurate chromosome segregation and genetic variation. Rnf212 was previously inferred to be a limiting factor for crossing over formation, single copy of the Rnf212 gene caused inefficient crossovers. To understand relationship between crossovers and level of RNF212, we generated transgenic mouse lines with varying numbers of the Rnf212 gene. Meiotic chromosomes showed positive correlation between Rnf212 copy number and crossover rate. However, crossover numbers plateaued at high Rnf212 copy number, suggesting that crossovers are constrained by additional processes. Crossover interference, inhibition of closely spaced crossovers, and chromosome length are potential crossover-constraining process. We recently found that the ubiquitin-family protein, SUMO, regulates lengths of meiotic chromosomes. Excess SUMO, caused by SENP1 mutation, alters chromatin organization to produce longer chromosomes. In Senp1 mutant, crossover rates also increased. Combining the Senp1 mutation with extra copies of the Rnf212 gene had an additive effect on crossover rate, likely because many chromosomes are now longer than the crossover interference distance such that RNF212 now can catalyze additional crossovers. Together, our data confirm that RNF212 is a limiting factor for meiotic crossovers, but that chromosome length and the crossover interference distance place additional constraints on overall crossover rate.

At 21: The Formative Research and Implementation of an Inclusive Pelvic Health Campaign

Teresa Valadez
Sponsor: Natalia Deeb Sossa, Ph.D.
Chicano Studies

Disparities exist in knowledge of cervical cancer prevention and uptake of gynecological exams among young adults. The purpose of this formative research was to develop an inclusive, student-centered public health campaign promoting pelvic health for all UC Davis undergraduates who have a cervix. To understand current knowledge around pelvic health and barriers to receiving Pap tests among undergraduates at UC Davis, we conducted two focus groups with cisgender women and sent an anonymous survey to transmasculine students. We also analyzed data from the Spring 2017 National College Health Assessment (NCHA). NCHA data showed that half of all eligible cisgender students and none of eligible transgender students had received a gynecological exam in the last year. In the focus group and survey, cisgender women reported a general lack of knowledge around pelvic health while transmasculine students reported barriers to care that included gender dysphoria and lack of trust in their providers. These data show that cisgender women and transmasculine students each have unique needs when it comes to their pelvic health. These data informed the development of "At 21," the first -- to our knowledge -- trans-inclusive pelvic health campaign on a college campus.

Automated Image Analysis of Fluorescence-Based Cell Identification and Quantification in Pancreatic Islets

Richard Van
Sponsor: Mark Huising, Ph.D.
Neuro Physio & Behavior

Over 30 million people in the U.S. have diabetes, which affects hormone-producing cells organized in mini-organs within the pancreas known as islets. These hormone-producing cells are organized into a distinct arrangement, which is important to maintain glucose control. Through immunofluorescence imaging, we can distinguish between islet cell type populations and obtain spatial information to quantify islet architecture. Our current quantification methods require analysis of hundreds of images for robust and statistically significant results and depend on a human to assign each cell to a particular subpopulation, which is rigorous but labor-intensive. Therefore, my project focuses on automating the process of manual fluorescence-based cell identification and quantification for images containing nuclear and cytosolic markers. Using ImageJ, a common image analysis program used in research, I have developed an algorithm that 1) identifies nuclei as a specific cell type based on fluorescence and incorporates a context-dependent fidelity score to manually validate a subset of events and 2) quantifies the distance of each nucleus from the center and edge of the islet. Implementation of the program is expected to significantly reduce manual quantification time and offer a higher-throughput and unbiased approach towards image analysis and cell quantification of pancreatic islet cell types.

Effect of Livelihood Diversification on Extreme Poverty Across Seven Sub-Saharan African Nations

Heather Van Buskirk
Sponsor: Ryan Finnigan, Ph.D.
Sociology

Extreme poverty is a persistent problem in Sub-Saharan Africa, affecting the wellbeing of over 400 million people. Most of the extremely poor in the region live in rural areas, and although conventional wisdom has assumed that most of these households subsist through agricultural production on their own smallholdings, empirical research finds that many of these households have multiple income sources. This study examines the effect of livelihood diversification as an extreme poverty reduction strategy. Using the FAO Small Family Farms Dataportrait, I test the hypothesis that increased household livelihood diversification (i.e., off-farm income) is associated with lower extreme poverty (households living on less than $1.90 PPP per person per day) across seven Sub-Saharan African nations. Through multivariate logistic regression, I find that the odds of extreme poverty for diversified households compared to mainly agricultural households are lower by 73% across all countries. These results suggest that expanding the livelihood options available to poor households will be more effective in combatting extreme poverty than interventions focused on the agricultural sector alone.

Effect of Resource Abundance and Population Size on Daphnia Genotypes

Jenifer Vang
Sponsor: Thomas Schoener, Ph.D.
Evolution & Ecology

Daphnia are a particular suitable model organism for studies in ecology and evolution in the field and laboratory. They respond quickly to environmental changes, have fast generation times, and reach large population sizes. In this study, we tested to see if population structure and resource abundance influence which genotype is favored in Daphnia. We tested this by concurrently tracking population sizes, nutrient levels, and the frequencies of two genotypes (genotype A and genotype B). We hypothesized that low population density conditions can support a higher survival rate of one genotype over the other. We also considered whether elevated food conditions correlate with the genotype that dominated during that time period. Our results show density is a significant predictor of the proportion of genotype A, where higher densities correlate with higher proportions of A. However, resource abundance, measured as chlorophyll a, did not significantly affect the proportion of genotype A. This suggests genotypes may coexist via a trade-off that is based on population density, but not resource abundance. However, other unmeasured environmental factors such as sunlight or specific phytoplankton groups could be more important in affecting the proportion of the two genotypes.

Engaging the *Hmong Population* through Participatory Research Surveys: Concerns of High Blood Pressure Prevalence

Molly Vang
Sponsor: Christian Bohringer, M.D.
MED: Anesth & Pain Medicine

Since their acculturation into American society from Laos, there is a lack of health research on the current Hmong demographics in larger Hmong populated areas. California houses the largest population of Hmong in the country, with Sacramento being the third highest Hmong populated city. In order to account for lacking data, we have conducted surveys from April-October 2018 at heavily populated Hmong locations such as Hmong Supermarkets and community events in Sacramento. Participants completed a demographics survey and had vitals taken voluntarily. This study evaluates age, gender, amount of exercise, annual household income, formal education, blood pressure status, and glucose levels. It further discusses the limitations of the data collected and compliance due to cultural practices. Finally, this analysis aims to identify shortcomings of current methods, as well as channels for improving data collection, and effective outreaching towards individuals without formal education. Emerging potential results show a higher blood pressure reading amongst male participants compared to female participants. Data shows, with age, blood pressure tends to increase in Hmong individuals regardless of gender. Results of this study will be useful to health care workers who are looking to learn more about significant comorbidities among Hmong populations.

Asking for Help: The Influence of Hints on Children's Memory Decisions

Alexandra Varallo
Sponsor: Simona Ghetti, Ph.D.
Psychology

Metamemory, or the ability to evaluate and self-regulate one's memory, develops throughout middle childhood and is recognized as a critical skill in effective learners (Donker et al., 2014). Metamemory can benefit children's memory performance by helping children determine when they are uncertain and need help. In the current study, we investigated whether encouraging children to actively ask for recommendations would improve children's metamemory ability. Children ages 5-, 7- and 9-years-old (Current N=143, Projected N= 156) completed a recognition memory task during which reliable cues (75% valid, 25% invalid) were available. Participants were either always provided with cues (given condition) or chose which trials they wanted to use the cues (ask condition). Metamemory was measured using confidence ratings which were provided after each memory decision. We predict that children in the ask condition will have better metamemory and benefit more from the recommendations relative to the given condition, because choosing when to ask for help may encourage children to engage in greater self-reflection compared to a situation in which help is given independent of children's requests. This study provides insight into the development of metamemory strategies and children's ability to regulate their learning.

Culturing and Identification of Beneficial Microorganisms for Coral in *Montipora digitata*

Natascha Varona
Sponsor: Raquel Peixoto, Ph.D.
UC Davis Genome Center

In recent years, coral bleaching events have become a worldwide phenomenon causing massive die-offs of reefs. Bleaching occurs when coral symbionts, which supply their host with essential nutrients, leave the coral. The term Beneficial Microorganisms for Coral (BMC) has been recently proposed to define specific symbionts that promote coral health. The aim of this study is to develop and optimize culturing strategies to grow and identify BMCs using the coral Montipora digitata. Symbionts were grown on varying media: Marine Broth Agar, Marine Broth Gelzan™ and Agar containing Coral fragments ("Coral Juice"). Isolates grown on Marine Broth Agar had the highest yield for different colonies averaging 2.9 morphotypes per plate from a 1/1000 diluted stock solution, whereas Marine Broth Gelzan™ yielded 2.2 morphotypes per plate. Gelzan™ and Agar plates with Coral Juice yielded the lowest with 2.1 and 0.6 different colonies per plate, respectively, using a 1/100 dilution. DNA was extracted from 12 colonies with visually different morphological traits, 16S rRNA genes were amplified through PCR, and sequenced for identification.

Characterizing Bond Failure in FRP-Concrete Composites

Emmanuel Vazquez
Sponsor: Lijuan Cheng, Ph.D.
Civil & Environmental Engr

Concrete structures have a life span of nearly 50-100. The service life of structure can be extended by renovating the damage. The use of Near-surface mounted (NSM) Fiber-reinforced polymers (FRP) has emerged as a promising technique to rehabilitate these concrete structures because of the FRP's immunity to corrosion and lightweight nature. Current use of this system involves a conservative design model. The model maintains design safety but at a reduced cost efficiency. This investigation characterizes the bond strength of NSM FRPs, presenting the bond performance of the FRP, adhesive, and concrete composite. The FRPs were tested in varying configurations of 2 cross-sections: round spiral-wound rod and rectangular strip bars; 3 distinct surface roughness: smooth, roughened, and sand coated; and 4 adhesives of varying bond strengths. A total of 96 embedded specimens were tested in direct pullout loading. Data collected from testing will be used to index the various parameters. With further characterization of the composite's strength and design configurations, the NSM FRPs can prove to be a viable method of increasing the service life of concrete structures.

Social Media and Eating Disorders

Sarah Vegliante
Sponsor: Carolyn Thomas, Ph.D.
Undergraduate Education

This study asks the question 'What impact does social media have on eating disorders? This is important because social media may change the way students eat and perceive their bodies. This study engaged UC Davis students with disordered eating using Qualtrics, using a mixture of multiple-choice questions and written answers. Two themes recurred in the questionnaire: 1) how social media influences body perception and 2) the influence of social media and a person's eating behaviors. I hypothesize that just one hour of social media use per day will increase the likelihood that students will have distorted perceptions of their bodies and irregular eating behaviors. This would be an important finding for UC Davis students. When I present my research, students who attend will have the opportunity to think about their own social media use, how it has affected them and be able to make the choice to cut back on their social media use. Also, this would be an important finding for the students who are part of the Body Project. The students who participate in this survey will now have a better understanding of how social media impacts their perception of their bodies or their eating behaviors.

Cinnamaldehyde-evoked Itch and Calcium Imaging of Dorsal Root Ganglia (DRG) Neurons in Mice

Lauren Velasquez
Sponsor: Earl Carstens, Ph.D.
Neuro Physio & Behavior

Cinnamaldehyde (CA) elicits itch sensation in humans. Previous research shows that TRPV1, TRPA1, and TRPV4 channels are involved in the transduction of other itch mediators; however, the role of these channels in CA-evoked itch is not completely understood. In the current study, TRPV1 knockout, TRPA1 knockout, TRPV4 knockout, and wild type mice were used in behavioral experiments to investigate the involvement of these channels in CA-evoked itch. Hindlimb scratch bouts, forelimb wipes, and bilateral facial groom bouts following intradermal cheek injections of CA were counted. CA elicited significant dose-related increases in spontaneous scratching ($p<0.05$) but not wiping or grooming ($p>0.05$). In comparison to wildtype mice, CA-evoked scratching was significantly reduced in TRPV1 and TRPV4 knockouts ($p<0.05$) but not in TRPA1 knockouts ($p>0.05$). Acutely dissociated dorsal root ganglion (DRG) neurons from these animals were loaded with Fura-2 fluorescent dye and ratiometric calcium microfluorimetry was used to monitor responses to CA application. The number of neurons that responded to CA application was significantly reduced in TRPV4 knockouts ($p<0.05$) and significantly increased in TRPV1 knockouts ($p<0.05$). CA application did not elicit responses from DRG neurons collected from TRPA1 knockouts. Our results suggest that CA-evoked itch may involve an indirect non-neuronal sensory pathway.

The Role of Context-Specific Neurons in the Ventral Hippocampus During Fear Memory Retrieval

Rasika Venkatesh
Sponsor: Brian Wiltgen, Ph.D.
Psychology

The hippocampus (HPC) is a brain structure necessary for contextual fear memories, in which an animal learns to associate a previously neutral context with fear. The amygdala (AMY) is likely the site of plasticity, combining contextual information from the HPC with information about the fear-inducing stimulus from brainstem nuclei. The ventral hippocampus (VHC) is the only HPC region that sends direct, monosynaptic projections to the basal amygdala (BA), suggesting reactivation of context-specific VHC neurons is necessary and sufficient for context fear memory retrieval. Using optogenetics, our lab replicated studies suggesting normal activity in VHC-BA projections is necessary for contextual fear memory retrieval. Previous studies demonstrated that reactivating neural ensembles active during learning in dorsal HPC can drive memory retrieval. Here, we tag active VHC neurons in animals that undergo contextual fear conditioning or explore a neutral context. We then optogenetically reactivate these neurons in novel and familiar environments, determining whether activation of context-specific neurons in the VHC can drive fear memory retrieval. In this ongoing study, we expect animals with cells tagged in a neutral context will not show freezing in the novel context, whereas animals with cells tagged in a feared context will show freezing in the novel context.

Investigation of the Influence of Problem Construction on Chemistry Students' Success with Stoichiometry Problems

Brandon Vernoy
Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Chemistry students struggle with interpreting given information in problems and separating relevant information from distractors, causing failures in generating successful solutions. Chemistry educators have implemented different methods such as using solution maps to teach their students how to approach problems and successfully tackle them. However, the effectiveness of problem construction by utilizing given solutions on students' problem-solving achievement has not been studied yet. In this study, a group of chemistry students (N=45) participated in three think-aloud sessions. The group was divided into a control group (N=15) and an experimental group (N=30). During the pre-intervention session, all the students were asked to solve five stoichiometry problems while thinking aloud. After two weeks, the intervention session was conducted in which the experimental group was asked to construct eleven chemistry problems by examining the given detailed solutions. In the post-intervention session, both groups solved slightly modified versions of the pre-intervention questions in order to observe changes in their strategy, knowledge, and accuracy. The goal of this study is to better identify students' struggles with solving chemistry problems, and to examine the effects of problem construction as a potential method to increase students' success with problem solving in chemistry and other subjects.

The Benefits of Physical Therapy Following Fetal Repair of Myelomeningocele in an Ovine Model

Victoria Vicuna
Sponsor: Diana Farmer, M.D.
MED: Surgery

Myelomeningocele (MMC) is one of the most severe forms of spina bifida that can affect up to 1 in 4,000 babies annually. This debilitating birth defect is caused by the failure of spinal cord development, leading to full or partial paraplegia. Our preceding research using the fetal ovine model of myelomeningocele, discovered that fetal treatment with placenta-derived mesenchymal stromal cells (PMSCs) leads to significant improvements in the motor function of the lambs. However, because the ovine model is limited by the surgically created spinal instability, we are now testing the improvement of motor function with daily physical therapy. Our therapy includes once to twice daily sessions, five days a week, in which one lamb, treated with PMCSs, performs our ten current exercises for core and hind limb strength. One lamb currently undergoing therapy has lived for 77 days and continues to progress. Our two previous lambs that did not receive physical therapy only survived 29 and 65 days. Both were euthanized for the inability to walk and nurse, which resulted from muscle atrophy. This study explores the importance of physical therapy on recovering MMC lambs, how it may impede the process of muscle atrophy, and shows initial promising results.

Respiratory Sinus Arrhythmia of Parent-Child Pairs in Happy-Sad Task

Elia Villanueva
Sponsor: Daniel Choe, Ph.D.
Human Ecology

Self-regulation is a process of guiding one's own thoughts, feelings, and behaviors. Happy-Sad is a Stroop-like task measuring self-regulation and executive function that is more sensitive in detecting age differences in performance than other Stroop-like tasks1. Respiratory sinus arrhythmia (RSA) is a measure of heart rate regulation through parasympathetic control, and is considered a physiological marker of self-regulation. Decreases in heart rate and increases in RSA are expected when participants engage with non-threatening environmental stimuli or relax in safe environments2. Increases in the parent's and child's RSA values during Happy-Sad correlating with their higher task performance would suggest that self-regulation can be monitored physiologically. This present study compares RSA values of a preliminary sample of 10 preschoolers (Mean age = 50.7 months, SD = 5.3) and their parents while they complete Happy-Sad in separate rooms (compared to their RSA values at rest when they are alone) to see whether physiological control and self-regulation are related within the individual and across dyadic pairs. This ongoing study uses parent–child pairs to determine how self-regulation development is influenced by parents and psychophysiology to better understand how children adapt to different situations.

The Role of Context-Specific Neurons in the Ventral Hippocampus During Fear Memory Retrieval

Nina Vishwakarma
Sponsor: Brian Wiltgen, Ph.D.
Psychology

The hippocampus (HPC) is a brain structure necessary for contextual fear memories, in which an animal learns to associate a previously neutral context with fear. The amygdala (AMY) is likely the site of plasticity, combining contextual information from the HPC with information about the fear-inducing stimulus from brainstem nuclei. The ventral hippocampus (VHC) is the only HPC region that sends direct, monosynaptic projections to the basal amygdala (BA), suggesting reactivation of context-specific VHC neurons is necessary and sufficient for context fear memory retrieval. Using optogenetics, our lab replicated studies suggesting normal activity in VHC-BA projections is necessary for contextual fear memory retrieval. Previous studies demonstrated that reactivating neural ensembles active during learning in dorsal HPC can drive memory retrieval. Here, we tag active VHC neurons in animals that undergo contextual fear conditioning or explore a neutral context. We then optogenetically reactivate these neurons in novel and familiar environments, determining whether activation of context-specific neurons in the VHC can drive fear memory retrieval. In this ongoing study, we expect animals with cells tagged in a neutral context will not show freezing in the novel context, whereas animals with cells tagged in a feared context will show freezing in the novel context.

Function-Oriented Synthesis Yields an Improved Psychoplastogenic Analog of Iboga Alkaloids

Jayashri Viswanathan
Sponsor: David Olson, Ph.D.
Chemistry

Ibogaine is a naturally occurring alkaloid that has great therapeutic potential as it has been shown to reduce drug cravings in human clinical trials. However, in addition to these medicinal effects, ibogaine is also a powerful hallucinogen that carries some health risk as a hERG inhibitor. Our group hypothesizes that ibogaine's beneficial effect of reducing relapse stems from its ability to promote neuroplasticity and facilitate change in regions of the brain relevant to drug dependence—specifically the prefrontal cortex. Not much is known about what structural features are responsible for giving ibogaine these anti-addictive properties. So, to better understand the structure-activity relationships, we synthesized a series of analogs that each maintained some of ibogaine's key structural motifs while also varying functional groups. These analogs were then tested using in vitro neuroplasticity assays which revealed that certain functional groups allowed the analogs to maintain ibogaine's neuroplasticity-promoting effects while others almost completely removed symptoms associated with hallucinations. These results allowed us to design an optimized analog of the iboga alkaloid tabernanthine. Further in vivo and in vitro assays confirmed that this analog is capable of promoting neuroplasticity while producing minimal behavioral effects associated with hallucinations.

Engineering Adhesion-Induced Probiotic Strain for Enhanced Survivability and Efficacy Under Environmental Stress

Christopher Vo
Sponsor: Cheemeng Tan, Ph.D.
Biomedical Engineering

Imbalances of the human gut microbiome cause various metabolic diseases. These diseases could be treated using beneficial microorganisms, known as probiotics. However, probiotics often need to be taken daily to maintain their benefits to the host. To prolong probiotic efficacy in the gut, we have engineered a probiotic strain Escherichia coli Nissle 1917, using a synthetic adhesion module that promotes microbial adhesion. Our previous work has shown that this adhesion module provides the E. coli B strain protection against bacterial toxins through cell-to-cell adhesion. Here, we transferred and optimized the adhesion module in the E. coli Nissle strain. We verified microbial adhesion between engineered E. coli Nissle cells by DNA staining, microscopy, and flow cytometry. Engineered E. coli Nissle cells were subjected to harsh conditions, such as high concentrations of salt, low concentrations of nutrients, and fluctuations in pH and temperature. Its probiotic survivability and efficacy in culture and inside Caenorhabditis elegans were compared to the original E. coli Nissle strain. Analysis of the results shows that engineered E. coli Nissle had greater resistance to these harsh conditions. Our results have an impact on the control and engineering of probiotics using synthetic adhesion modules.

Rapid-Throughput Characterization of Dietary Fiber Supplements Employing Ultra High-Performance Liquid Chromatography paired with Triple Quadrupole Mass Spectrometry (UHPLC/QqQ MS)

Thai Thanh Vo
Sponsor: Carlito Lebrilla, Ph.D.
Chemistry

Dietary fibers are largely found in a plant-based diet and are a major component in food carbohydrates. As they are naturally indigestible and reside mainly in the large intestines, fermentation process by the gut microbes results in byproducts that are beneficial to the health. Currently, most of the US population fail to meet the recommended daily intake which has led to an increased interest in fiber supplements. Despite the biological importance, marginal advancements have been made towards the development of rapid-throughput methods for their structural characterization. This is primarily attributed to monosaccharide heterogeneity and wide composition of up to 100,000 monosaccharides. In this research, two rapid-throughput UHPLC/QqQ MS methods were developed and applied for monosaccharide and linkage composition characterization of carbohydrates in commercially available fiber supplements. For monosaccharide analysis, samples were hydrolyzed to release free monosaccharides followed by derivatization with 3-methyl-1-phenyl-2-pyrazoline-5-one (PMP). at the reducing end. To perform linkage analysis, samples were first permethylated and then hydrolyzed resulting in free hydroxyl groups at previous linkage locations. Permethylated monosaccharides were derivatized with PMP and reconstituted in 70% methanol/water (v/v) preceding injection into a UHPLC/QqQ-MS. Theoretical pre-cursor ion masses and experimentally determined quantifier and qualifier ion masses were used for linkage identification.

Persistence, motivation, and executive functioning in adolescents with ADHD

Tram Vo
Sponsor: Julie Schweitzer, Ph.D.
MED: Psychiatry & Behav Sci

Grit is known as persistence, resilience, and endurance. Executive Functioning can be described as an individual's ability to self-act on motivation, emotion, and restraint during high-order tasks that require multiple levels of prioritization. Participants with and without Attention-deficit/Hyperactivity Disorder/-(ADHD) were assessed for both grit and Executing Functioning. The GRIT scale is a self-assessment scale developed that measures perseverance and resilience of individuals in order to determine their success for task completions and overall trend for tendency to succeed in life. The BDEFS is a parent reported measure of multiple domains of Executive Functioning. Individuals with ADHD have lower GRIT scores compared to Typically Developing Individuals. Lower GRIT scores were associated with higher BDEFS scores. Based on the results, individuals with ADHD are more likely to start new projects frequently, yet do not finish each completely due to lack of focus on specificity. In addition, without consistency, ADHD participants will require much more motivation and restraint than other groups to succeed at anything they are pursuing in life. Some challenges could arise such as the inability to follow through with higher education and to adapt in work settings that could span for long-term.

Development, Implementation, and Assessment of UC Cares Diabetes Prevention Program (DPP) for Staff and Faculty of UC Davis

Elizabeth Von Klan
Sponsor: Francene Steinberg, Ph.D.
Nutrition

The purpose of this study on the Group Lifestyle Balance curriculum in the UC Davis Diabetes Prevention Program is to determine the success of a one year long CDC-recognized diabetes prevention program for staff and faculty at a higher education campus, and to analyze what factors correlate with successes and failures of this diabetes prevention program. These measures of success include improved dietary behavior, increased minutes of physical activity, decrease in hemoglobin A1C and fasting blood glucose, and 5-7% weight loss to reduce risk of chronic disease. This program is given financial support by the UC Office of the President, as an initiative to address health and well-being of staff and faculty, all ranging in various lifestyle habits, and educate cohorts of staff and faculty together on Type 2 Diabetes Prevention. Method of data collection include data collection of weight and average activity levels following each teaching session, and submitting data to the CDC. The conclusions we hope to reach will include what behaviors and characteristics are correlated with greater success in the program, allowing UC Davis Occupational Health more insight regarding successful implementation of diabetes prevention resources in an occupational college setting.

Evaluation of the Therapeutic Window for Deep Brain Stimulation in a Rodent Model of Traumatic Brain Injury

Myat Wai
Sponsor: Gene Gurkoff, Ph.D.
MED: Neurological Surgery

The septohippocampal theta rhythm, a 6-10Hz oscillation observed in the EEG, is critical for cognition. In rats, traumatic brain injury (TBI) results in reduced theta and impaired cognition. We hypothesized that stimulation of the medial septal nucleus (MSN), the pacemaker for septohippocampal theta, could improve spatial learning when applied after the initial post-injury period. Rats underwent sham surgery of lateral fluid percussion injury. A stimulating electrode was implanted in MSN. Animals were subsequently grouped: Sham, TBI (no-stimulation), TBI-Acute (PID0-4), TBI-Mid (PID3-7), and TBI-Late Stimulation (PID8-12). Stimulation occurred at 7.7Hz, 80uA, 30min/day for 5 days. On PID8-11 and 13-17, animals were tested on the Barnes and Morris Water Maze respectively. In both the Barnes and Water maze, TBI rats took longer to find the escape box compared to sham. Acute and Mid stimulation improved latency on the Barnes but not the water maze. Conversely, Late stimulation improved only Water maze performance. These data indicate that 30 minutes of stimulation immediately prior to a behavior, do not improve outcome. However, there seems to be a lasting effect of stimulation that improves performance over the course of days but not weeks.

Fast Green FCF as an Alternative to Ponceau S for Normalization of Western Blots

Samantha Wallace
Sponsor: Aldrin Gomes, Ph.D.
Neuro Physio & Behavior

Ponceau S is a commonly used stain when normalizing for western blots. Although Fast Green FCF has been used before for this purpose, it is very rarely utilized because of the need for a fluorescent imager. We hypothesized that Fast Green FCF would be a better normalization stain and could be used like Ponceau S as a colorimetric stain. We also wanted to determine if Fast Green FCF can detect lower amounts of proteins than Ponceau S. Rat liver proteins and purified bovine serum albumin were transferred to nitrocellulose membranes and stained with either the Ponceau S or the Fast Green FCF. The Fast Green FCF was found to be significantly more sensitive in detecting proteins relative to the Ponceau S, both as a colorimetric and fluorescent stain. Fast Green FCF was also able to detect lower amounts of protein compared to Ponceau S. Fast Green FCF is more cost efficient and more sensitive than Ponceau S, making it possibly a more desirable and frequently used tool when normalizing western blots. Fast Green FCF was also found to be compatible with immunodetection after removal of the dye.

Kids in the Basement: Space and Virtuality in American and South Korean Esports

Hannah Wang
Sponsor: Patrick Lemieux, Ph.D.
Cinema & Digital Media

Discourse on the sociology of sport has focused on how the spaces in which competitions are held reflect changing identities of the game, its players, and its fans in modern-day society. While past research improves our understanding about the intersection between existing social spaces and competition, this project presents a change in focus from traditional sports to the developing esports (professional video gaming) scene and its ongoing production of both virtual and actual space. The explosion of global esports from out of South Korea, in many ways fueled by casual play in Korean internet cafes, demonstrates the role of physical space in the production of both casual and professional player identities. By taking a comparative approach to American and South Korean esports, this project helps to illuminate the role of the production of space for practice, competition, and socialization. I hope to suggest the integral role of space in developing player identities, and by so doing provide new insight on the implications of the esports community's growth for both competitors and society as a whole.

Deciphering the Function of BRCA2-SYCP3 Interaction During Meiotic Recombination

Rui Wang
Sponsor: Neil Hunter, Ph.D.
Microbiology & Molec Genetics

Homologous recombination is an error-free mode of DNA repair through which the damaged chromosome is repaired using information from an intact homologous chromosome. BRCA2 plays a central role in homologous recombination regulation by delivering the recombinase RAD51 to sites of damage, which then catalyzes DNA pairing and strand invasion of the template chromosome. Recent evidence suggests that BRCA2 interacts with a meiotic-specific protein SYCP3 when it is aberrantly expressed in cancer cells. SYCP3 is a major component of meiotic chromosome axes that helps fold meiotic chromosomes into chromatin loops and regulate recombination. This study aims to confirm that BRCA2 and SYCP3 interact during meiosis and characterize the physiological significance of this interaction. Since commercial BRCA2 antibodies are unreliable and non-specific, we constructed a novel epitope-tagged version of the native Brca2 gene in mouse. Homozygous Brca2-3HA mice develop normally and are fully fertile. With this unique reagent, interactions between BRCA2-3HA and SYCP3 proteins were confirmed by immuno-precipitation experiments. Ongoing analysis of this interaction and its role in meiotic recombination will be presented.

Investigating the Antifungal Activity of Diterpenes Produced by Enzymes of *Setaria italica*

Sadira Wang
Sponsor: Philipp Zerbe, Ph.D.
Plant Biology

Diterpenoids are a major class of plant secondary metabolites that mediate plant-environment interactions under both abiotic and biotic stress. Knowledge of these defenses are critical in limiting crop yield losses from drought and disease especially given the predicted population of 9.3 billion by 2050. Diterpene biosynthesis is governed by two large enzyme families--diterpene synthases (DTPSs) and cytochrome P450 monooxygenases (P450s). DTPSs catalyze initial cyclization of prenyl diphosphates to form scaffolds that are hydroxylated by P450s to afford biologically active metabolites. We had previously characterized the diterpene synthase (DTPS) family and one P450 from foxtail millet (Setaria italica) an ancient food crop and an emerging model for biofuel grasses. Gene expression studies using qPCR showed induced gene expression of certain diterpene biosynthetic enzymes under simulated fungal (mycoprotein) stress suggesting that resulting diterpene products may exhibit antifungal activity. We used an in vitro assay to test the antifungal activity of S. italica diterpenes against two major fungal pathogens of maize (Zea mays) Fusarium verticillioides and Fusarium subglutinans. Further, we wanted to test the stability of hydroxylated diterpenes stored in DMSO and analyzed their antifungal activities in vitro.

Long-term Evolution of Soft Drusen in Rhesus Macaques as a Model of Age-related Macular Degeneration

Yinwen Wang
Sponsor: Glenn Yiu, M.D.,Ph.D.
MED: Ophthalmology

Soft drusen are the hallmark features of age-related macular degeneration (AMD), one of the leading causes of central vision loss in the elderly. Drusen appear as yellowish dome-shaped deposits between the retinal pigmented epithelium (RPE) and Bruch's membrane in the retina. Nonhuman primates are a useful preclinical retinal model for AMD because they are the only animals, besides humans, that possess a macula. Here, we evaluated the progression of soft drusen in 5 geriatric rhesus macaques over a 2-year period using spectral-domain optical coherence tomography (SD-OCT). Semi-automated segmentation and manual foci marking were used to measure the thickness of retinal layers, the volume of RPE-drusen complex, and height of individual drusen. Most of the drusen increased in volume over time, but a small subset underwent regression. Our results suggest dynamic remodeling of drusen in rhesus macaques, and enhance our understanding of drusen pathogenesis in both macaques and humans with AMD.

Impact of Diary Manure Application on Chemical Properties of Agricultural Soil

Qianyu Wang
Sponsor: Kate Scow, Ph.D.
Land Air & Water Resources

With the development of the dairy industry, dairy farms produce an increasing amount of manure. Since manure is rich in nitrogen, leaching and subsequent groundwater contamination will occur if manure is exposed to the environment and not processed properly. In the meantime, manure is also widely used as an organic fertilizer for soils. Manure provides multiple benefits to soils and crops, including an enhanced soil C sequestration, as well as a stable and slow release N source for soil microbes and crops. With a high demand for manure from the crop farming industry, manure application to crops can help solve the environmental issues associated with dairy farms and improve crop yield. We are currently conducting a field trial at Russell Ranch Sustainable Agriculture Research Facility to investigate the initial impact of dairy manure application on various soil properties, including pH, EC, plant available nitrogen, labile carbon, and microbial biomass.

Antibiotics Susceptibility in the Transgenic Petunia (*Petunia hybrida*) Plants Over-Expressing a Transcription Factor PhOBF1

Yuanzhi Wang
Sponsor: Cai-zhong Jiang, Ph.D.
Plant Sciences

Antibiotics are widely used to select transgenic plants. Plants susceptibility to antibiotics is a complex stress-related-physiological process which results in different levels of physiological and morphological response. The degree of susceptibility depends on either species or varieties. The underlying mechanisms are still unknown. PhOBF1, a petunia (Petunia hybrida) basic leucine zipper (bZIP) transcription factor, binds specifically to ocs elements in P. hybrida. In the previous study, our lab noticed that transgenic P. hybrida, over-expressing PhOBF1, appeared sensitivity to kanamycin. Kanamycin is a bactericidal aminoglycoside antibiotic which blocks crucial protein production for plants survival. Our goal was to investigate how transformed P. hybrida responds to antibiotics. In this study, we used the wild-type P. hybrida, three PhOBF1 overexpression lines (OX-B, OX-D, OX-H), and one PhOBF1 anti-sense line (AS-6). We planted P. hybrida seeds in ½MS media along with an increasing kanamycin concentration gradient. Then, we measured the seedling root length and growth rate. We created a susceptibility response curve. We observed that the PhOBF1 overexpression lines showed significant susceptibility to kanamycin within 20-30 µg/mL, compared with 50+ µg/mL in anti-sense lines and 10 µg/mL in wild-type. Further study needs to be conducted to understand the underlying mechanisms.

Sociogenomic Methods for Determining Phenotypes for Educational Attainment and Economic Success

Dawn Warfield
Sponsor: Emily Merchant, Ph.D.
Science & Technology Studies

Genomic science and data are becoming ubiquitously entwined with how we describe the human condition in both its physical, psychological, and social expression. Sociogenomic research delves into genetic data science to reveal possible conditions, correlates, and determinants for particular behaviors and aptitudes that shape our individual and collective human experience. Science and Technology Studies [STS] can contribute insights towards the construction of architecture for understanding the technosocial mechanisms of Sociogenomics via scholarship grounded in frameworks of psychology, economics, education, sociopolitics, and moral philosophy. My research on the history of Sociogenomics focus on four longitudinal studies that curate genetic data from large sample groups of human subjects over time [the Wisconsin Longitudinal Study; Fragile Families and Child Well-Being Study; the National Institute on Aging's Health and Retirement Study; and the National Longitudinal Study of Adolescent to Adult Health] to investigate trends, applications, and implications for Sociogenomic phenotyping methods that identify negative versus optimal genetic determinants for educational attainment and economic success.

Determining the role of the Nup2 MAR in the meiotic progression of *S. cerevisiae*

Lakshmi Warrier
Sponsor: Sean Burgess, Ph.D.
Molecular & Cellular Bio

Meiosis is responsible for the formation of sperm and egg cells. Errors in meiosis could result in serious or fatal abnormalities, therefore, it is crucial to understand the mechanisms of the proteins responsible for its healthy progression. Brewer's yeast, Saccharomyces cerevisiae, is used as a model due to its conserved proteins and functional pathways. Using mutation analysis, a 60 amino acid region of the yeast nucleoporin Nup2 has been found to affect normal meiotic progression. The exact function of this region, termed the meiotic autonomous region, MAR, is unknown, and there are currently two possibilities: an inhibitory activity or a chromatin binding activity. Bioinformatics research reveals that a corresponding region in a homologous protein to Nup2 in Mus musculus interacts with cyclin-dependent kinase inhibitor 1B, suggesting that the MAR could possess this activity. Previous research also suggests that the MAR binds to meiotic chromosomes. Analysis of chromosome spreads reveal the MAR binding to chromosomes at the nuclear envelope, and mutations at selected residues result in a null phenotype. It is unlikely that the MAR possesses both activities due to its small size, and analysis of the MAR mutants can better determine its properties.

How do Spanish-English and Cantonese-English Bilingual Children Differ in Their Development of English Narrative Skills?

Zixuan Wei
Sponsor: Yuuko Tonkovich, Ed.D.
Education

This longitudinal study investigated the differences in macro-level components of English oral narratives among a total of 40 bilingual children (16 Spanish-English and 24 Cantonese-English) who were enrolled in transitional bilingual educational programs. Children's English narratives were collected by having them tell a story using Frog, Where are You?, a wordless picture book. The narrative quality was assessed using the Narrative Scoring Scheme (NSS), which measures children's narratives along seven elements (introduction, character development, mental states, referencing, conflict resolution, cohesion, conclusion), each of which is scored holistically on a scale of 1–5. Scores from each category of the NSS were compared between Spanish-English and Cantonese-English children. Results showed that on average, narratives scores developed over the three years. Results also showed that Spanish-English children scored higher than Cantonese-English children on character development, cohesion, conclusion and significantly higher on mental states. Cantonese-English children scored higher than Spanish-English children on the introduction elements. The conclusions from this study may help inform educational strategies to best support language development among different groups of bilingual children.

Addressing Student Misconceptions in Meiosis in an Upper Division Genetics Course

Chloe Wei
Sponsor: Marina Crowder, Ph.D.
Molecular & Cellular Bio

A solid understanding of meiosis is crucial and fundamental in a student's study of genetics. Misconceptions in meiosis can act as major learning barriers for comprehension of other genetic concepts. The purpose of this study is to assess common student misconceptions regarding meiosis in an upper-division, high enrollment genetics course at UC Davis, and what learning activities are effective at correcting these misconceptions. A detailed understanding of what students struggle with at this level of genetics is essential for informing how to modify our curriculum and which learning activities best support students' understanding. A pre-survey was administered in Week 1 of the course to gather information about common misconceptions students have regarding meiosis. To assess the effectiveness of different learning activity structures in correcting these misconceptions, a post-survey was administered after students participated in either a hands-on activity or an interactive video activity that reviewed meiotic chromosome segregation. Preliminary analysis revealed that students commonly struggle with distinguishing between unreplicated and replicated chromosomes and distinguishing between homologous chromosomes and sister chromatids. Further analysis is in progress to determine if one type of learning activity - and if so, which type - is more effective at correcting these misconceptions.

An N-terminal Flag-tag Impairs TPP1 Regulation of Telomerase Function

Derek Wei
Sponsor: Lifeng Xu, Ph.D.
Microbiology & Molec Genetics

The shelterin protein complex binds to telomeres and protects chromosome ends from being recognized as damaged DNA. Shelterin also regulates telomerase, an enzyme which adds telomeric sequences to the ends of DNA. Dysfunction of the shelterin complex can lead to health issues such as premature aging syndromes and cancer. One subunit of the shelterin complex, TPP1, has been shown to directly interact with telomerase and is essential in promoting extension of telomeric sequences. Although TPP1 protein has been extensively studied through the use of epitope tags, the cellular effects of tagging have not been characterized adequately. To study this, we examined the effects of placing a 3x Flag tag to the N- or C-terminus of TPP1 in human cells. Molecular and cellular analyses showed a difference between the two tags. While the position of the tag did not affect TPP1's interaction within the shelterin complex, it affected TPP1's regulation of telomerase function. Specifically, the N-terminal tag impaired telomerase processivity, which resulted in a failure to stimulate telomere elongation in vivo. In contrast, the C-terminal tag functioned in a similar capacity to the untagged version of TPP1. These findings suggest that caution should be taken when using tags to study TPP1.

Characterizing and Comparing Bacterial Isolates Found in Tissues of Sea Urchins and Porcelain Crabs Sampled in Their Natural Environment.

Amy Wen
Sponsor: Jonathan Eisen, Ph.D.
Evolution & Ecology

Culture-based isolation of host-associated bacteria has allowed sequencing of whole genomes of organisms and has contributed to a flux of experiments that have shed light on hosts' long-term interactions with other organisms (i.e., symbiosis). The aim of this study is to compare bacteria that can be found in various tissues of sea urchins and porcelain crabs across host species and locations. Moreover, we are looking for possible correlations between these microbes and host: (i) tissues, (ii) species, and/or (iii) location where the hosts were collected. Thus far in the laboratory, we dissected the organisms, grew their bacteria on solid agar growth media for the enrichment of marine microbes, picked individual colonies of bacteria for DNA extraction and preservation, and sequenced these colonies' DNA for gene analysis and identification. Next, we will build a phylogenetic tree (i.e., evolutionary diagram) from all the DNA sequences to learn about their genetic relatedness and look for patterns in our tree that could be explained by associations of the bacteria with specific hosts, tissues, or geographic location. Our preserved bacteria would contribute to experiments that seek to isolate and grow microbes to learn about effects they may have on their hosts.

Boys Don't Cry, but Real Men Do: Negotiating Contemporary Masculinities

Megan West
Sponsor: Laura Grindstaff, Ph.D.
Sociology

In the wake of recent social justice movements such as #MeToo, many are wondering how men can challenge "toxic" forms of masculinity to better support women, marginalized communities, and their own well-being. My research seeks to answer this question by conducting participant observation of a men's support group in California, along with 20 in-depth interviews with the group's members. At the intersections of religion, sexuality, and gender, this group engages over two hundred men every week at a local church to discuss their understanding and expressions of masculinity and what it means to be a "real" man. They aim to "be better men" through promoting emotional well-being, social support, and healthier sexuality, but they also uphold some aspects of traditional masculinity, such as revering physical strength, idealizing male relationships, and expressing heteronormative views and assumptions. The men thus enact what sociologists call "hybrid masculinity," blending progressive and traditional ideologies that reinforce masculine privilege. Although the group embraces emotional expressiveness and social support among men, my research shows the limitations of their approach and the struggles men in America still face in rejecting the harmful dimensions of manhood that stand in the way of gender equality for both women and men.

Proportion of Resprouters is Influenced by Fire Severity, Proportion of Annuals is not

Maaike Wielenga
Sponsor: Hugh Safford, Ph.D.
Environmental Science & Policy

Fire is an integral process in ecosystems all over the world. Fire severity, the magnitude of a fire's effect on the ecosystem, has the potential to alter plant community composition and vegetation structure by favoring certain plant traits over others. High severity fires are becoming increasingly common in California, suggesting a change in plant community make-up. This project investigated how plant communities in post-fire landscapes dominated by yellow pine/mixed conifer forests change across the fire severity gradient. It was hypothesized that high fire severity would favor seeders over resprouters and annuals over perennials, indicating that different severity levels would affect plant communities differently. We sampled plant communities across the fire severity gradient after three different wildfires and categorized all woody plant species observed by their life history strategies. We found that high severity fire significantly favored plants with the ability to resprout, while fire severity did not appear to have a significant effect on annual/perennial proportions. Our results suggest that resprouting hardwood trees and shrubs may dominate over conifers, a key seeder species, in future forests in the Sierra Nevada. Therefore, replanting efforts to restore conifers may become necessary in order to preserve our forests.

Forgotten Radicals: The Legacy of the United States Prisoner's Rights Movement

Tiana Williams
Sponsor: Jesse Drew, Ph.D.
Cinema & Digital Media

In recent years, there has been an increasing discourse centered on the prison-industrial complex, addressing issues that range from ending the school-to-prison pipeline to calls for the abolition of prisons entirely. However, this movement is far from a novelty, rather, it is the resurgence of a forgotten moment in history that is being revitalized through a different lens. It is important to provide context to these current conversations and ensure that the prominent lens utilized for such discussions is that of the prisoner's rights movement. With primary and secondary sources, archival footage and a collection of oral histories, the research will examine the ways in which the prisoner's rights movement fueled hostility that produced negative systemic backlash and a present-day declension narrative. By highlighting prisoner activism of the 1970s, this article challenges the declension hypothesis approach to the prisoner's rights movement and investigates the movement's effects on the current day structure of the criminal justice system.

Suppression of Micronuclei by Autophagy

Mark Williams
Sponsor: Kenneth Kaplan, Ph.D.
Molecular & Cellular Bio

Failures to properly segregate and resolve sister chromatids in mitosis can lead to the formation of micronuclei, where nuclear envelopes form inappropriately around a lagging chromosome. The formation of micronuclei increases under conditions of replication stress, a common state of many tumor cells, and micronuclei have been implicated in the type of genomic instability observed in cancers. Recent work has suggested that micronuclei formation may normally be suppressed by autophagy, a membrane trafficking pathway that targets cellular cargo to the vacuole/lysosome. Consistent with this idea,work in the Kaplan lab has shown that replication stress induces a nucleophagy, a unique form of autophagy that targets a subset of nuclear proteins, and this induction is dependent on the DNA replication stress checkpoint. We hypothesize that this pathway will be conserved in normal human cells and is induced by replication stress. To test this hypothesis, we will induce micronuclei in normal human epithelial cells with reagents that either inhibit DNA replication, chromosome segregation or cell division. Although each of these treatments will increase the frequency of micronuclei formation, we predict that only treatments that induce the DNA replication stress checkpoint will induce nucleophagy and suppress micronuclei formation.

Identification of an Additional Antifungal Compound Produced by *Collimonas arenae* Cal35

Catherine Williams
Sponsor: Johan Leveau, Ph.D.
Plant Pathology

Many fungal plant pathogens can infect and destroy crop plants, posing a risk to food security and the agricultural industry. Given concerns about traditional fungicides, research into alternative modes of pathogen management, such as biocontrol, has become important. Some bacteria are known to possess the ability to inhibit fungal growth. These include members of the bacterial genus Collimonas. In particular, strain Collimonas arenae Cal35 has antifungal activity against multiple fungal plant pathogens, and the Leveau lab has several leads on the genes that underlie this activity. It was observed that inactivation of these genes decimated Cal35's production of a potential antifungal compound that inhibited all tested fungi with the exception of Magnaporthe grisea, the causative agent of rice blast disease. Since these mutants that could not produce this compound still inhibited M. grisea, I hypothesize that Cal35 harbors an additional gene locus imparting activity against M. grisea. This hypothesis is tested by screening a Cal35 transposon library for mutants that have lost antifungal activity against M. grisea, and identifying the transposon insertion site in such mutants. This project will contribute to our understanding of antifungal activity by Collimonas, which may help in the development of novel biocontrol applications for agriculture.

Train the Trainer for Healthy Smiles: Improving Knowledge and Attitudes of Future Health Professionals on Oral Health

Reese Wilson
Sponsor: Gerald Kayingo, Ph.D.
Betty I Moore Nursing School

The oral cavity is a gateway to the rest of the body, therefore, oral health is crucial for overall well-being. Yet, due to limited access, education and poor attitudes, dental care is the most common unmet health need in America, particularly, in racial and ethnic minorities. According to the centers for disease control (CDC), about 47% of U.S. adults have some form of periodontal disease. There is an urgent need for action both at an individual and population level. The purpose of this project is to improve the knowledge, skills and attitudes of future health care professionals towards oral health care. With the use of didactic presentations and hands-on exercises, UC Davis pre-health students will be trained on self-preventative oral care, basic oral exams, and the importance of dental-physician partnerships. Trained pre-health students will engage with college students and the Davis community to train and advocate for oral health. Improvement in knowledge will be assessed using surveys and direct observations. We hope that the educational intervention at the college level will create needed awareness to improve oral health in our communities.

Investigation of the Influence of Problem Construction on Chemistry Students' Success with Stoichiometry Problems

Wylen Winchell
Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Chemistry students struggle with interpreting given information in problems and separating relevant information from distractors, causing failures in generating successful solutions. Chemistry educators have implemented different methods such as using solution maps to teach their students how to approach problems and successfully tackle them. However, the effectiveness of problem construction by utilizing given solutions on students' problem-solving achievement has not been studied yet. In this study, a group of chemistry students (N=45) participated in three think-aloud sessions. The group was divided into a control group (N=15) and an experimental group (N=30). During the pre-intervention session, all the students were asked to solve five stoichiometry problems while thinking aloud. After two weeks, the intervention session was conducted in which the experimental group was asked to construct eleven chemistry problems by examining the given detailed solutions. In the post-intervention session, both groups solved slightly modified versions of the pre-intervention questions in order to observe changes in their strategy, knowledge, and accuracy. The goal of this study is to better identify students' struggles with solving chemistry problems, and to examine the effects of problem construction as a potential method to increase students' success with problem solving in chemistry and other subjects.

Structure-Function Analysis of the Dynamin-related Protein Mgm1

Melissa Wong
Sponsor: Jodi Nunnari, Ph.D.
Molecular & Cellular Bio

Mitochondria are dynamic, double-membrane organelles that form an interconnected network within cells and are required to communicate and integrate cellular signaling pathways. Maintaining a balance between division and fusion events is essential in regulating mitochondrial distribution and function, as disrupting this balance, mitochondrial networks are transformed into extreme products of fusion and division – interconnected nets or small, fragmented mitochondria – and mitochondrial genome (mtDNA) copy number is altered. Key players in mitochondrial division and fusion are dynamin-related proteins (DRPs) that are responsible for catalyzing membrane remodeling via their ability to self-assemble. Specifically, Mgm1 is a DRP responsible for the fusion of the mitochondrial inner membrane and maintenance of cristae morphology. To examine the role of Mgm1 in mitochondrial morphology and mtDNA maintenance, we took a structure-function approach in budding yeast. Specifically, we made point mutations in Mgm1 that would interfere with inter- and intra-molecular interactions based on the protein structure. Based on our data, disrupting molecular interactions within Mgm1 may affect mitochondrial morphology and mtDNA copy number, suggesting the importance of Mgm1 inter- and intra-molecular interactions for mitochondrial function.

Identification of SynDIG1 and its Proximal Proteins for Excitatory Synapse Development

Breana Wong
Sponsor: Elva Denise Diaz, Ph.D.
MED: Pharmacology

Glutamate receptors, such as the alpha-amino-3-hydroxy-5-methyl-4-isoxazole propionic acid receptor (AMPAR), are embedded in postsynaptic membranes which make them important components of memory and cognition. SynDIG1 is a brain-specific type II transmembrane protein that functions as a possible auxiliary subunit for AMPARs. My experiment will focus on the association of SynDIG1 to proximal proteins by using a proximity labeling approach. Using molecular biology techniques, fusions of BirA will be ligated to SynDIG1. The fusion will include the BirA enzyme that can biotinylate nearby proteins to SynDIG1 and be detected with streptavidin chromatography. Results from previous experiments to create the fusion construct were unsuccessful because the cloning strategy with the plasmid pHM6-SynDIG1, was non-directional and self-ligated without BirA. New primers have been designed for unidirectional cloning that will prevent self-ligation. The SynDIG1-BirA construct is in progress of being made and further experimentation will include expression in mammalian cells to verify expression and purification of the proximal proteins using affinity purification. The results will reveal novel proximal protein associations to SynDIG1 that may provide further insight on the role of SynDIG1 to AMPARs.

Diversion Ratios and Pricing in Soft Drink Markets

Walter Woodard
Sponsor: Andre Boik, Ph.D.
Economics

Diversion ratios measure the fraction of consumers that switch to a different product—their second choice—after a price increase in their first choice. Diversion ratios are a central part of merger analysis between companies that produce similar products as they help the antitrust authority to determine if a proposed merger is to the detriment of consumers. This paper uses pricing, sales, flavor, brand and quantity data collected by Dominick's Finer Foods for the University of Chicago between 1989 and 1994. The data is sorted by eliminating irrelevant information, including other companies and resulting in a shorter period of time needed to estimate demand systems for Coca-Cola and Pepsi. These demand systems are then paired with the collected data to estimate diversion ratios for the two companies. The fact that the companies make such similar products suggests that diversion ratios will be relatively high, and a merger is unlikely to be allowed between the two.

The Invisible Victims: The Long-Term Educational Impacts of Growing up in Recessions

Jiaman Wu
Sponsor: Giovanni Peri, Ph.D.
Economics

Economic recessions affect families mainly through the reduction of family incomes. The decline in family incomes has several important implications for children development. Physically, parents find it more difficult to meet children's nutritional requirements, therefore, leaving children in food insecurity. Moreover, recessions are a stressful time for parents. The stress has negative impacts on effective parenting. As a result, recessions increase the risk of parental maltreatment. Furthermore, recessions also increase probabilities of frequent moves, loss of proper health care, and less supportive learning environment. The combined effects of these factors reduce children's educational attainments and performances. In this paper, I look at the long-term effects of recessions on educational attainments, specifically the probability of completing high school. I focus on two aspects: the age effect and the severity effect. The age effect concerns with whether the exposure to recessions at an earlier age increases the risk of high school dropout. The severity effect concerns with whether more severe recessions increase the risk of high school dropout. The results show that exposures to recessions at age 5 to 10 increase the probability of high school dropout. However, this sample does not show recession severity have a statistically significant effect.

Investigating the Function of the WPP Proteins during Cell Division in Arabidopsis

Yifan Wu
Sponsor: Bo Liu, Ph.D.
Plant Biology

The WPP family proteins contain the conserved Trp-Pro-Pro motif and are found exclusively in plants. In the model plant Arabidopsis thaliana, two highly homologous WPP proteins WPP1 and WPP2 show localization pattern on the nuclear envelope in prophase and developing cell plate during telophase in root cells so that they were hypothesized to play a role in cell division and root development. However, the specific cellular functions of the two proteins are not understood. I have isolated homozygous single mutants that contain T-DNA insertions in both genes by PCR-based genotyping but did not detect a noticeable phenotype in either mutant when compared to the wild type control. Therefore, I hypothesized that WPP1 and WPP2 function redundantly. To generate plants having both genes knocked out, the wpp1 and wpp2 mutant lines were crossed and F2 plants were tested by genotyping. To date, I have isolated mutant plants containing only a single wild-type copy of either the WPP1 or WPP2 gene. Currently, I am examining the F3 plants produced by these F2 plants to isolate homozygous wpp1 wpp2 double mutants for phenotypic analysis. In conclusion, the investigation of WPP1 and WPP2 will advance our understanding of mechanisms that regulate plant cell division.

Student Perceptions and Use of Lecture Capture

Xiuyin Xian
Sponsor: Julia Chamberlain, Ph.D.
Chemistry

Technology integration within learning environments has been increasingly normalized with the adoption of online homework platforms and e-books at different levels of education. Nevertheless, the teaching community has many open questions about making lectures digitally available using Lecture Capture (LC) technology. Studies into instructor attitudes reveal that the predominant argument against LC to be grounded on speculation of increased absenteeism and decreased student performance, while research on student performance has shown mixed results from various LC usage behaviors. In this work, we investigated student perspectives of Lecture Capture technology in a large general chemistry course at UC Davis. As one of the first academic hurdles to a degree in STEM, it is important for academic resources to support student learning outcomes and retention rates, as well as positive student attitudes. We surveyed two sections of CHE 2C students on their LC use for the course and analyzed student comments using thematic analysis. Preliminary outcomes indicate that approximately 90% of students used LC at least once. Furthermore, contrary to faculty concerns, majority of students perceived LC to be a supplement to attending lectures rather than a replacement.

UC Davis' Nitrogen Footprint Reduction Stimulations

Breanna Xiong
Sponsor: Benjamin Houlton, Ph.D.
Land Air & Water Resources

Nitrogen is a necessary nutrient in both human and natural ecosystems; however, excess anthropogenic reactive nitrogen can lead to declines in global human health, biodiversity, and air and drinking water quality. Building upon the Nitrogen Footprint calculated last year, we are updating our 2016-2017 baseline measurements with new and more complete information using the Sustainability Indicator Management and Analysis Platform (SIMAP). In addition, we are simulating scenarios for future emissions and developed comparisons across similar institutes. By determining which UC Davis sectors emit more reactive nitrogen than other comparable universities, we are targeting potential areas for emission reductions. To assess the effectiveness of potential reduction measures we are creating simulations that project the effect that various nitrogen reducing actions will have on the total footprint of the university. Thus, we will develop a foundation of data that can be used to help guide policy in creating a nitrogen reduction plan.

Studies on the Fungal Pathogen and Insect Vector of Thousand Cankers Disease, an Emerging Threat to Walnut Orchard Health and Sustainability

Jia Yu Xuan
Sponsor: Richard Bostock, Ph.D.
Plant Pathology

Thousand cankers disease (TCD) is a disease of the phloem of walnut trees that is manifested by localized lesions in the inner and outer bark. The causal agent, Geosmithia morbida, is a fungus vectored by the walnut twig beetle (WTB), Pityophthorus juglandis. Upon mass attack by WTB, numerous lesions form and coalesce leading to girdling of branches and dieback of tree crowns. TCD poses a threat to many walnut species in the USA including Juglans regia and Juglans nigra, both of which are the basis of significantly large industries. Little is known about G. morbida in regards to the molecular and genetic basis of infection. To address this, an Agrobacterium tumefaciens-mediated transformation technique was developed in which two G. morbida isolates were transformed with green fluorescent protein (GFP). Some fungi can be resistant to transformation, and previous attempts to transform G. morbida have been unsuccessful. The method we developed provides an important basis for further molecular studies of G. morbida. Transformants can be used to better understand the molecular basis of infection through utilizing gene knock-out mutants, or visualizing the progression of fungal growth within bark tissue via fluorescence microscopy. These applications can further our understanding of the TCD pathosystem.

Chemotherapy Reduces PD-L1 Expression in Human Kidney Cells

Yingying Xue
Sponsor: Ching-hsien Chen, Ph.D.
MED: Div Of Internal Med

Program death-1 ligand (PD-L1), a transmembrane protein, is expressed on various types of cells including macrophages, epithelial cells and cancer cells, and plays a significant role in regulating immune homeostasis. Upon binding to the program death-1 (PD-1) receptor on T cells, PD-1 delivers signals to suppress T-cell proliferation, cytokine production, and eventually results in cell death. However, upregulation of PD-L1 allows cancers to escape host immune surveillance and promotes tumor development and aggressiveness. Chemotherapy cisplatin remains the first-line of cancer treatment and results in kidney injury in cancer patients after receiving cisplatin. Herein, we investigated how PD-L1 is regulated in epithelial cells, and its role in the context of chemotherapy. We first performed cell viability assays to determine cisplatin IC_{50} of normal proximal tubule cells (HK2) and several kidney cell lines. Next, we performed Western blot protein analysis to determine PD-L1 expression level in both normal kidney epithelial cells and cancer cells after cisplatin treatment. Our results show that chemotherapy induces PD-L1 expression in kidney cancer cells but reduces its expression in normal kidney cells, suggesting the mechanism where cisplatin induces kidney inflammation through downregulating PD-L1 expression.

Producing and Characterizing SMAD4-GFP Reporter For BMP Signaling Dynamics

Andy Yan
Sponsor: Dominik Haudenschild, Ph.D.
MED: Orthopedic Surgery

Bone Morphogenetic Proteins (BMPs) are growth factors that promote bone growth and are used in clinical settings to treat bone fractures and spinal fusions. However, the treatment requires substantial amount of BMP to be effective, and inadvertently results in side effects such as heterotopic ossification - the growth of bone in abnormal areas. BMPs will bind and activate cell-surface receptors through phosphorylation. The receptors will phosphorylate SMAD1/5/8 to bind and form a transcriptional complex with SMAD4 protein in the cytoplasm and translocate into the nucleus - activating the bone forming genes. Transduction with a SMAD4-GFP lentivirus allows us to monitor the movement of the SMAD4 complex by incorporating a gene into the DNA of the cell to express a SMAD4 protein tagged with a fluorescent marker. My research will revolve around analyzing the nuclear localization kinetics of the SMAD4 transcriptional complex. Nuclear SMAD4 controls the activation of bone forming genes by BMPs. We will also analyze the period of bone activated genes with different presentations of BMPs and how it will correlate to bone growth. By studying the BMP dynamics during bone formation, we hope to lower the necessary concentration of BMPs to lower the side effects and cost.

Developing Belonging: Transitioning to UC Davis

Tian Yang
Sponsor: Kali Trzesniewski James, Ph.D.
Human Ecology

Previous research shows that many students struggle to develop a sense of belonging to the new university community transitioning from high school. Students have difficulty fitting in are more likely to withdraw socially and academically and perform worse in school (Yeager et al., 2016). Although research has noted this is particularly true for students from disadvantaged backgrounds (e.g., socioeconomic), it has not been widely studied in other students groups such as international students. In addition to the difficulties of transitioning from high school to universities, international students experience more adversities than domestic students. International students have to leave home and study abroad in a different country, learn in depth materials in their second language and adapt to a new culture. This study compares the sense of belonging for three different groups: Freshman, Transfer students, and international students. In Summer 2018, these students were asked to participate in a belonging activity and survey. We predict that international students have the lowest level of belonging out of all three groups when they first arrive on campus, transfer students higher, and freshman highest. And after two years, the gaps between these three groups will become smaller, but maintaining the same pattern.

Engaging the *Hmong Population* through Participatory Research Surveys: Concerns of High Blood Pressure Prevalence

Pahoua Yang
Sponsor: Christian Bohringer, M.D.
MED: Anesth & Pain Medicine

Since their acculturation into American society from Laos, there is a lack of health research on the current Hmong demographics in larger Hmong populated areas. California houses the largest population of Hmong in the country, with Sacramento being the third highest Hmong populated city. In order to account for lacking data, we have conducted surveys from April-October 2018 at heavily populated Hmong locations such as Hmong Supermarkets and community events in Sacramento. Participants completed a demographics survey and had vitals taken voluntarily. This study evaluates age, gender, amount of exercise, annual household income, formal education, blood pressure status, and glucose levels. It further discusses the limitations of the data collected and compliance due to cultural practices. Finally, this analysis aims to identify shortcomings of current methods, as well as channels for improving data collection, and effective outreaching towards individuals without formal education. Emerging potential results show a higher blood pressure reading amongst male participants compared to female participants. Data shows, with age, blood pressure tends to increase in Hmong individuals regardless of gender. Results of this study will be useful to health care workers who are looking to learn more about significant comorbidities among Hmong populations.

A Computer Vision Approach to Make Broadside Ballads of Seventeenth Century Accessible as Text, Art, Music, and Cultural Records

Jiayin Yang
Sponsor: Carl Stahmer, Ph.D.
Library

Broadside Ballads were a product printed on one side of poor quality paper with eye-catching illustrations and alluring poems in 17thcentury [1]. In 2003, when people planned to research on street literature with a focus on broadside ballads, they found the access was blocked, since original editions were guarded, and copies were difficult to locate and read [2]. Here, we proposed to address the problem by developing the software that visualized all ballad images in a two-dimensional projection within which similar images were clustered together. We did this by utilizing SURF and other Computer Vision algorithms to compute similarity network of all images and classify them based on distances. Then, we applied the TSNE algorithm to generate coordinates for each image for three-dimensional layout and utilized OpenGL library to build the website. The resulting website successfully visualized and cataloged 16034 ballad images. This project paves the way for a content-based search and retrieval platform for digital archives of other historical printed materials [3].

"Homecoming": A Short Film Script

Cliff Yang
Sponsor: Andrew Smith, M.A.
Cinema & Digital Media

“Homecoming” is a script I wrote for TCS 198 (Screenwriting) that was then put into pre-production in TCS 175 (Film Production) in Fall 2017 and Winter 2018, respectively. The script was designed to be a short film that follows strange events that have occurred in an isolated part of town. I came up with the story from looking at a distant field that had a small house on one end and a large radio tower on the other end. The story was inspired by many popular science fiction works, and aims to create a feeling of suspense, immersion, and sense of unease in the atmosphere through careful selection of location, color, sound, and shots. After writing the script, I had planned to direct and produce the script and turn it into a ten-minute short film, and planned out the necessary pre-production elements including budgeting, location scouting, auditioning, moodboards, and other inspirational media.

Respiratory Sinus Arrhythmia of Parent-Child Pairs in Happy-Sad Task

Amanda Yap
Sponsor: Daniel Choe, Ph.D.
Human Ecology

Self-regulation is a process of guiding one’s own thoughts, feelings, and behaviors. Happy-Sad is a Stroop-like task measuring self-regulation and executive function that is more sensitive in detecting age differences in performance than other Stroop-like tasks[1]. Respiratory sinus arrhythmia (RSA) is a measure of heart rate regulation through parasympathetic control, and is considered a physiological marker of self-regulation. Decreases in heart rate and increases in RSA are expected when participants engage with non-threatening environmental stimuli or relax in safe environments[2]. Increases in the parent’s and child’s RSA values during Happy-Sad correlating with their higher task performance would suggest that self-regulation can be monitored physiologically. This present study compares RSA values of a preliminary sample of 10 preschoolers (Mean age = 50.7 months, SD = 5.3) and their parents while they complete Happy-Sad in separate rooms (compared to their RSA values at rest when they are alone) to see whether physiological control and self-regulation are related within the individual and across dyadic pairs. This ongoing study uses parent–child pairs to determine how self-regulation development is influenced by parents and psychophysiology to better understand how children adapt to different situations.

Quantification of Monocyte Chemoattractant Proteins Using High Resolution Extraction-Ion Chromatogram Mass Spectrometry

Victoria Yee
Sponsor: Armann Andaya, Ph.D.
Campus Mass Spec Facilities

As a means to protect itself from infection, injury, or illness, the body elicits an innate inflammatory response when triggered. During these responses, cytokines, a major group of small proteins between 5-20 kDa are released to elicit a cascade of cell signaling responses. Within this major family of proteins are chemokines, cells which secrete specific chemical signals that influence the behavior of other cells. Monocyte chemoattractant proteins, MCPs, are a subfamily that secrete chemical signals to guide monocytes, a specific type of leukocyte or white blood cell, to the site of inflammation. Thus, the greater presence of MCPs implies a greater likelihood of an inflammatory response. Herein, we devised a simple mass spectrometry method to quantify the amount of four members of the MCP family, MCP-1, MCP-2, MCP-3, and MCP-4. Using a hybrid mass spectrometer known as a Q-ToF, we analyzed human serum and quantified the native amounts of the four chemokines using an extracted-ion chromatogram (XIC) method. Using this rapid, yet robust, method allowed for quantitative analysis of relatively low abundant proteins within a complex solution.

Optimizing evaluation of the older kidney transplant candidate

Anusha Yerraguntala
Sponsor: Ling-xin Chen, M.D.
MED: Div Of Internal Med

In the United States, 22% of patients diagnosed with end stage renal disease are between the ages of 65 and 74, with this percentage trending upwards. Elderly patients have a plethora of chronic health conditions, which can make evaluating them for kidney transplantation challenging. Multiple factors are considered before determining whether a patient is eligible for transplant including frailty phenotype, nutritional condition, functional status, comorbidity burden, and psychiatric illness. We conducted a single-center prospective study enrolling 100 patients aged 65 and greater presenting at our center for transplant evaluation. Patients underwent multiple tests: Fried Frailty Assessment, Nutrition Focused Physical Exam, Short Physical Performance Battery test, and Patient Health Questionnaire-9 depression screen. Medical histories were studied to evaluate comorbidity burden. Transplant evaluation statuses were followed to listing or case closure. Amongst 100 patients, 48 are undergoing evaluation, 35 had their cases closed, and 17 were listed. No statistically-significant predictors of listing status were identified from the tests done, but our study demonstrates the feasibility of performing a battery of tests in a busy clinic. Our final results will provide the transplant community with an important understanding of which assessments are useful for evaluation of older kidney transplant candidates.

Christoff Rösener's *Honorable Compliments and Praises of the Knightly Free Art of the Fencer* and the Brotherhood of St. Mark

Seiji Yokota
Sponsor: Carlson Arnett, Ph.D.
German & Russian

The aim of this project is to translate into modern English and make freely accessible online Christoff Rösener's fencing book, Ehren Tittel und Lobspruch der Ritterlichen Freyen Kunst der Fechter (1589). Christoff Rösener was a member and sword-master of the Brotherhood of St. Mark (Marxbrüder), the preeminent fencing guild of the Holy Roman Empire that operated from 1487 through the 17th century. Translating this book is important because no modern English translation has been made, restricting access to German speakers and scholars. Texts such as these are primary sources for European fencing history and are our only links to understanding the praxis and theory of historical fencing traditions. I used a transcription by fencing historian Karl Wassmandorff (1821-1906) to translate Rösener's book using a combination of Early New High German, Middle High German, and Latin dictionaries, assistance from my supervising Professor, and my own German literacy. Translation has revealed that the text includes an extensive contemporary history of fencing extending back to Antiquity, a list of the techniques and of Marxbrüder's fencing, a commentary of the knightly qualities requisite of any fencer, and a fictional narrative detailing the Marxbrüder's Fencing Master examination.

Thermodynamic Studies of Chevrel Phases

Ray Yoo
Sponsor: Kristina Lilova, Ph.D.
Chemistry

Chevrel phases possess good thermoelectric and catalytic properties and remarkable superconductivity, which makes them important materials for catalytical and electrical applications. Hence, the thermodynamic properties studies become a critical first step. We used high temperature drop solution calorimetry to determine and compare the thermodynamic stability of several ternary Chevrel phases. High-temperature drop-solution calorimetry was performed using a Tian Calvet twin-type calorimeter AlexSYS at 1073 K. The samples were pressed into pellets and dropped into a platinum crucible, containing molten sodium molybdate solvent. Pure oxygen gas was flushed over the solvent at 90 ml/min and bubbled through it at 5 ml/min to ensure the complete oxidation. The heat effect consists of three parts – heat content (from 298 K to 1073 K), heat of solution in the solvent, and heat of oxidation. Specifically, two groups of ternary Chevrel phases were studied: three sulfides with different transition metal (Fe, Ni, and Cu) and three copper-based phases with different chalcogenides S, Se, and Te). The drop solution enthalpies of the compounds and those of the pure elements were used to calculate the enthalpies of formation.

Comparative Fitness of St. Louis Encephalitis Virus in Mice

Katherine Young
Sponsor: Lark Schneider, Ph.D.
VM: Pathology, Micro, & Immun

St. Louis encephalitis virus (SLEV) is a mosquito-borne flavivirus that can cause severe neurologic disease in humans. Although SLEV has circulated in California since the 1940s, it was not detected in California from 2004-2014 despite intensive surveillance. In 2015, SLEV re-emerged in Coachella Valley, CA and has since spread to 15 other California counties. Phylogeographic analyses revealed that SLEV in California since 2015 represents a new genetic lineage from South America that is distinct from all SLEV in the state pre-2003. Two previous SLEV studies compared an epidemic progenitor strain to two non-epidemic strains in murine models, and found that the epidemic SLEV produced higher viremias and mortalities than the non-epidemic strains. Thus, we hypothesize that contemporary SLEV from California will produce higher and longer murine viremias compared to the historic pre-2003 SLEV from California, which may reflect virus adaptation to increase vertebrate virulence. Swiss Albino mice will be inoculated subcutaneously with either a 2003 or 2016 SLEV strain from California. Viremia levels in blood samples measured by RT-qPCR and survival kinetics will be compared over time. We expect the 2016 strain to exhibit a higher mortality rate and have an increased duration of murine viremias than the 2003 strain.

Summer Literacy Development: Bilingual Books for Emergent Spanish-English Bilinguals

Qihao Yu
Sponsor: Yuuko Tonkovich, Ed.D.
Education

The population of emergent Spanish-English bilinguals is growing in the United States. However, these bilingual children from low-income environments are experiencing a decline in English skills over the summer. In this study, we will examine how bilingual children spend their summers. We will focus on the following questions: 1) How much Spanish and English do Spanish-English bilinguals hear and use during the summer? and 2) How do Spanish-English bilinguals spend their typical summer days? Then, we aim to identify an effective summer reading program that may help prevent summer literacy decline. We provided bilingual books to four children and conducted focus group interviews with their parents. Preliminary results suggest that language exposure in Spanish and English is varied. Our focus group interviews suggest that Spanish-English speaking children from low-income homes may not have access to literacy resources over the summer and, thus, are unable to further develop their literacy skills. However, both parents and children would actively engage in literacy activities over the summer if provided with the appropriate resources tailored to their interests and that accommodate for social factors that may limit their accessibility to resources. The findings suggest that providing library resources to parents may be helpful.

Developing Drought Tolerance Tools for Maize Using Plant Viruses

Eric Yu
Sponsor: Clare Casteel, Ph.D.
Plant Pathology

Extreme conditions, such as drought, are predicted to increase in severity and prevalence due to climate change in the near future. Droughts can be devastating to crop yields since water availability is a limiting factor for crop production, so it would be beneficial to find a way to enhance drought tolerance when it is needed. The goal of this study is to express genes aiding in drought tolerance in viral vectors, which can be deployed rapidly when a drought occurs. To address this goal, we used Sugarcane mosaic virus (SCMV) as an overexpression tool to evaluate three genes that have been previously been shown to enhance drought tolerance in transgenic plants: 1) ZmNF-YB2, a transcription factor found in maize, 2) CspB, is a bacterial cold-shock protein found in Bacillus subtilis, and 3) CodA, a choline oxidase found in Arthrobacter globiformis. In this experiment, virus replication, transgene expression, and drought tolerance traits will be measured.

Summer Literacy Development: Bilingual Books for Emergent Spanish-English Bilinguals

Julia Yu
Sponsor: Yuuko Tonkovich, Ed.D.
Education

The population of emergent Spanish-English bilinguals is growing in the United States. However, these bilingual children from low-income environments are experiencing a decline in English skills over the summer. In this study, we will examine how bilingual children spend their summers. We will focus on the following questions: 1) How much Spanish and English do Spanish-English bilinguals hear and use during the summer? and 2) How do Spanish-English bilinguals spend their typical summer days? Then, we aim to identify an effective summer reading program that may help prevent summer literacy decline. We provided bilingual books to four children and conducted focus group interviews with their parents. Preliminary results suggest that language exposure in Spanish and English is varied. Our focus group interviews suggest that Spanish-English speaking children from low-income homes may not have access to literacy resources over the summer and, thus, are unable to further develop their literacy skills. However, both parents and children would actively engage in literacy activities over the summer if provided with the appropriate resources tailored to their interests and that accommodate for social factors that may limit their accessibility to resources. The findings suggest that providing library resources to parents may be helpful.

The Effect of Salinity on Three-spined Stickleback (*Gasterosteus aculeatus*) Larvae

Zixin Yu
Sponsor: Dietmar Kueltz, Ph.D.
Animal Science

Sticklebacks inhabit coastal areas in large parts of the world. They are affected by the coastal salinization caused by climate change. Here, we test how salinity increase influences early development of sticklebacks. Six 10-day salinity acclimation experiments were conducted on stickleback larvae from a landlocked freshwater population. One batch of fertilized eggs was raised under freshwater conditions on day one with a 5 ppt salinity increase per day. A parallel batch from the same clutch was raised under freshwater condition (0 – 3 ppt). The stickleback larvae were euthanized and collected after yolk-sac resorption for subsequent proteomic analysis. Statistical analysis using t-test after performing F-test indicates that increasing salinity has no significant effect on hatching success of the stickleback embryos ($P = 0.909$) but significantly increases the mortality rate between hatching and yolk sac resorption ($P < 0.05$). The time to hatching is not statistically different between the two groups ($P = 0.740$) but there is a trend as larvae raised with increasing salinity tend to hatch out earlier. The results indicate that climate change may impact the development of three-spined sticklebacks. Additional analysis will reveal mechanism (proteomics) and increase statistical power. This study was supported by NSF award 1656371.

Straightforward method for singularized and region-specific CNS microvessel isolation

Yinyu Yuan
Sponsor: Lillian Cruz-Orengo, Ph.D.
VM: Anat Physio & Cell Biology

Human central nervous system (CNS) coordinates cognitive function and exerts major control over all physiological processes. The blood-brain-barrier (BBB) efficiently maintains CNS homeostasis and normal function by limiting the passage of pathogens, macromolecules, etc., while allowing nutrient entry and gas exchange. The sophisticated function of BBB is attributed to the unique microvasculature of CNS, also known as neurovascular unit. The techniques for harvesting and isolating those microvessels are essential to study BBB and CNS homeostasis. Unfortunately, existing methods of microvessels isolation are restricted to brain cortex tissue, excluding other important regions like cerebellum, brainstem and spinal cord. They also require pooling of cortical tissue from multiple individuals to obtain enough yield for accurate analysis. Here, we developed a single-mouse region-specific CNS microvessel isolation. Additionally, we adapted this method to rhesus macaque CNS tissues. This method can inform molecular and cellular differences between CNS regions that would otherwise be obscured by excluding non-cortical tissue. It also allows for revealing variations between individuals that remain hidden with multiple samples pooling as is normally done. Lastly, the successful adaptation to isolate microvessels from non-human primate CNS tissues will allow for more translational studies of the BBB.

Molecular Dynamics Simulations of N-Linked Glycosylated Proteins

Brian Yuen
Sponsor: Lee-ping Wang, Ph.D.
Chemistry

The covalent attachment of glycans onto proteins often have a profound effect on both the structure and function of a protein. As a result, the study of these glycosylations is an active field of research. Through the use of molecular dynamics (MD) simulations, we investigated the behavior of glycans on N-linked glycosylated proteins. We simulated eight different glycan isomers attached to a bovine RNase B molecule and measured how the glycan and the protein conformation evolved over time. Our results suggest that each glycan isoform will associate to a different portion of the RNase B protein, and that the glycans do not cause any major protein conformational changes. Several questions still need to be answered, such as the effect of initial conditions on glycan behavior, and how closely our simulations correlate with experimental mass spectrometry measurements of glycoprotein size. We expect that our simulations will provide valuable structural predictions of glycan-protein interactions, pending verification with the experimental data.

Object Processing Biases in Infancy and Toddlerhood

Cassey Loise Zagala
Sponsor: Lisa Oakes, Ph.D.
Psychology

Visual scenes can be processed in terms of local features (e.g., the color and shape of leaves on a tree, the color and shape of slats on a bench) or global features (e.g., tree and bench in a park scene). The purpose of this project is to investigate visual processing biases during toddlerhood. Using eye tracking, we will assess whether children employ a global information processing approach (e.g., noticing the global shape or features) versus a local approach (e.g., noticing the details). We will present children with an image in which a shape (e.g., triangle, heart) is made up of small objects (e.g., circles, spades). When children fixate this image, we will present two new objects; one that is made up of the same individual elements but is a different global shape (local match) and another that is the familiar global shape but different individual elements comprised of novel individual elements (global match). Children who employ a global processing strategy will direct their first looks towards the global match, and children who employ a more local processing strategy will direct their first looks towards the local match.

Students' Use of Lecture Capture Videos in General Chemistry

Yuanxin Zhang
Sponsor: Julia Chamberlain, Ph.D.
Chemistry

Lecture capture technology allows students to view recorded lecture videos anytime outside of classroom. As it provides students an additional source to study, some instructors hesitate to record class out of concern of increasing student absences. Prior research has examined students' satisfaction, usage preference, and the relationship between viewing lecture videos and course performance for STEM courses, but there is no study that specifically analyzed on General Chemistry course. As outcomes may vary by course and student population, this study compares the lecture capture usage patterns for students in two sections of a large introductory General Chemistry course, as well as their affective response to this resource. Initial findings show statistically significant differences between morning and afternoon lecture times, with students from the morning section more likely to use lecture capture due to absence. A majority of students, including students who had never used this resource, agreed that lecture capture should continue to be provided. Affective responses indicated that students believed the benefits to all students surpass the concerns about absences. We conclude that lecture capture video, as a supplement for traditional lecture and sometimes a replacement, can contribute to students feeling supported in a large introductory General Chemistry courses.

Identification of Host Target Proteins of a Pathogen Effector in Lettuce by Mass Spectrometry

Chi Zhang
Sponsor: Richard Michelmore, Ph.D.
Plant Sciences

Downy mildews are oomycete-caused diseases on several important agricultural crops including grapes, crucifers, and lettuce. During infection, pathogens release proteins called "effectors" which help to defeat the plant immune system. RXLR3 is an effector protein secreted by Bremia lactucae, the downy mildew pathogen of lettuce, that is known to suppress host small RNA-mediated RNA interference. However, the underlying mechanism remains unknown. We hypothesized that RXLR3 captures siRNAs and sequesters them in peroxisomes to inhibit their further functioning. Since RXLR3 does not contain a peroxisome-targeting signal, we searched for possible host target proteins using immunoprecipitation (IP) and mass spectrometry (MS). Candidate target proteins were purified from protein extracts of lettuce overexpressing RXLR3. Several different antibodies and protein constructs were used during IP to control for nonspecific binding. The eluates were then sent for MS, whose results were using Significance Analysis of INTeractome (SAINT). We generated a list of candidate proteins with the highest SAINT scores, and are following up with further screening and protein binding assay. A greater understanding of RXLR3's function will provide new insights into the importance of RNA interference in the plant immune system and might lead to novel treatment of downy mildew in lettuce and other plants.

Iteration, An interactive Design Process Guide App

Xiao Zhang
Sponsor: Thomas Maiorana, M.F.A.
Design Program

When encountering projects, students and designers often have to navigate through uncertainties. The process of figuring out design constraints can be confusing, afflicting and time consuming, which leads to procrastinations, and self-doubt . Eventually, people give up in the middle of their design process. These emotions are all due to the lack of proper guidance in their design process. After reading the book Solving Product Design Exercises by Artiom Dashinsky, we learned that there is a provenly good method for iterating through a project. However, merely suggesting books to designers is far from a good solution due to the linear format of book and lack of accessibility. Therefore we decided to take advantage of the smartphone platform and created Iteration. Iteration is an app that assists designers in building their own design framework by helping them understand the purpose of their project, approaches to the problem, and the execution of their designs. Users can define the value of their designs, go through each design stage systematically, upload photos of their prototypes and ideations during the process, and eventually receive statistics of overall effectiveness in their current project.

Vaccine Design Against Chlamydia Using Hepatitis E Viral Nanoparticle for Mucosal Delivery

Wenjing Zhang
Sponsor: R holland Cheng, Ph.D.
Molecular & Cellular Bio

Chlamydia trachomatis is the most common sexually transmitted bacterium worldwide and is the leading cause of preventative blindness. Mucosal delivery is an attractive choice of vaccination strategy against Chlamydia to induce local and systemic immune responses to pathogens. While whole organism-based vaccines have short-lived activity, serovar/subgroup-specific immunity causes an adverse reaction in vaccinated subjects. The major outer membrane protein (MOMP) of Chlamydia trachomatis is a prime candidate for vaccination because its exposed variable domains (VDs) have shown to induce appropriate B-cell and T-cell responses. We used the hepatitis E viral nanoparticle (HEVNP) as a nanoplatform delivery vehicle by conjugating highly immunogenic epitopes derived from MOMP's VD1 and VD4 onto its multivalent protruding arms. HEVNP's structural characteristics prevent the NPs from deformation or degradation in harsh acidic and enzymatic conditions of the GI-tract, allowing for use in oral/nasal mucosal delivery. We used both chemical conjugation and genetic engineering for single and double VD epitope insertion. Enzyme labeled immunosorbent assays were used to confirm successful epitope conjugation. Future work focuses on developing a 3D construct of the variable domains using cryo-electron microscopy to further identify them as plausible targets for vaccines.

Antibiotics Susceptibility in the Transgenic Petunia (*Petunia hybrida*) Plants Over-Expressing a Transcription Factor PhOBF1

Tong Zhen
Sponsor: Cai-zhong Jiang, Ph.D.
Plant Sciences

Antibiotics are widely used to select transgenic plants. Plants susceptibility to antibiotics is a complex stress-related-physiological process which results in different levels of physiological and morphological response. The degree of susceptibility depends on either species or varieties. The underlying mechanisms are still unknown. PhOBF1, a petunia (Petunia hybrida) basic leucine zipper (bZIP) transcription factor, binds specifically to ocs elements in P. hybrida. In the previous study, our lab noticed that transgenic P. hybrida, over-expressing PhOBF1, appeared sensitivity to kanamycin. Kanamycin is a bactericidal aminoglycoside antibiotic which blocks crucial protein production for plants survival. Our goal was to investigate how transformed P. hybrida responds to antibiotics. In this study, we used the wild-type P. hybrida, three PhOBF1 overexpression lines (OX-B, OX-D, OX-H), and one PhOBF1 anti-sense line (AS-6). We planted P. hybrida seeds in ½MS media along with an increasing kanamycin concentration gradient. Then, we measured the seedling root length and growth rate. We created a susceptibility response curve. We observed that the PhOBF1 overexpression lines showed significant susceptibility to kanamycin within 20-30 µg/mL, compared with 50+ µg/mL in anti-sense lines and 10 µg/mL in wild-type. Further study needs to be conducted to understand the underlying mechanisms.

How Does Early Parental Care Alter Oxytocin Receptors in the Brain and Behavior?

Susanna Zheng
Sponsor: Karen Bales, Ph.D.
Psychology

All mammals, including humans, depend on early parental care for their future well-being. Children who lack adequate parental care often develop emotional and psychological problems. One valuable model for human parental care is the prairie vole, a rodent species where parents form monogamous pair bonds and provide biparental care. Alterations in parental care are associated with a variety of long-term consequences in offspring, ranging from behavioral changes, differences in neuroanatomy, neuronal connections, and gene expression. In our study, we explore possible neural mechanisms behind these behavioral differences. Oxytocin (OT), a neuropeptide involved in social bonding, is one candidate. In this project, we use autoradiography to quantify and compare OXTR expression in the nucleus accumbens, insula, prelimbic cortex, temporal association area, parietal association area, primary motor cortex, primary somatosensory cortex, and auditory cortex of prairie voles that received different amounts of parental care. We hypothesize that prairie voles with low parental contact will have higher amounts of oxytocin receptor expression than those with high parental contact because prior research shows that male prairie voles with low parental contact sped up their pair bonding. The results of this study will give us insight into how early experiences influence brain organization and behavior.

Examining the Use of Social Cues by Early Word Learners

Yier Zhu
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

An important social cue that young infants use is directing their eye gaze to the same objects or person that their caregiver does. Our research examines how infants integrate eye gaze cues and spoken-word cues by studying whether infants follow the gaze or the spoken label to guide attention. In our experiment, infants watch a video recording of an experimenter in the center of the screen and two familiar objects, for example, an object (e.g. shoe on the lower left side, key on the right). In one condition the experimenter says the name of one of the items while she looks at the item she is naming. In another condition the experimenter names an object but looks at the opposite object. We tracked the child's eye gaze during each trial to see if infants are more likely to look at the item that was spoken, or if they looked at the item the experimenter looked at. We predict that 24-month-old infants are likely to look where the experimenter looks, because early word learners are very attentive to social cues, which we expect to override the linguistic cues.

Income Inequality between Urban and Rural Residency in China

Jianfeng Zhuang
Sponsor: Giovanni Peri, Ph.D.
Economics

Since the Reform and Opening Policy was issued in 1978, China has been growing rapidly, and became the second largest economic entity in 2010. However, as a developing country, China still faces many serious problems, and one of which is the income inequality between rural and urban citizens. The growing income gap and job discrimination has become more and more severe every year after the policy was issued. Rural workers are less likely to enter some fields which have well-paid jobs, and they receive less payment than the urban citizens with same types of jobs. Hukou system, the unique household registration system of China, cannot catch up with fast pace of economy. In this paper, I research the effect of Hukou system to the job and income and draw on micro evidence to ask to what extent the wage gap between different Hukou is present. The result shows that the discrimination due to Hukou system is an important factor to income inequality between urban and rural citizens. It informs that China need to modify existing household registration policies, complete the social welfare to rural citizens, and eliminate the discrimination to rural workers in the job market.