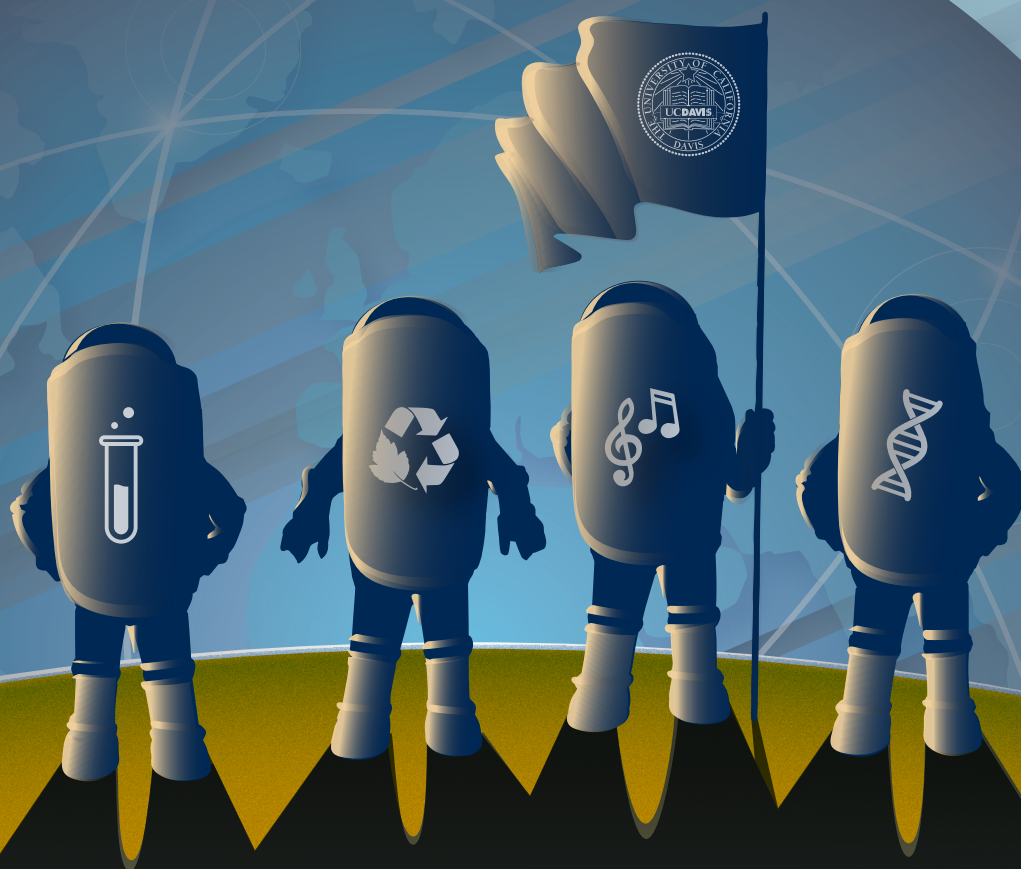


DESIGN • CREATE • EXPLORE • DISCOVER • IMPACT

29th Annual
Undergraduate Research, Scholarship
& Creative Activities Conference



POSTER SESSIONS

Friday, April 27, 2018
3:00 - 6:00 pm
ARC PAVILION

ARTS EXHIBIT

Friday, April 27, 2018
3:00 - 6:00 pm
ARC PAVILION

ORAL SESSIONS

Saturday, April 28, 2018
1:00 - 4:30 pm
WELLMAN HALL

urc.ucdavis.edu

UC DAVIS
Undergraduate Research Center
Office of Undergraduate Education

29th Annual Undergraduate Research, Scholarship and Creative Activities Conference

Letter from the Chancellor

April 27, 2018

Dear Students, Colleagues and Guests:

Welcome to UC Davis' annual exhibition of undergraduate research.

As the new chancellor of UC Davis, I am learning continually about the exceptional conferences hosted by our campus. This particular one exemplifies the best in UC Davis by bringing hundreds of promising students together in a spirit of collaboration and shared quest for refining their skills.

We pride ourselves at UC Davis as being 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 the sustaining the health of humans and animals. These student participants, who reflect a wide variety of fields, are the leaders and change makers of tomorrow.

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. These oral and poster presentations are a great form of practice as our students prepare to enter the next chapters of their lives, including graduate school and the workforce.

I congratulate the students 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. Also, I am deeply grateful to the faculty members who served 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 who we are at UC Davis.

I wish everyone a great conference and thank you for bringing out the best in our university.

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).

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Design and Publications

Sharon Knox | *Undergraduate Education*
Steven A. Morse | *Undergraduate Education*

AGENDA

Poster Sessions: Friday, April 27, 2018

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 27, 2018

(concurrent with poster session)

3–6 p.m., ARC Pavilion

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

Oral Sessions: Saturday, April 27, 2018

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

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Abala, Michael Anthony	Session C	Poster 59	5:00 PM	Pavillion ARC
Agrawal, Anika	Session C	Poster 42	5:00 PM	Pavillion ARC
Agung, Michael	Session 1	Oral	2:15 PM	216 Wellman Hall
Akanda, Rifa	Session B	Poster 31	4:00 PM	Pavillion ARC
Akramy, Shabana	Session C	Poster 150	5:00 PM	Pavillion ARC
Akre, Samir	Session A	Poster 17	3:00 PM	Pavillion ARC
Alvarado-Martinez, Cynthia	Session C	Poster 22	5:00 PM	Pavillion ARC
Alvarez, Kenneth	Session B	Poster 73	4:00 PM	Pavillion ARC
Amaya Bautista, Meysel	Session C	Poster 79	5:00 PM	Pavillion ARC
Antoine-Goeas, Xavier (WITHDRAWN)	Session B	Poster 93	4:00 PM	Pavillion ARC
Apreghilio, Abigail	Session 1	Oral	2:15 PM	6 Wellman Hall
Aquino, Romae-Anne	Session C	Poster 126	5:00 PM	Pavillion ARC
Arabit, Jenny Lyn	Session C	Poster 71	5:00 PM	Pavillion ARC
Arao, Bianca	Session A	Poster 41	3:00 PM	Pavillion ARC
Araujo, Juan	Session B	Poster 14	4:00 PM	Pavillion ARC
Arbaugh, Benjamin	Session A	Poster 31	3:00 PM	Pavillion ARC
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Baker, Sarina	Session B	Poster 1	4:00 PM	Pavillion ARC
Banathy, Gabrielle	Session 1	Oral	1:15 PM	230 Wellman Hall
Barnedo, William (WITHDRAWN)	Session A	Poster 93	3:00 PM	Pavillion ARC
Bates, Sofie	Session 1	Oral	1:45 PM	212 Wellman Hall
Bayat, Helena	Session A	Poster 57	3:00 PM	Pavillion ARC
Bellinder, Jeffrey	Session C	Poster 47	5:00 PM	Pavillion ARC
Benipal, Simranjeet	Session B	Poster 129	4:00 PM	Pavillion ARC
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Berrios, David	Session B	Poster 58	4:00 PM	Pavillion ARC
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Betchart, Julia	Session C	Poster 146	5:00 PM	Pavillion ARC
Betz, Oliver	Session A	Poster 25	3:00 PM	Pavillion ARC
Bhan, Jee Young	Session C	Poster 125	5:00 PM	Pavillion ARC
Bhandari, Nandini	Session C	Poster 86	5:00 PM	Pavillion ARC
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Bhatnagar, Aditi	Session 1	Oral	1:15 PM	126 Wellman Hall
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Bostic, Darcy	Session B	Poster 24	4:00 PM	Pavillion ARC
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Broughton, Alexander	Session B	Poster 98	4:00 PM	Pavillion ARC
Brownridge, Ty	Session C	Poster 28	5:00 PM	Pavillion ARC
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Calcagno, Gary	Session 1	Oral	1:15 PM	119 Wellman Hall
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Chen, Jessica	Session C	Poster 32	5:00 PM	Pavillion ARC
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Chen, Madeline	Session C	Poster 96	5:00 PM	Pavillion ARC

Chen, Ting Chia	Session A	Poster 87	3:00 PM	Pavillion ARC
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Chittaranjan, Shivani	Session B	Poster 88	4:00 PM	Pavillion ARC
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Chokshi, Tanvi	Session B	Poster 153	4:00 PM	Pavillion ARC
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Chu, Rianna	Session 2	Oral	3:45 PM	6 Wellman Hall
Chun, Elisabeth	Session C	Poster 17	5:00 PM	Pavillion ARC
Clark, Raquelmarie	Session B	Poster 103	4:00 PM	Pavillion ARC
Coats, Matthew	Session C	Poster 128	5:00 PM	Pavillion ARC
Cobb, Evan	Session B	Poster 100	4:00 PM	Pavillion ARC
Cohen, Julia	Session A	Poster 1	3:00 PM	Pavillion ARC
Cohen, Marcus	Session C	Poster 70	5:00 PM	Pavillion ARC
Cohen-Sandler, Rose	Session B	Poster 89	4:00 PM	Pavillion ARC
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Cornejo, Karen	Session B	Poster 66	4:00 PM	Pavillion ARC
Cornett, Juliana	Session B	Poster 48	4:00 PM	Pavillion ARC
Cortez, Gina	Session B	Poster 29	4:00 PM	Pavillion ARC
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Cox, Kyle	Session A	Poster 59	3:00 PM	Pavillion ARC
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Culberson, Matthew	Session A	Poster 102	3:00 PM	Pavillion ARC
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De Anda, Danielle	Session B	Poster 151	4:00 PM	Pavillion ARC
Deforest, Natalie	Session 1	Oral	1:00 PM	106 Wellman Hall
Dekeater, Jenna	Session B	Poster 127	4:00 PM	Pavillion ARC
Delarazan, Angelique	Session A	Poster 117	3:00 PM	Pavillion ARC
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Dhanota, Puja	Session B	Poster 57	4:00 PM	Pavillion ARC
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Dimon, Matthew	Session B	Poster 109	4:00 PM	Pavillion ARC
Ditzel, Alexander	Session C	Poster 56	5:00 PM	Pavillion ARC

Docto, Diego Gabriel	Session C	Poster 72	5:00 PM	Pavillion ARC
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Downing, Ashlyn (WITHDRAWN)	Session B	Poster 61	4:00 PM	Pavillion ARC
Downing, Lauren	Session A	Poster 14	3:00 PM	Pavillion ARC
Doyle, Shayna	Session B	Poster 5	4:00 PM	Pavillion ARC
Drew, Aimee	Session A	Poster 66	3:00 PM	Pavillion ARC
Dumas, Evan	Session B	Poster 32	4:00 PM	Pavillion ARC
Dunbar, Tia	Session C	Poster 45	5:00 PM	Pavillion ARC
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Duong, Andrew	Session A	Poster 150	3:00 PM	Pavillion ARC
Ednalino, Marielle		A & D Exhibit	3:00 PM	Pavillion ARC
Eijansantos, Emily	Session 2	Oral	4:00 PM	212 Wellman Hall
Elder, Violet	Session C	Poster 85	5:00 PM	Pavillion ARC
Ellis, Cody	Session C	Poster 64	5:00 PM	Pavillion ARC
Erenstein, Daniel (WITHDRAWN)	Session A	Poster 93	3:00 PM	Pavillion ARC
Erickson, Katherine	Session 1	Oral	1:45 PM	216 Wellman Hall
Esparza, Yasmin	Session B	Poster 41	4:00 PM	Pavillion ARC
Espinosa-Iniguez, Fernando	Session C	Poster 142	5:00 PM	Pavillion ARC
Estevez, Talia	Session B	Poster 35	4:00 PM	Pavillion ARC
Estrada Torres, Liliana	Session A	Poster 77	3:00 PM	Pavillion ARC
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Falcon, Alexandria	Session C	Poster 78	5:00 PM	Pavillion ARC
Fann, Helen	Session C	Poster 120	5:00 PM	Pavillion ARC
Farivar, Daniel	Session B	Poster 49	4:00 PM	Pavillion ARC
Farman, Parisa	Session B	Poster 40	4:00 PM	Pavillion ARC
Farran, Ian	Session A	Poster 86	3:00 PM	Pavillion ARC
Fastenau, Caitlyn Rose	Session C	Poster 25	5:00 PM	Pavillion ARC
Favilla, Amanda	Session C	Poster 9	5:00 PM	Pavillion ARC
Ferino, Eva	Session 1	Oral	2:00 PM	212 Wellman Hall
Ferreira, Shanthal	Session C	Poster 27	5:00 PM	Pavillion ARC
Fisher, Hana	Session B	Poster 9	4:00 PM	Pavillion ARC
Flores, Tony	Session 1	Oral	1:45 PM	6 Wellman Hall
Fogel, Adira	Session A	Poster 118	3:00 PM	Pavillion ARC
Fong, Taylor	Session C	Poster 106	5:00 PM	Pavillion ARC
Fontus, Kerstin	Session C	Poster 94	5:00 PM	Pavillion ARC
Franklin, Rachel	Session B	Poster 37	4:00 PM	Pavillion ARC
Franzetti, Tristan	Session 1	Oral	2:00 PM	126 Wellman Hall
Frediani, Tanner	Session B	Poster 127	4:00 PM	Pavillion ARC
Frey, Madeline	Session B	Poster 45	4:00 PM	Pavillion ARC
Galindo, Kimberly	Session A	Poster 75	3:00 PM	Pavillion ARC
Gallegos, Rudolph	Session 2	Oral	3:30 PM	26 Wellman Hall
Gamage, Ratnapala	Session B	Poster 84	4:00 PM	Pavillion ARC
Ganesh, Sandya	Session A	Poster 143	3:00 PM	Pavillion ARC
Ganesh, Siddhi	Session 2	Oral	3:00 PM	6 Wellman Hall

Garaffo, Nicholas	Session B	Poster 142	4:00 PM	Pavillion ARC
Garcia, Madison	Session 1	Oral	1:45 PM	2 Wellman Hall
Garza, Anabelle	Session C	Poster 19	5:00 PM	Pavillion ARC
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Getachew, Tadewos	Session A	Poster 64	3:00 PM	Pavillion ARC
Ghayoumi, Bardia	Session C	Poster 148	5:00 PM	Pavillion ARC
Gikura, Charity	Session B	Poster 63	4:00 PM	Pavillion ARC
Gillis, Shane	Session C	Poster 155	5:00 PM	Pavillion ARC
Gin, Michelle	Session A	Poster 53	3:00 PM	Pavillion ARC
Glevanik, Lauren	Session B	Poster 55	4:00 PM	Pavillion ARC
Gloekler, Lauren	Session 2	Oral	4:00 PM	2 Wellman Hall
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Gomes, Anna	Session B	Poster 19	4:00 PM	Pavillion ARC
Gomez, Oriel	Session B	Poster 68	4:00 PM	Pavillion ARC
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Gordon, Grayson	Session C	Poster 77	5:00 PM	Pavillion ARC
Gould, Kennedy	Session C	Poster 13	5:00 PM	Pavillion ARC
Grant, Grace	Session B	Poster 30	4:00 PM	Pavillion ARC
Grayda, Joanne Alexandr	Session B	Poster 122	4:00 PM	Pavillion ARC
Greb, Alexandra	Session A	Poster 96	3:00 PM	Pavillion ARC
Guarnieri, Mia	Session B	Poster 40	4:00 PM	Pavillion ARC
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Gunaseelan, Anita	Session 2	Oral	3:30 PM	212 Wellman Hall
Guorgui, Jacob	Session B	Poster 42	4:00 PM	Pavillion ARC
Gupta, Pranav	Session B	Poster 77	4:00 PM	Pavillion ARC
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Hamada, Natalie	Session B	Poster 18	4:00 PM	Pavillion ARC
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Hanna, Matthew	Session 2	Oral	3:15 PM	202 Wellman Hall
Hanson, Andrew		A & D Exhibit	3:00 PM	Pavillion ARC
Harber, Cristina	Session 1	Oral	1:15 PM	202 Wellman Hall
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Harris, Rebecca	Session B	Poster 62	4:00 PM	Pavillion ARC
Hartanto, Mario (WITHDRAWN)	Session B	Poster 89	4:00 PM	Pavillion ARC
Hartman, Elisabeth	Session C	Poster 25	5:00 PM	Pavillion ARC
Haugland, Megan	Session A	Poster 13	3:00 PM	Pavillion ARC
Haywood, Wyatt	Session 1	Oral	1:45 PM	230 Wellman Hall
He, Shuhua	Session C	Poster 123	5:00 PM	Pavillion ARC
Hekmat, Behnaz	Session 2	Oral	3:15 PM	230 Wellman Hall

Helpio, Erin	Session 1	Oral	1:45 PM	226 Wellman Hall
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Hisey, Erin	Session B	Poster 159	4:00 PM	Pavillion ARC
Hitomi, Alex	Session A	Poster 34	3:00 PM	Pavillion ARC
Ho, Wai Lone	Session A	Poster 99	3:00 PM	Pavillion ARC
Hodgson, Kirsten	Session A	Poster 55	3:00 PM	Pavillion ARC
Holt, Anne	Session C	Poster 43	5:00 PM	Pavillion ARC
Homara, Tara	Session 2	Oral	3:30 PM	202 Wellman Hall
Hopper, Aleshia	Session 2	Oral	3:15 PM	126 Wellman Hall
Houston, Parker	Session 2	Oral	3:45 PM	230 Wellman Hall
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Hsieh, Caroline	Session 1	Oral	2:00 PM	106 Wellman Hall
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Hsiung, Tanya	Session A	Poster 26	3:00 PM	Pavillion ARC
Hsu, Alice	Session A	Poster 112	3:00 PM	Pavillion ARC
Hsu, Emily	Session 1	Oral	2:15 PM	106 Wellman Hall
Hu, Lin-Ya	Session 2	Oral	3:00 PM	233 Wellman Hall
Hua, Trang	Session B	Poster 121	4:00 PM	Pavillion ARC
Huang, Calvin	Session B	Poster 54	4:00 PM	Pavillion ARC
Huang, Carissa	Session A	Poster 132	3:00 PM	Pavillion ARC
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Huang, Sophia	Session C	Poster 25	5:00 PM	Pavillion ARC
Huben, Mariana	Session 1	Oral	2:00 PM	230 Wellman Hall
Huddleson, Amy	Session A	Poster 47	3:00 PM	Pavillion ARC
Hudson, Nikita	Session 2	Oral	3:30 PM	233 Wellman Hall
Huezo, Elizabeth	Session A	Poster 42	3:00 PM	Pavillion ARC
Huynh, Justin	Session 1	Oral	2:00 PM	233 Wellman Hall
Huynh, Khiet	Session A	Poster 142	3:00 PM	Pavillion ARC
Hwang, Hyeyeon	Session 1	Oral	1:45 PM	229 Wellman Hall
Hwang, Yunjin	Session 2	Oral	3:00 PM	233 Wellman Hall
Hyde, Kendall	Session B	Poster 2	4:00 PM	Pavillion ARC
Ilanthiraian, Stegi	Session C	Poster 58	5:00 PM	Pavillion ARC
Immaredy, Ramya	Session C	Poster 130	5:00 PM	Pavillion ARC
Indraganti, Lahari	Session A	Poster 58	3:00 PM	Pavillion ARC
Ingelson-Filpula, Willa	Session C	Poster 49	5:00 PM	Pavillion ARC
Ixcoy, Endy	Session 1	Oral	1:30 PM	6 Wellman Hall
Jacobs, Kyle	Session 1	Oral	1:30 PM	216 Wellman Hall
Jagannathan, Dhriti	Session B	Poster 132	4:00 PM	Pavillion ARC
Jahangiri, Arman	Session C	Poster 131	5:00 PM	Pavillion ARC
Jamaludin, Noor	Session 1	Oral	1:15 PM	234 Wellman Hall
Jani, Khushboo	Session B	Poster 112	4:00 PM	Pavillion ARC
Jayaraman, Anjana	Session 1	Oral	2:15 PM	229 Wellman Hall

Jeong, Grace	Session B	Poster 69	4:00 PM	Pavillion ARC
Jiang, Tiffany	Session B	Poster 108	4:00 PM	Pavillion ARC
Jianu, Julia	Session 1	Oral	1:00 PM	212 Wellman Hall
Jimenez, Reyna	Session C	Poster 5	5:00 PM	Pavillion ARC
Jimenez, Robert	Session B	Poster 157	4:00 PM	Pavillion ARC
Jin, Eunice	Session A	Poster 149	3:00 PM	Pavillion ARC
Jin, Ruiheng	Session A	Poster 120	3:00 PM	Pavillion ARC
Jing, Shaotong	Session C	Poster 40	5:00 PM	Pavillion ARC
Johal, Simran	Session B	Poster 111	4:00 PM	Pavillion ARC
Johnson, Virginia	Session 2	Oral	3:45 PM	106 Wellman Hall
Johnston, Jessica	Session C	Poster 113	5:00 PM	Pavillion ARC
Jones, Asia	Session A	Poster 54	3:00 PM	Pavillion ARC
Jow, Tiffany	Session A	Poster 146	3:00 PM	Pavillion ARC
Jun, Elizabeth	Session B	Poster 148	4:00 PM	Pavillion ARC
Kaeser, Paul	Session A	Poster 27	3:00 PM	Pavillion ARC
Kaloti, Aaron	Session 2	Oral	3:30 PM	229 Wellman Hall
Kamal, Kimia	Session B	Poster 139	4:00 PM	Pavillion ARC
Kao, Sean	Session A	Poster 134	3:00 PM	Pavillion ARC
Karashchuk, Irina	Session A	Poster 155	3:00 PM	Pavillion ARC
Karunatileka, Praveen	Session C	Poster 123	5:00 PM	Pavillion ARC
Kashikar, Devashish	Session A	Poster 71	3:00 PM	Pavillion ARC
Kawahara, Derek	Session 2	Oral	3:00 PM	126 Wellman Hall
Kaye, Megan	Session B	Poster 97	4:00 PM	Pavillion ARC
Kelly, Amanda	Session 2	Oral	3:15 PM	6 Wellman Hall
Khan, Muhammad	Session C	Poster 52	5:00 PM	Pavillion ARC
Kim, Angela	Session 1	Oral	2:15 PM	119 Wellman Hall
Kim, Boyoung	Session A	Poster 110	3:00 PM	Pavillion ARC
Kim, Elizabeth	Session C	Poster 140	5:00 PM	Pavillion ARC
Kim, Kaela	Session B	Poster 33	4:00 PM	Pavillion ARC
King, Kathryn	Session C	Poster 105	5:00 PM	Pavillion ARC
Kini, Pooja (WITHDRAWN)	Session A	Poster 93	3:00 PM	Pavillion ARC
Kiniry, Cody	Session C	Poster 10	5:00 PM	Pavillion ARC
Kinner, Jane	Session B	Poster 71	4:00 PM	Pavillion ARC
Kirilova, Anna	Session A	Poster 153	3:00 PM	Pavillion ARC
Klein, Kelsey	Session A	Poster 119	3:00 PM	Pavillion ARC
Knowles, Lucille	Session A	Poster 32	3:00 PM	Pavillion ARC
Kogon-Schneider, Ethan	Session 1	Oral	2:15 PM	230 Wellman Hall
Komaria, Aparna	Session A	Poster 37	3:00 PM	Pavillion ARC
Kopetzky, Jennifer	Session 2	Oral	3:45 PM	119 Wellman Hall
Kourmoutas, Ioannis	Session B	Poster 146	4:00 PM	Pavillion ARC
Kraemer, Niklas	Session A	Poster 101	3:00 PM	Pavillion ARC
Kravitz, Caroline	Session 2	Oral	3:15 PM	226 Wellman Hall
Krush, Milana	Session C	Poster 62	5:00 PM	Pavillion ARC
Kulkarni, Sheila	Session A	Poster 85	3:00 PM	Pavillion ARC
Kumar, Nithya	Session 1	Oral	1:30 PM	26 Wellman Hall

Kumaravelu, Soundarya	Session 1	Oral	1:45 PM	106 Wellman Hall
Kumari, Madhuri	Session C	Poster 102	5:00 PM	Pavillion ARC
Kumari, Sonam	Session 1	Oral	1:30 PM	106 Wellman Hall
Kumetat, Grace	Session 2	Oral	3:45 PM	226 Wellman Hall
Kung, Brandon	Session C	Poster 44	5:00 PM	Pavillion ARC
Kwan, Bernice	Session A	Poster 29	3:00 PM	Pavillion ARC
Kwong, Stephen	Session A	Poster 126	3:00 PM	Pavillion ARC
Kyaw, Sumon	Session B	Poster 9	4:00 PM	Pavillion ARC
La, Jennifer	Session A	Poster 114	3:00 PM	Pavillion ARC
Lahti, Gabriella	Session 2	Oral	3:30 PM	106 Wellman Hall
Lai, Andrew	Session B	Poster 143	4:00 PM	Pavillion ARC
Lam, Aileen	Session A	Poster 44	3:00 PM	Pavillion ARC
Lam, Tricia	Session A	Poster 33	3:00 PM	Pavillion ARC
Langlois-Ackerson, Nathaniel	Session B	Poster 21	4:00 PM	Pavillion ARC
Lara, Alexander	Session A	Poster 90	3:00 PM	Pavillion ARC
Larach, Manuel	Session A	Poster 83	3:00 PM	Pavillion ARC
Laskin, Emily	Session B	Poster 34	4:00 PM	Pavillion ARC
Le, Thanhmai	Session C	Poster 147	5:00 PM	Pavillion ARC
Leal, Kirsten	Session A	Poster 4	3:00 PM	Pavillion ARC
Lee, Anna	Session 2	Oral	3:45 PM	233 Wellman Hall
Lee, Chiao Hwei	Session 1	Oral	2:00 PM	226 Wellman Hall
Lee, Elizabeth	Session B	Poster 124	4:00 PM	Pavillion ARC
Lee, Hye Yun	Session A	Poster 60	3:00 PM	Pavillion ARC
Lee, Kevin	Session C	Poster 53	5:00 PM	Pavillion ARC
Lee, Monica	Session B	Poster 150	4:00 PM	Pavillion ARC
Lee, Owen	Session C	Poster 75	5:00 PM	Pavillion ARC
Leng, Calvin	Session C	Poster 95	5:00 PM	Pavillion ARC
Leon Sandoval, Arturo	Session C	Poster 92	5:00 PM	Pavillion ARC
Leung, Ho Ting	Session C	Poster 39	5:00 PM	Pavillion ARC
Leung, Joshua	Session A	Poster 21	3:00 PM	Pavillion ARC
Leung, Timothy	Session 1	Oral	1:00 PM	233 Wellman Hall
Lew, Megan	Session C	Poster 158	5:00 PM	Pavillion ARC
Lewandowski, Sierra	Session 2	Oral	4:00 PM	216 Wellman Hall
Li, Jinmeng	Session C	Poster 120	5:00 PM	Pavillion ARC
Li, Liangying	Session B	Poster 123	4:00 PM	Pavillion ARC
Li, Wenzhe	Session A	Poster 45	3:00 PM	Pavillion ARC
Liang, Cindy	Session 2	Oral	4:15 PM	26 Wellman Hall
Liao, Wyatt	Session 1	Oral	2:00 PM	229 Wellman Hall
Lim, Kahui	Session A	Poster 63	3:00 PM	Pavillion ARC
Lingel-Gary, Emma	Session 1	Oral	1:45 PM	119 Wellman Hall
Llewellyn, Joseph	Session A	Poster 129	3:00 PM	Pavillion ARC
Lo, Jeane Gladys	Session C	Poster 36	5:00 PM	Pavillion ARC
Lo, Kristen	Session B	Poster 149	4:00 PM	Pavillion ARC
Loo, Beverley	Session C	Poster 4	5:00 PM	Pavillion ARC
Lopez, Catherine	Session 2	Oral	3:45 PM	202 Wellman Hall

Lopez, Christopher	Session B	Poster 51	4:00 PM	Pavillion ARC
Lopez, Graciela	Session A	Poster 118	3:00 PM	Pavillion ARC
Lopez-Lugo, Kassandra	Session A	Poster 125	3:00 PM	Pavillion ARC
Louderback-Valenzuela, Annabelle	Session B	Poster 38	4:00 PM	Pavillion ARC
Lu, Junqi	Session A	Poster 30	3:00 PM	Pavillion ARC
Lu, Shuhan	Session C	Poster 124	5:00 PM	Pavillion ARC
Ludwick, Sara	Session C	Poster 99	5:00 PM	Pavillion ARC
Luo, Elle		A & D Exhibit	3:00 PM	Pavillion ARC
Luo, Yi		A & D Exhibit	3:00 PM	Pavillion ARC
Luu, Bao	Session C	Poster 159	5:00 PM	Pavillion ARC
Mackey, Gabriela	Session C	Poster 146	5:00 PM	Pavillion ARC
Maddox, Madeline	Session C	Poster 109	5:00 PM	Pavillion ARC
Madrone, Matisse	Session 2	Oral	3:45 PM	126 Wellman Hall
Maginnis, David	Session C	Poster 153	5:00 PM	Pavillion ARC
Mai, Caroline	Session C	Poster 121	5:00 PM	Pavillion ARC
Mak, Hiu Ling	Session A	Poster 9	3:00 PM	Pavillion ARC
Malik, Azza (WITHDRAWN)	Session 1	Oral	1:45 PM	234 Wellman Hall
Mallory, Benjamin	Session 2	Oral	3:45 PM	26 Wellman Hall
Mancini, Shelby	Session B	Poster 160	4:00 PM	Pavillion ARC
Mannikar, Neha	Session C	Poster 63	5:00 PM	Pavillion ARC
Maquiling, Sophie		A & D Exhibit	3:00 PM	Pavillion ARC
Marathe, Ria	Session 1	Oral	1:15 PM	212 Wellman Hall
Marcucci, Juan	Session A	Poster 43	3:00 PM	Pavillion ARC
Marfin, Mark	Session 2	Oral	3:15 PM	26 Wellman Hall
Marshall, Melissa	Session C	Poster 33	5:00 PM	Pavillion ARC
Martin, Zoe Nicole	Session C	Poster 87	5:00 PM	Pavillion ARC
Martinez, Gabriel	Session 1	Oral	2:00 PM	2 Wellman Hall
Mascareno, Daniel	Session B	Poster 76	4:00 PM	Pavillion ARC
Mashat, Bayan	Session B	Poster 104	4:00 PM	Pavillion ARC
Mastoras, Mira	Session B	Poster 62	4:00 PM	Pavillion ARC
Mathur, Gautam	Session B	Poster 47	4:00 PM	Pavillion ARC
Maudlin, Megan	Session 1	Oral	2:15 PM	126 Wellman Hall
Mccarthy, Taylor	Session A	Poster 135	3:00 PM	Pavillion ARC
Mcelroy, Natalie	Session B	Poster 23	4:00 PM	Pavillion ARC
Mcnamara, Alexander	Session A	Poster 40	3:00 PM	Pavillion ARC
Meckler-Pacheco, Joaquin	Session C	Poster 35	5:00 PM	Pavillion ARC
Meller, Mikhail	Session C	Poster 149	5:00 PM	Pavillion ARC
Mena Roman, David	Session B	Poster 116	4:00 PM	Pavillion ARC
Mende, Abigail	Session A	Poster 127	3:00 PM	Pavillion ARC
Mendoza, Laura	Session A	Poster 154	3:00 PM	Pavillion ARC
Meng, Zihan	Session B	Poster 60	4:00 PM	Pavillion ARC
Meola, Sofia	Session C	Poster 112	5:00 PM	Pavillion ARC
Metcalfe, Ashley	Session B	Poster 85	4:00 PM	Pavillion ARC
Miakicheva, Svetlana	Session B	Poster 72	4:00 PM	Pavillion ARC
Michael, Alec	Session B	Poster 141	4:00 PM	Pavillion ARC

Mighell, Sarah	Session B	Poster 105	4:00 PM	Pavillion ARC
Milkey, Analisa	Session 1	Oral	1:00 PM	233 Wellman Hall
Minie, Vanessa	Session C	Poster 116	5:00 PM	Pavillion ARC
Minsky, Hana	Session A	Poster 23	3:00 PM	Pavillion ARC
Mitchell, Kimberly	Session A	Poster 51	3:00 PM	Pavillion ARC
Mkrtchyan, Carina	Session 1	Oral	2:00 PM	234 Wellman Hall
Moher, Daniel	Session A	Poster 146	3:00 PM	Pavillion ARC
Molodanof, Sofia	Session 1	Oral	1:00 PM	230 Wellman Hall
Mora, Manuel	Session B	Poster 59	4:00 PM	Pavillion ARC
Morales, Brian	Session A	Poster 68	3:00 PM	Pavillion ARC
Moreno, Jose	Session A	Poster 103	3:00 PM	Pavillion ARC
Mori, Yuji	Session B	Poster 15	4:00 PM	Pavillion ARC
Morizono, Michael	Session C	Poster 121	5:00 PM	Pavillion ARC
Movich, Catherine	Session C	Poster 46	5:00 PM	Pavillion ARC
Mukai, Gabriella	Session C	Poster 2	5:00 PM	Pavillion ARC
Mummidivarapu, Nitika	Session 1	Oral	1:00 PM	107 Wellman Hall
Munguia Ramos, Miroslava	Session B	Poster 27	4:00 PM	Pavillion ARC
Munkres, Ivan	Session 1	Oral	1:15 PM	229 Wellman Hall
Munoz, Ariel	Session A	Poster 137	3:00 PM	Pavillion ARC
Murakami, Kalani	Session A	Poster 73	3:00 PM	Pavillion ARC
Murdock, Maylin	Session 2	Oral	3:00 PM	226 Wellman Hall
Muriki, Maneesha	Session A	Poster 12	3:00 PM	Pavillion ARC
Mwaniki, Janice	Session 2	Oral	4:15 PM	2 Wellman Hall
Nabavizadeh, Aryana	Session A	Poster 91	3:00 PM	Pavillion ARC
Nadvi, Navid	Session B	Poster 77	4:00 PM	Pavillion ARC
Najafi, Negeen	Session B	Poster 4	4:00 PM	Pavillion ARC
Nandakumar, Dhruv	Session 2	Oral	3:30 PM	119 Wellman Hall
Naqvi, Mohsin	Session 2	Oral	3:30 PM	2 Wellman Hall
Naqvi, Sanye Zehra	Session B	Poster 16	4:00 PM	Pavillion ARC
Narayan, Madhuri	Session B	Poster 9	4:00 PM	Pavillion ARC
Nasirishargh, Aida	Session C	Poster 154	5:00 PM	Pavillion ARC
Naslund, Andrew	Session C	Poster 3	5:00 PM	Pavillion ARC
Natividad, Monica Lyn	Session 2	Oral	4:00 PM	26 Wellman Hall
Neelakantan, Taruna	Session A	Poster 84	3:00 PM	Pavillion ARC
Nemes, Sonya	Session B	Poster 114	4:00 PM	Pavillion ARC
Neufeld, Rebecca	Session C	Poster 115	5:00 PM	Pavillion ARC
Neville, Brooke	Session A	Poster 10	3:00 PM	Pavillion ARC
Ng, Brandon	Session 2	Oral	3:15 PM	2 Wellman Hall
Ng, C Michelle	Session C	Poster 17	5:00 PM	Pavillion ARC
Ng, Juliana	Session B	Poster 69	4:00 PM	Pavillion ARC
Ng, Kristell Isabel	Session C	Poster 38	5:00 PM	Pavillion ARC
Nguyen, Amanda	Session B	Poster 53	4:00 PM	Pavillion ARC
Nguyen, Amy	Session B	Poster 145	4:00 PM	Pavillion ARC
Nguyen, Angela (WITHDRAWN)	Session B	Poster 93	4:00 PM	Pavillion ARC
Nguyen, Duc	Session B	Poster 135	4:00 PM	Pavillion ARC

Nguyen, Jennifer Anne	Session 2	Oral	3:45 PM	233 Wellman Hall
Nguyen, Leilani	Session A	Poster 5	3:00 PM	Pavillion ARC
Nguyen, Marina	Session 2	Oral	3:00 PM	26 Wellman Hall
Nguyen, Michelle	Session C	Poster 138	5:00 PM	Pavillion ARC
Nguyen, Michelle	Session 1	Oral	1:30 PM	107 Wellman Hall
Nguyen, Minh	Session C	Poster 93	5:00 PM	Pavillion ARC
Nguyen, Quynh	Session A	Poster 147	3:00 PM	Pavillion ARC
Nguyen, Vivian	Session 1	Oral	1:30 PM	233 Wellman Hall
Nourkhalaj, Yasaman	Session 1	Oral	1:00 PM	234 Wellman Hall
Nwafor, Gilliane	Session C	Poster 19	5:00 PM	Pavillion ARC
Ochoa, Christopher	Session C	Poster 6	5:00 PM	Pavillion ARC
Ochoa, Daisy	Session C	Poster 24	5:00 PM	Pavillion ARC
Okorie, Chiamaka	Session 1	Oral	2:00 PM	6 Wellman Hall
Olano, Lorenzo Ray	Session C	Poster 2	5:00 PM	Pavillion ARC
Olea Lopez, Jissel (WITHDRAWN)	Session C	Poster 82	5:00 PM	Pavillion ARC
Olson, Mariah	Session 1	Oral	1:30 PM	226 Wellman Hall
Ormonde, Amanda	Session C	Poster 160	5:00 PM	Pavillion ARC
Osborn, Ellen	Session B	Poster 20	4:00 PM	Pavillion ARC
Osborne, Danielle	Session B	Poster 45	4:00 PM	Pavillion ARC
Osgood, Geoffrey	Session C	Poster 12	5:00 PM	Pavillion ARC
Owen, Julia	Session 2	Oral	4:15 PM	126 Wellman Hall
Oyao, Alexis	Session A	Poster 111	3:00 PM	Pavillion ARC
Pai, Mansi	Session B	Poster 155	4:00 PM	Pavillion ARC
Palmer, Oliver	Session B	Poster 22	4:00 PM	Pavillion ARC
Palmer, Rebecca	Session 1	Oral	1:30 PM	212 Wellman Hall
Pan, Xuankang	Session C	Poster 61	5:00 PM	Pavillion ARC
Pandey, Abha	Session A	Poster 69	3:00 PM	Pavillion ARC
Pang, Joseph	Session C	Poster 121	5:00 PM	Pavillion ARC
Pantoja, Erika	Session C	Poster 16	5:00 PM	Pavillion ARC
Park, Caroline	Session A	Poster 128	3:00 PM	Pavillion ARC
Park, Heui Hye	Session B	Poster 148	4:00 PM	Pavillion ARC
Park, Wesley	Session 2	Oral	4:00 PM	202 Wellman Hall
Pascual Gutierrez, Eileen	Session B	Poster 132	4:00 PM	Pavillion ARC
Pastor, Ilse	Session 1	Oral	1:45 PM	126 Wellman Hall
Paterson, Shona	Session B	Poster 27	4:00 PM	Pavillion ARC
Patterson, Cavan	Session A	Poster 124	3:00 PM	Pavillion ARC
Peer, Kami	Session B	Poster 27	4:00 PM	Pavillion ARC
Pendergast, Izabella	Session A	Poster 2	3:00 PM	Pavillion ARC
Peng, Chantal	Session A	Poster 61	3:00 PM	Pavillion ARC
Perez, Alma	Session A	Poster 79	3:00 PM	Pavillion ARC
Perez, Paola	Session B	Poster 39	4:00 PM	Pavillion ARC
Perry, Russell	Session A	Poster 100	3:00 PM	Pavillion ARC
Petrie, Rachel	Session B	Poster 113	4:00 PM	Pavillion ARC
Phillips, Lindsey	Session C	Poster 105	5:00 PM	Pavillion ARC
Pneh, Sharon	Session C	Poster 14	5:00 PM	Pavillion ARC

Pomales, Stephanie	Session B	Poster 102	4:00 PM	Pavillion ARC
Ponek, Ronni	Session 2	Oral	3:30 PM	234 Wellman Hall
Pontius, Maxine	Session A	Poster 56	3:00 PM	Pavillion ARC
Prakash, Nishant	Session A	Poster 131	3:00 PM	Pavillion ARC
Proffitt, Allison	Session A	Poster 109	3:00 PM	Pavillion ARC
Puentes, Bryan	Session C	Poster 1	5:00 PM	Pavillion ARC
Puso, Michael	Session 2	Oral	3:00 PM	229 Wellman Hall
Quan, Phung	Session C	Poster 73	5:00 PM	Pavillion ARC
Quart, Zachary	Session A	Poster 8	3:00 PM	Pavillion ARC
Quintana, Melissa	Session A	Poster 61	3:00 PM	Pavillion ARC
Quintero, Diana	Session C	Poster 68	5:00 PM	Pavillion ARC
Quiroz Alonso, Alejandra	Session C	Poster 133	5:00 PM	Pavillion ARC
Radut, Brian	Session C	Poster 134	5:00 PM	Pavillion ARC
Rahgozar, Sahar (WITHDRAWN)	Session 2	Oral	3:15 PM	212 Wellman Hall
Rai, Ananya	Session C	Poster 67	5:00 PM	Pavillion ARC
Ramesh, Sharani	Session B	Poster 82	4:00 PM	Pavillion ARC
Ramirez, Andrea	Session B	Poster 117	4:00 PM	Pavillion ARC
Ramirez, Andrew	Session B	Poster 92	4:00 PM	Pavillion ARC
Ramirez Perez, Susana	Session 2	Oral	3:45 PM	229 Wellman Hall
Ramos-Maciel, Stephanie	Session C	Poster 117	5:00 PM	Pavillion ARC
Raytis, Matthew	Session C	Poster 87	5:00 PM	Pavillion ARC
Raza, Ziqra	Session C	Poster 84	5:00 PM	Pavillion ARC
Reddy, Shivani	Session A	Poster 130	3:00 PM	Pavillion ARC
Reddy, Vijay	Session A	Poster 39	3:00 PM	Pavillion ARC
Remstedt, Anna	Session B	Poster 45	4:00 PM	Pavillion ARC
Rencken, Camerin	Session C	Poster 137	5:00 PM	Pavillion ARC
Rewinski, Eva	Session B	Poster 152	4:00 PM	Pavillion ARC
Reyes, Andres	Session A	Poster 50	3:00 PM	Pavillion ARC
Reyes, Docnary	Session B	Poster 12	4:00 PM	Pavillion ARC
Reyes Valenzuela, Jocelin	Session C	Poster 83	5:00 PM	Pavillion ARC
Rivas Gutierrez, Victor	Session 2	Oral	3:30 PM	230 Wellman Hall
Rivera, Stephanie	Session B	Poster 9	4:00 PM	Pavillion ARC
Robertson, Alexander	Session 2	Oral	4:00 PM	230 Wellman Hall
Robinson, Foxy	Session 1	Oral	1:45 PM	107 Wellman Hall
Rodriguez, Jennifer	Session A	Poster 78	3:00 PM	Pavillion ARC
Rodriguez, Natanael	Session 2	Oral	3:30 PM	6 Wellman Hall
Roman, Eric	Session B	Poster 52	4:00 PM	Pavillion ARC
Roth, Katerina	Session A	Poster 20	3:00 PM	Pavillion ARC
Rothbart, Nicholas	Session B	Poster 89	4:00 PM	Pavillion ARC
Roy, Sucharita	Session A	Poster 24	3:00 PM	Pavillion ARC
Rusit, Xylina	Session 1	Oral	1:00 PM	233 Wellman Hall
Rusly, Florence	Session B	Poster 80	4:00 PM	Pavillion ARC
Sahabandu, Natalie	Session A	Poster 36	3:00 PM	Pavillion ARC
Sainato, Carlotta	Session B	Poster 26	4:00 PM	Pavillion ARC
San Pablo, Alexandra Camil	Session A	Poster 62	3:00 PM	Pavillion ARC

Sanchez, Alma	Session C	Poster 27	5:00 PM	Pavillion ARC
Sanchez, Camilo	Session 2	Oral	4:00 PM	126 Wellman Hall
Sandoval, Jose	Session 2	Oral	4:00 PM	119 Wellman Hall
Sanghavi, Priyanka	Session C	Poster 110	5:00 PM	Pavillion ARC
Sanjaya, Nathaniel Ryan	Session 2	Oral	3:45 PM	234 Wellman Hall
Santich, Sinead	Session 1	Oral	2:00 PM	119 Wellman Hall
Santoyo, Diana	Session B	Poster 70	4:00 PM	Pavillion ARC
Sara, Samuel	Session C	Poster 51	5:00 PM	Pavillion ARC
Scolati, Haley	Session 2	Oral	4:00 PM	106 Wellman Hall
Serrato, Grace	Session 1	Oral	1:45 PM	26 Wellman Hall
Shahrivini, Bitra	Session A	Poster 38	3:00 PM	Pavillion ARC
Shao, Anran	Session 1	Oral	1:00 PM	26 Wellman Hall
Sharma, Shonit	Session 1	Oral	2:00 PM	216 Wellman Hall
Shephard, Andrew (WITHDRAWN)	Session B	Poster 77	4:00 PM	Pavillion ARC
Sheu, Ting-Jung	Session B	Poster 147	4:00 PM	Pavillion ARC
Shipman, Samuel	Session A	Poster 105	3:00 PM	Pavillion ARC
Shita, Yordanos	Session A	Poster 67	3:00 PM	Pavillion ARC
Siddeek, Mohamed Hisham	Session A	Poster 48	3:00 PM	Pavillion ARC
Sidhu, Suhail	Session 1	Oral	1:00 PM	126 Wellman Hall
Sillas, Andre	Session A	Poster 113	3:00 PM	Pavillion ARC
Silva, Selena	Session 2	Oral	3:30 PM	226 Wellman Hall
Silverstein, Madeleine	Session B	Poster 127	4:00 PM	Pavillion ARC
Simileysky, Alexander	Session C	Poster 65	5:00 PM	Pavillion ARC
Simmons, Gabriel	Session B	Poster 79	4:00 PM	Pavillion ARC
Sin, Steffi	Session B	Poster 8	4:00 PM	Pavillion ARC
Singh, Alexis	Session A	Poster 108	3:00 PM	Pavillion ARC
Singh, Jasmine	Session B	Poster 130	4:00 PM	Pavillion ARC
Singh, Sarvagya	Session A	Poster 71	3:00 PM	Pavillion ARC
Singhal, Kartik	Session C	Poster 48	5:00 PM	Pavillion ARC
Sirovica, Lara	Session 1	Oral	1:15 PM	226 Wellman Hall
Sjafii, Evelyn	Session A	Poster 39	3:00 PM	Pavillion ARC
Skandalis, Christina	Session B	Poster 107	4:00 PM	Pavillion ARC
Smart, Kyra	Session B	Poster 3	4:00 PM	Pavillion ARC
Smoot, Jeanelle	Session A	Poster 82	3:00 PM	Pavillion ARC
So, Christina	Session C	Poster 54	5:00 PM	Pavillion ARC
Solomon, Samantha	Session 1	Oral	1:30 PM	119 Wellman Hall
Soltanzadeh Zarandi, Sina	Session 2	Oral	3:15 PM	119 Wellman Hall
Somepalle, Sai Sahitha	Session 2	Oral	4:15 PM	212 Wellman Hall
Sorrell, Clifton	Session 2	Oral	3:00 PM	216 Wellman Hall
Souza, Chelsey	Session B	Poster 6	4:00 PM	Pavillion ARC
Sramek, Natasha	Session B	Poster 96	4:00 PM	Pavillion ARC
Sridharan, Samvardhini	Session B	Poster 156	4:00 PM	Pavillion ARC
Stack, Emily	Session 1	Oral	2:00 PM	202 Wellman Hall
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2 Wellman Hall, Moderator: Nidia Banuelos

- 1:00 PM Candieas, Travis - International Relations**
Refocusing Student Perspective in Higher Education Through Co-Curricular Involvement
- 1:15 PM Higgins, Hannah - Microbiology**
The Racialized Collective Memory and Media Framing of New Orleans Natural Disasters
- 1:30 PM Zhu, Cenxiao - Sociology--Organizational Studies**
How the Deferred Action for Childhood Arrivals (DACA) Program Affects Immigrants' Mental Health
- 1:45 PM Garcia, Madison - Sociology--Organizational Studies**
Navigating the "Hidden Curriculum": College Student Academic Engagement Strategies with Authority Figures
- 2:00 PM Martinez, Gabriel - Political Science**
Immigrant Backlash Latino and Asian Voting in the 2016 Presidential Election
- 2:15 PM Buck, Taylor - Political Science--Public Service**
Gaps in Representation: Evaluating the Effectiveness of Nonpartisan Redistricting Commissions in Curbing Gerrymandering

6 Wellman Hall, Moderator: Sarah Perrault

- 1:00 PM Zaragoza, Diana - Psychology**
Fototestimonios: Campus Climate in Davis
- 1:15 PM Wang, Michelle - Political Science**
Fototestimonios: Campus Climate in Davis
- 1:30 PM Ixcoy, Endy - Psychology**
The Latinx Homeless Situation in the Orange and Los Angeles County
- 1:45 PM Flores, Tony - Chicana/Chicano Studies**
The Latinx Homeless Situation in the Orange and Los Angeles County
- 2:00 PM Okorie, Chiamaka - African American and African Studies**
Beyond Racialization Theory and Immigration Identity in Two Films and Two Short Stories
- 2:15 PM Aprelilio, Abigail - English**
Preserving Cultural Identity Through the Collective: A Lacanian Perspective on Reconciling the Fractured Asian-American Identity

26 Wellman Hall, Moderator: Veronica Morales

- 1:00 PM Shao, Anran - Clinical Nutrition**
Use of Iron Supplements by Women During Pregnancy in Cameroon: A Cross-Sectional Study
- 1:15 PM Gueniot, Jordan - Psychology**
Milk Fat Globule Membrane and its Implications in Infant Neurodevelopment
- 1:30 PM Kumar, Nithya - Food Science**
Human Milk Protease Kinetics: Quantification of Peptide Release During Digestion
- 1:45 PM Serrato, Grace - Community and Regional Development**
Empowering Desert Rats: Social and Environmental Well-Being of Youth in Victorville, CA
- 2:00 PM Bridges, Matthew - International Agricultural Development**
Fighting For a Better Life: Farmworker Advocacy in Yolo County

106 Wellman Hall, Moderator: Amy Fabritius

- 1:00 PM Deforest, Natalie - Pharmaceutical Chemistry**
Chemoenzymatic Synthesis of Sialyl Lewis X, A Biologically Important Tetrasaccharide, and the Cloning and Characterization of Enzymes for Carbohydrate Synthesis
- 1:15 PM Castro, Noemi - Biochemistry and Molecular Biology**
Possible Compensatory Effects Lead to Phenotype Variability in Zebrafish PCNT Mutants
- 1:30 PM Kumari, Sonam - Neurobiology, Physiology and Behavior**
Healthcare in the San Joaquin Valley: Current Challenges and Successful Strategies
- 1:45 PM Kumaravelu, Soundarya - Biochemistry and Molecular Biology**
Secondhand Smoke Exposure Modifies Stress-Induced Arrhythmia Burden in Mice
- 2:00 PM Hsieh, Caroline - Cell Biology**
Quantifying Ubiquitin Inclusions in an Inducible Mouse Model of Fragile X-Associated Tremor/Ataxia Syndrome (FXTAS)
- 2:15 PM Hsu, Emily - Biological Sciences**
Translational Neuroscience in Reverse: Adapting EEG Analysis Techniques from Bedside to Bench

107 Wellman Hall, Moderator: Theetha Pavankumar

- 1:00 PM Mummidivarapu, Nitika - Biochemistry and Molecular Biology**
Transcriptional Regulation of Transposable Elements During Hydra Embryogenesis
- 1:15 PM Arnold, Joshua - Computer Engineering**
Deep Learning for Simulation of Mass Spectra
- 1:30 PM Nguyen, Michelle - Environmental Toxicology**
Hepatitis E Virus Nanoparticles as Insulin Oral Delivery Vector
- 1:45 PM Robinson, Foxy - Biochemistry and Molecular Biology**
BRCA1/BARD1 Ubiquitin Ligase Activity Mediates DNA Repair in *Caenorhabditis elegans*
- 2:00 PM Velazquez, Marysol - Biochemistry and Molecular Biology**
Complicated Interactions Between Substrate and Product Inhibition in *E. coli* CTP Synthetase
- 2:15 PM Wang, Colin - Neurobiology, Physiology and Behavior**
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119 Wellman Hall, Moderator: Jon Rossini

- 1:00 PM Washington, Jasmine - Theatre and Dance**
Callus: A Black Experience
- 1:15 PM Calcagno, Gary - Art History**
Imperial Consciousness: Japanese Colonial Architecture in Seoul
- 1:30 PM Solomon, Samantha - Comparative Literature**
Encountering the Alien: Exploitation, Appropriation, and Subversion in Postcolonial Science Fiction and Fantasy
- 1:45 PM Lingel-Gary, Emma - Art History**
The Manipulation of Memory In Situ and Abroad: Memorialization of the Holocaust in Museums in Europe and the United States
- 2:00 PM Santich, Sinead - Cinema and Digital Media**
Break The Cycle: A Documentary about Sustainable Cycles, a Menstrual Activist Cyclist Group
- 2:15 PM Kim, Angela - Gender, Sexuality and Women's Studies**
A Critical Analysis of UC Davis Student Housing's Investment in Whiteness

126 Wellman Hall, Moderator: Jun yi Wang

- 1:00 PM Sidhu, Suhail - Psychology**
A Longitudinal Review of Breastfeeding Smartphone Apps Using Social Cognitive Theory
- 1:15 PM Bhatnagar, Aditi - Psychology**
Improving Memory Through Mindfulness Practice
- 1:30 PM Taylor, Christopher - Psychology**
Sex-Specific Behavior Modulation of OT in the Anterior BNST
- 1:45 PM Pastor, Ilse - Cognitive Science**
Do In-Class Distractions Associated with Cellphone Notifications Influence Recollection- or Familiarity-Based Memory?
- 2:00 PM Franzetti, Tristan - Animal Biology**
Juveniles Reduce Affiliation Between Socially Monogamous Titi Monkey Pairs (*Callicebus cupreus*)
- 2:15 PM Maudlin, Megan - Psychology**
Assessing Behavioral Evidence for Replay of Neutral and Emotionally Arousing Information

202 Wellman Hall, Moderator: Andy Jones

- 1:00 PM Condie, Shelbie - English**
Hold Your Horses, It's Just an Adaptation
- 1:15 PM Harber, Cristina - English**
The Materialization of Free Will in Milton's *Paradise Lost*
- 1:30 PM West, Megan - English**
Charlotte Brontë and the Politics of Feeling
- 1:45 PM Yoakam, Michael - Environmental Policy Analysis and Planning**
The Sexuality of Gothic Literature: An Analysis of the Connection Between the Portrayal of Sexuality in Gothic Literature and Victorian Repression
- 2:00 PM Stack, Emily - English**
Came From a Woman, Got Our Name From a Woman: Female Bodies as Sites of Identity, History, and Narrative in *Absalom, Absalom!*
- 2:15 PM Aamot, Taylor - English**
Crises of the Self in Crime Fiction

212 Wellman Hall, Moderator: Janine Lasalle

- 1:00 PM Jianu, Julia - Biochemistry and Molecular Biology**
Confirmation of DNA Methylation Differences in Umbilical Cord Blood From Autism Subjects in the MARBLES Study
- 1:15 PM Marathe, Ria - Genetics and Genomics**
Investigating the Association between Maternal Prenatal Vitamin Intake and Placental DNA Methylation in Autism Spectrum Disorder
- 1:30 PM Palmer, Rebecca - Animal Science**
Using a Mouse Disease Model and Western Blot to Determine the Role of the Snord116 Deletion in Prader-Willi Syndrome
- 1:45 PM Bates, Sofie - Genetics and Genomics**
Recruitment-Based Approaches to Epigenetic Editing of HER2
- 2:00 PM Ferino, Eva - Animal Science**
Introduction of KCNB1 Human Missense Mutations Associated with Infantile Epilepsy Using Gene Editing in Zebrafish
- 2:15 PM Chen, Jenny - Cell Biology**

Overcoming Therapy Resistance in Breast Cancer with Hexamethylene Amiloride

216 Wellman Hall, Moderator: Soichiro Yamada

- 1:00 PM Yee, Jacqueline - Biomedical Engineering**
Determining the Roles of CrkII, CrkL, and YAP1 in Force-Sensitive Protein Interactions Surrounding Zyxin
- 1:15 PM Cheah, Joleen - Biological Sciences**
Identifying Force-Sensitive Protein Interactions in Cell Migration
- 1:30 PM Jacobs, Kyle - Biomedical Engineering**
Visualizing Real-Time Changes in Force-Dependent Protein Localization
- 1:45 PM Erickson, Katherine - Biomedical Engineering**
Identifying Fusion Proteins in Epithelial Cells
- 2:00 PM Sharma, Shonit - Biomedical Engineering**
Frugal Science: Digitally Controlled Open-Source Syringe Pump
- 2:15 PM Agung, Michael - Biomedical Engineering**
Fluorescence Lifetime Imaging Combined with Intravascular Ultrasound for Cardiovascular Disease Characterization

226 Wellman Hall, Moderator: Allen Pettey

- 1:00 PM Wadsworth, Derek - Chemical Engineering**
Enhancing Understanding of the Molecular Toolkit Employed by Anaerobic Fungi to Degrade Plant Material
- 1:15 PM Sirovica, Lara - Animal Science**
Enrichment Preference in Mature Boars, and the Impact of Enrichment Exposure on Boar Welfare
- 1:30 PM Olson, Mariah - Animal Biology**
Classification of Vocal Responses to Social Isolation in Female Domestic Piglets
- 1:45 PM Helpio, Erin - Biological Sciences**
First Report of a New Crown Rot Disease of Tomato in California, Caused by Pathogens in the *Fusarium solani* Species Complex
- 2:00 PM Lee, Chiao Hwei - Pharmaceutical Chemistry**
Near Infrared Spectrometry (NIR) as a Fast and Reliable Tool for Fat and Moisture Analysis in Olives

229 Wellman Hall, Moderator: Mariana Barboza

- 1:00 PM Hagelthorn, David - Biochemistry and Molecular Biology**
Characterization of Stress-Inducible Diterpene Synthases in *Panicum virgatum*
- 1:15 PM Munkres, Ivan - Biochemistry and Molecular Biology**
Novel Diterpenes in Maize Repress Growth of Major Fungal Pathogens
- 1:30 PM Zhu, Yong - Biochemistry and Molecular Biology**
Novel Diterpenes in Maize Repress Growth in Major Fungal Pathogens
- 1:45 PM Hwang, Hyeyeon - Computer Science**
Multi-Player Augmented Reality Game: Developing a Collision Avoidance System in a Simulated Environment
- 2:00 PM Liao, Wyatt - Chemical Engineering**
Determining Ions' Effects on Micelle Sizes
- 2:15 PM Jayaraman, Anjana - Chemical Engineering**
Centrifugation Induced Release of ATP from Red Blood Cells

230 Wellman Hall, Moderator: Joanna Regulska

- 1:00 PM** **Molodanof, Sofia - English**
Law, Gender, and Mental Illness in Margaret Atwood's *Alias Grace*
- 1:15 PM** **Banathy, Gabrielle - Religious Studies**
Boys Will Be Boys: Temperament and Attachment in the Apocryphal Childhood of Jesus Christ
- 1:30 PM** **Hampson, Lauren - Classical Civilization**
Ambush in the Dark: A Study in Reception of Homer's *Iliad* in Virgil's *Aeneid*
- 1:45 PM** **Haywood, Wyatt - Art History**
A Grave Form of Art: A Comparative Discussion of Bronze Age Cycladic Figurines and Egyptian Shabti Statuettes
- 2:00 PM** **Huben, Mariana - English**
Profanity in Early Modern Drama
- 2:15 PM** **Kogon-Schneider, Ethan - Classical Civilization**
Developments in Antisemitism During Late Antiquity: A Rhetorical Analysis

233 Wellman Hall, Moderator: Christopher Martinez

- 1:00 PM** **Milkey, Analisa - Biological Sciences**
Body Elongation as a Major Feature of Diversification in Eupercarian Fishes
- 1:00 PM** **Leung, Timothy - Marine and Coastal Science--Marine Ecology and Organismal Biology**
Body Elongation as a Major Feature of Diversification in Eupercarian Fishes
- 1:00 PM** **Rusit, Xylina - Biochemistry and Molecular Biology**
Body Elongation as a Major Feature of Diversification in Eupercarian Fishes
- 1:30 PM** **Nguyen, Vivian - Animal Science**
The Home Stretch: Body Elongation Diversity of Pelagic Fishes
- 1:30 PM** **Susman, Victoria - Wildlife, Fish and Conservation Biology**
The Home Stretch: Body Elongation in Pelagic Fishes
- 2:00 PM** **Waskowiak, Justin - Genetics and Genomics**
Comparative Analysis of Body Elongation as a Major Trend in Demersal Fishes
- 2:00 PM** **Huynh, Justin - Neurobiology, Physiology and Behavior**
Comparative Analysis of Body Elongation as a Major Trend in Demersal Fishes

234 Wellman Hall, Moderator: Suad Joseph

- 1:00 PM** **Nourkhalaj, Yasaman - Neurobiology, Physiology and Behavior**
The Middle East in U.S. Media Representation: An Analysis of the Term "Mussulman" in the New York Times (1900-1909)
- 1:15 PM** **Jamaludin, Noor - Environmental Policy Analysis and Planning**
The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Sunni*" in the New York Times (1900-1909)
- 1:30 PM** **Hovsepian, Natalie - 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)
- 1:45 PM** **(WITHDRAWN) Malik, Azza - International Agricultural Development**
The Middle East and North Africa in U.S. Media Representations: An Analysis of the Term "Yemen" in the New York Times (1900-1909)
- 2:00 PM** **Mkrtchyan, Carina - Anthropology**
Arabian Nights: Deconstructing Terminology and Exoticization in the New York Times
- 2:15 PM** **Zhang, Lienong - Biological Sciences**
Reimagination of Self: Transnational Human Quality Embodiment in Contemporary China

2 Wellman Hall, Moderator: Mark Huising

- 3:00 PM Van, Richard - Biochemistry and Molecular Biology**
The Role of Urocortin3 in Maintaining Delta Cell Identity Within Pancreatic Islets
- 3:15 PM Ng, Brandon - Biomedical Engineering**
Developing Better Tools to Quantify Running Related Injury Potential: Estimating Ground Contact Forces From Wearable Devices
- 3:30 PM Naqvi, Mohsin - Biomedical Engineering**
Forward Lunge Mechanics: Does Allowing the Knee to Go Past the Toes Result in High Forces in the Anterior Cruciate Ligament?
- 3:45 PM Bretz, Karen - Biomedical Engineering**
Analyzing Electromyography (EMG) Signal Quality of a New, Inexpensive EMG Electrode Approach Compared to Commercial EMG Systems
- 4:00 PM Gloekler, Lauren - Biomedical Engineering**
Next Steps in Designing a Helmet-Mounted Device to Provide Training Information to Cyclists: Adding Distance and Speed Information.
- 4:15 PM Mwaniki, Janice - Neurobiology, Physiology and Behavior**
Case Study of a Cholera Outbreak in the 21st Century.

6 Wellman Hall, Moderator: John Richards

- 3:00 PM Ganesh, Siddhi - Neurobiology, Physiology and Behavior**
Transportation Preferences of Patients Discharged Home from the University of California Davis Emergency Department
- 3:15 PM Kelly, Amanda - Neurobiology, Physiology and Behavior**
Methamphetamine Use and Heart Failure: Prevalence, Risk Factors, and Predictors
- 3:30 PM Rodriguez, Natanael - Psychology**
Student-Run Clinics: Preceptor Motivations
- 3:45 PM Chu, Rianna - Neurobiology, Physiology and Behavior**
Comparing the Acute Effects of Exercise and Dance on Mood
- 4:00 PM Tutuwan, Erica - Global Disease Biology**
Placenta Stem Cell Therapy for Spinal Cord Injury
- 4:15 PM Chen, Christopher - Biochemistry and Molecular Biology**
Developing Oncolytic Strategies for KSHV-Associated Malignancies

26 Wellman Hall, Moderator: Mark Winey

- 3:00 PM Nguyen, Marina - Neurobiology, Physiology and Behavior**
Poc5 is a Regulator of Centriole/Basal Body Assembly
- 3:15 PM Marfin, Mark - Neurobiology, Physiology and Behavior**
Meiotic Crossover Formation with Elevated Levels of RNF212
- 3:30 PM Gallegos, Rudolph - Genetics and Genomics**
Optimizing RAD54 Crystallization Conditions
- 3:45 PM Mallory, Benjamin - Biochemistry and Molecular Biology**
Saccharomyces cerevisiae DNA polymerase λ functions in homology-directed DNA repair in cooperation with DNA polymerase δ
- 4:00 PM Natividad, Monica Lyn - Microbiology**
Expanding Genetic Tools to Improve Tractability of the Parasite Entamoeba histolytica
- 4:15 PM Liang, Cindy - Neurobiology, Physiology and Behavior**
Investigating Whether Neuronal Integration in the Aging Brain is Governed by Extrinsic Environmental, or Intrinsic Molecular Factors

106 Wellman Hall, Moderator: Julia Chamberlain

- 3:00 PM Dominguez Aguilar, David - Chemical Physics**
Raman Scattering Investigations of Intercalation Controlled Charge Density Waves in Bi₂Se₃
- 3:15 PM Hanks, Kyle - Chemistry**
Thermal Properties of 2D Materials Measured by Probe Beam Fluctuation Due to Thermal Lensing
- 3:30 PM Lahti, Gabriella - Materials Science and Engineering**
Inside-Out Chemistry: Synthesizing Polymers in the van der Waals Gaps of Bi₂Se₃
- 3:45 PM Johnson, Virginia - Chemistry**
Solvothelmal Synthesis of Bi₂Se₃ Platelets
- 4:00 PM Scolati, Haley - Chemistry**
A Search for the Rotational Spectrum of the β -cyanovinyl Radical

119 Wellman Hall, Moderator: Melinda Livas

- 3:00 PM **Diaz, Isaac - Pharmaceutical Chemistry**
Using Fullerene CocrySTALLIZATION as a Purification Method
- 3:15 PM **Soltanzadeh Zarandi, Sina - Neurobiology, Physiology and Behavior**
The Therapeutic Potential of Ayahuasca in Treating Neuropsychiatric Disorders
- 3:30 PM **Nandakumar, Dhruv - Computer Science**
Incorporating a Socio-Scientific Issue Into the General Chemistry Curriculum to Improve Student Engagement
- 3:45 PM **Kopetzky, Jennifer - Biochemistry and Molecular Biology**
Incorporating a Socio-Scientific Issue Into the General Chemistry Curriculum to Improve Student Engagement
- 4:00 PM **Sandoval, Jose - Neurobiology, Physiology and Behavior**
Incorporating a Socio-Scientific Issue Into the General Chemistry Curriculum to Improve Student Engagement

126 Wellman Hall, Moderator: Barbara Blanco-Ulate

- 3:00 PM **Kawahara, Derek - Biotechnology**
Expression Analysis of Fruit Cell Wall Modifying Enzymes in a Non-Ripening Tomato Mutant
- 3:15 PM **Hopper, Aleshia - Biochemistry and Molecular Biology**
Direct Visualization of Fungal Invasion in Plants Through Microscopy and Staining
- 3:30 PM **Wang, Melissa - Genetics and Genomics**
Characterizing Growth of Botrytis cinerea in Soil
- 3:45 PM **Madrone, Matisse - Genetics and Genomics**
Genetic Mapping of Botrytis cinerea via Mitotic Mating
- 4:00 PM **Sanchez, Camilo - Biochemistry and Molecular Biology**
Characterization of a Black Bear Microsatellite Multiplex in California Optimized for Noninvasively Collected Samples
- 4:15 PM **Owen, Julia - Animal Biology**
Use of Noninvasive DNA to Determine Genetic Subdivisions Among Ecoregional Coyote Populations in the Sierra Nevada

202 Wellman Hall, Moderator: Bagher Modjtahedi

- 3:00 PM **Chen, Jennifer - Anthropology**
Stable Isotope Chemistry Shows that High Elevation Foragers of the Andes Mountains Primarily Ate Meat 7ka
- 3:15 PM **Hanna, Matthew - Sociology**
Suicide by Cop: A Sociological Study of Comparative Cases
- 3:30 PM **Homara, Tara - Managerial Economics**
Temporary Contracts in Madrid: Immigration and Youth Labor Force
- 3:45 PM **Lopez, Catherine - Linguistics**
How the Perception of a Learning Disability is Influenced by Generation Gaps
- 4:00 PM **Park, Wesley - Philosophy**
On Medical Ethics: A Virtue Theory Approach

212 Wellman Hall, Moderator: Aldrin Gomes

- 3:00 PM **Calaimany, Meena - Neurobiology, Physiology and Behavior**
Effect of Ibuprofen on Mouse Brain Proteasome Function.
- 3:15 PM **(WITHDRAWN) Rahgozar, Sahar - Neurobiology, Physiology and Behavior**
Proteasome Activity in Akita Mouse Liver
- 3:30 PM **Gunaseelan, Anita - Neurobiology, Physiology and Behavior**
Increasing Western Blotting Sensitivity with polyHRP
- 3:45 PM **Wallace, Samantha - Genetics and Genomics**
Fast Green FCF as an Alternative to Ponceau S for Normalization of Western Blots
- 4:00 PM **Eijansantos, Emily - Neurobiology, Physiology and Behavior**
Proteasome Function is Altered in Long-Lived Ames Dwarf Mice
- 4:15 PM **Somepalle, Sai Sahitha - Microbiology**
Effect of Ibuprofen on Mouse Kidney Protein Concentration

216 Wellman Hall, Moderator: Adam Zientek

- 3:00 PM Sorrell, Clifton - History**
The Hegemonic Institution of Violence in Slave Societies vs Societies with Slaves
- 3:15 PM Brandt, Louisa - History**
A Union of Conflicts: Tulare County in the Civil and Indian Wars, 1861-1865
- 3:30 PM Carey, Samantha - Political Science**
The Tripartite American Judiciary: The Influence of Rome's Mixed Constitution Upon the Founding Fathers
- 3:45 PM Crumrine, Casey - International Relations**
The United Nations Security Council's Responsibility to Protect: Security or Trade?
- 4:00 PM Lewandowski, Sierra - Political Science**
Distorted Democracy: How Prisons Divert Vote Power

226 Wellman Hall, Moderator: Volkmar Heinrich

- 3:00 PM Murdock, Maylin - Biotechnology**
Effects of Pro-Oxidants and Antioxidants on the Redox Signaling Pathway of Haustorium Initiation Using the Root Parasitic Plant *Triphysaria*
- 3:15 PM Kravitz, Caroline - Community and Regional Development**
The Mismanagement of Type 2 Diabetes in Low Income Communities and the Role of Policy and Infrastructure
- 3:30 PM Silva, Selena - Community and Regional Development**
Algorithms, Platforms, and Bias: An Integrative Literature Review
- 3:45 PM Kumetat, Grace - Community and Regional Development**
Market Driven Poverty Alleviation Programs in the United States: The Political Economy of the Kiva United States Program
- 4:00 PM Yasui, Osamu - Biomedical Engineering**
Enhancing Therapeutic Potential of MSC Spheroids with Perfusion
- 4:15 PM Xiao, Zhiyu - Biomedical Engineering**
Frustrated Phagocytic Spreading of Human Neutrophils on Different Densities of Surface-Immobilized IgG

229 Wellman Hall, Moderator: Mohamed Hafez

- 3:00 PM Puso, Michael - Mechanical Engineering**
Numerical Solutions of Ordinary Differential Equations
- 3:15 PM Christiersen, Blake - Mechanical Engineering**
Numerical Solutions of Partial Differential Equations with Applications in Engineering
- 3:30 PM Kaloti, Aaron - Computer Science**
debugR: A Debugging Tool for R
- 3:45 PM Ramirez Perez, Susana - Mechanical Engineering**
Designing and Manufacturing a Simplified Dynamic Model of the Lung to Investigate the Effects of Respiratory Flow on Particle Deposition

230 Wellman Hall, Moderator: Koen Van Rompay

- 3:00 PM Badra, Pablo - Global Disease Biology**
Testing the Efficacy of a Zika Vaccine in a Pregnant Rhesus Macaque Model of Congenital Zika Syndrome
- 3:15 PM Hekmat, Behnaz - Psychology**
Mitochondrial Toxicity of NRTI Therapy in HIV
- 3:30 PM Rivas Gutierrez, Victor - Animal Biology**
Genetic Investigation of Idiopathic Hypocalcemia in Thoroughbred Foals
- 3:45 PM Houston, Parker - Biochemistry and Molecular Biology**
Design of a Multiplex SNP Assay for the Detection of Five Different Arboviruses Transmitted by Aedes Mosquitoes
- 4:00 PM Robertson, Alexander - Global Disease Biology**
Using Primary Tracheal Cell Culture to Characterize the Innate Immune Response to Challenge with Infectious Bronchitis Virus in the Upper Respiratory System of Chickens

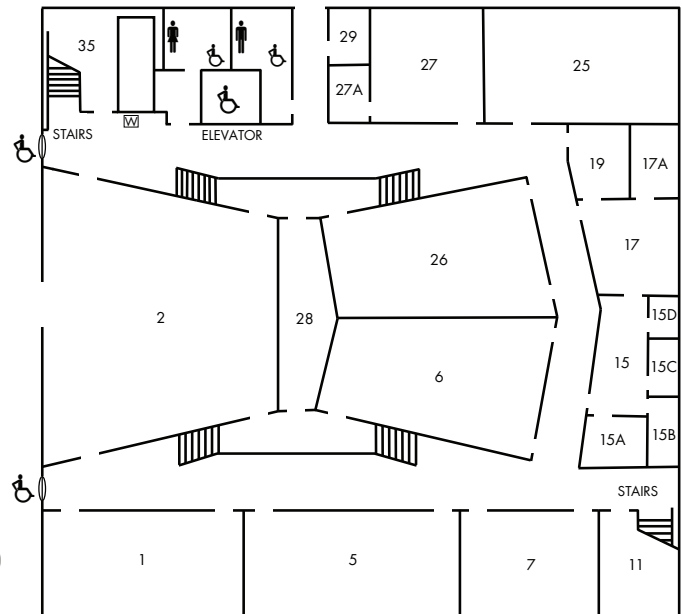
233 Wellman Hall, Moderator: Christopher Martinez

- 3:00 PM **Hwang, Yunjin - Neurobiology, Physiology and Behavior**
Relationships Between Head and Body Shapes in Scorpaeniform Fishes
- 3:00 PM **Hu, Lin-Ya - Genetics and Genomics**
Relationships Between Head and Body Shapes in Scorpaeniform Fishes
- 3:30 PM **Stajner, Anya - Marine and Coastal Science-- Marine Ecology and Organismal Biology**
Relationships Between Head Morphology and Body Depth in Labrid Fishes
- 3:30 PM **Hudson, Nikita - Environmental Toxicology**
Relationships Between Head Morphology and Body Depth in Labrid Fishes
- 3:45 PM **Nguyen, Jennifer Anne - Genetics and Genomics**
Does my Body Make my Head Look Big? Body-Head Shape Covariation in Cichlids
- 3:45 PM **Lee, Anna - Biological Sciences**
Does my Body Make my Head Look Big? Body-Head Shape Covariation in Cichlids
- 4:00 PM **Tovar, Angelly - Wildlife, Fish and Conservation Biology**
Body Shape as a Constraint on Head Diversity in Atherinomorph Fishes
- 4:00 PM **Tasmim, Tahmina - Animal Biology**
Body Shape as a Constraint on Head Diversity in Atherinomorph Fishes

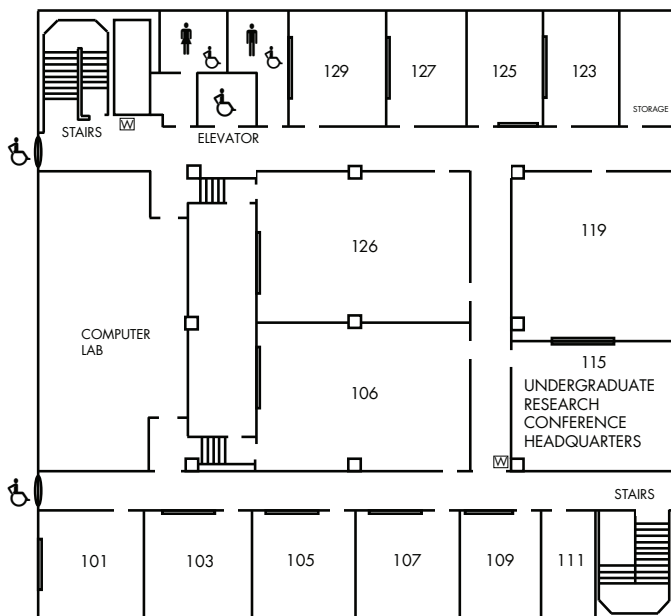
234 Wellman Hall, Moderator: Savithramma Dinesh-Kumar

- 3:00 PM **Blanc, Jennifer - Genetics and Genomics**
Detecting Local Adaptation in Gene Expression in Maize
- 3:15 PM **Bacus, Shelby - Marine and Coastal Science-- Oceans and the Earth System**
How Does Decreasing pH Affect the Anti-Predator Response in Two Species of Intertidal Snails?
- 3:30 PM **Ponek, Ronni - Biochemistry and Molecular Biology**
Investigating the Role of ATG8 Mediated Autophagy During Plant Immune Response
- 3:45 PM **Sanjaya, Nathaniel Ryan - Biotechnology**
Regulation of Plant Immunity by Phytohormones

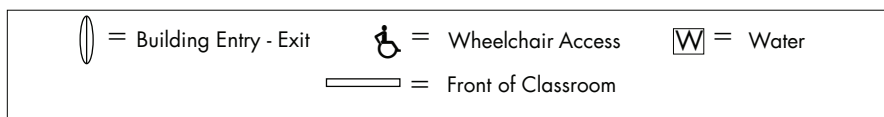
Lower Level



1st Floor



2nd Floor





ABSTRACTS

UC DAVIS

Undergraduate Research Center
Office of Undergraduate Education

Crises of the Self in Crime Fiction

Taylor Aamot

Sponsor: Mark Jerng, Ph.D.
English

Agatha Christie shattered the expectations of Crime Fiction when she revealed the narrator of *The Murder of Roger Ackroyd* to be the killer, creating one of the biggest and most controversial twists in the history of the genre. Far from being just a clever trick, this positioning of the narrative perspective to the opposing side of the detective's work allows for a close view at elements of the human experience that were critical in forming the genre: conflicts of the self and the other such as identity, egoism, and competition. To show this, I will be balancing a close reading of *The Murder of Roger Ackroyd* with a survey of if the Detective Fiction genre, as well as contextualizing Christie's representation of crime and the criminal within psychology, criminology, and philosophy. A historicization of the genre within these contexts will reveal how they codified the manner in which Crime Fiction can represent the self. *The Murder of Roger Ackroyd* explores the connections between identity, society, and crime as they are inextricably formed in relation to each other.

The Role of Core Replication Factors in Recombination-Associated DNA Synthesis During Meiosis

Michael Anthony Abala

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

Meiosis is a specialized cell division wherein diploid cells produce haploid gametes. During meiosis, recombination facilitates pairing and crossing over between homologous chromosomes, ensuring their accurate segregation. Failure to recombine can cause missegregation and aneuploidy in resulting gametes, leading to infertility, miscarriage, and congenital disease. Although meiotic recombination has been extensively studied, the intermediate steps requiring *de novo* DNA synthesis remain poorly understood. Recombination-associated DNA synthesis (RADS) is difficult to characterize *in vivo* because DNA replication factors are essential for viability. Furthermore, it is difficult to separate the DNA synthesis events of recombination from meiotic chromosome replication. We are addressing these challenges in the yeast *Saccharomyces cerevisiae* through use of the auxin-inducible degron system in highly synchronized meiotic cultures, which allows us to selectively inactivate target replication factors specifically during meiotic recombination. I aim to contribute to our mechanistic understanding of meiotic RADS by determining the roles of known replication factors. Specifically, I am examining the roles of DNA ligases, flap endonucleases, and replication fork protection complex proteins. These studies will provide novel insight into the specialized set of replication factors involved in the DNA synthesis required to form joint molecule intermediates and crossover products during meiotic recombination.

Effects of Cosmetics on the Purple Sea Urchin, *Strongylocentrotus purpuratus*

Anika Agrawal

Sponsor: Gary Cherr, Ph.D.
Environmental Toxicology

Pharmaceuticals and personal care products (PPCPs) end up in the oceans in a variety of ways. It is therefore important to investigate the effects of chemicals in cosmetics as very few studies have been conducted in this field. This study examines the toxicity of four chemicals commonly found in cosmetics—bismuth oxychloride (BiOCl), magnesium silicate (MgSiO₃), silicon dioxide nanoparticles (SiO₂), and zinc oxide-bulk (ZnO)—on embryos of the purple sea urchin, *Strongylocentrotus purpuratus*. Dose response assays for larval toxicity showed significant toxicity for SiO₂ and ZnO and no significant toxicity due to BiOCl or MgSiO₃. Chemicals were also tested in combination to mimic cosmetics. Tests showed that there was an increasing trend in larval toxicity with increasing concentration of ZnO. An actual cosmetic, MAC Honey Lust Eye Shadow™, showed no dose responsive toxicity but was significantly different from controls. Spermiotoxicity assays showed that only MgSiO₃ significantly inhibited fertilization. This study also looked at the effects of SiO₂ and ZnO as chemosensitizers on the multidrug resistance pump. It found that they significantly increase the toxicity of vinblastine. These assays prove that chemicals in cosmetics are toxic to sea urchin embryos and negatively alter their ability to fertilize.

Fluorescence Lifetime Imaging Combined with Intravascular Ultrasound for Cardiovascular Disease Characterization

Michael Agung

Sponsor: Laura Marcu, Ph.D.
Biomedical Engineering

This study evaluates the accuracy of a fluorescence lifetime imaging-intravascular ultrasound (FLIm-IVUS) bimodal imaging system in differentiating human coronary artery pathologies. Current diagnostic procedures, such as angiography, ultrasound, and optical coherence tomography (OCT) do not provide information on the artery biochemical composition. As a result, severe artery pathologies such as high-risk plaques cannot be properly detected. Without proper treatment, a high-risk plaque may rupture and lead to coronary thrombosis: clotting of the heart's blood supply. FLIm utilizes the autofluorescence properties of the tissue to analyze the different biochemical and structural information without the use of a contrast agent. Combined with IVUS, the system examines artery vessel composition and morphology to measure the progression and staging of artery pathology and early detection of disease. This project involves co-registering the FLIm-IVUS images of N=34 *ex vivo* human coronary arteries with analysis of their respective histologic sections to determine the parameters of the different artery pathologies. We aim to verify the ability of FLIm-IVUS to distinguish the different coronary artery diseases with a sensitivity and specificity of at least 90%. After FDA approval, FLIm-IVUS could be used in clinical trials to monitor the progression of artery disease and/or drug therapy.

The Role of Religiosity in Depressive Symptoms for Breast Cancer Patients

Rifa Akanda

Sponsor: Patricia Roberson, Ph.D.
Human Ecology

By 2018, there will be an estimated 266,120 women newly diagnosed with invasive breast cancer in the United States alone. About 50 percent of the women with breast cancer were diagnosed with depression and anxiety within the first year. There are several factors that may mitigate the high rate of depression. First, it is found that patients with breast cancer who report high religiosity have a significantly lower prevalence of depression. Though research has also shown that, in general, higher levels of social support can contribute to a longer lifespan, research directly showing associations between marital support when facing depression has not been studied extensively. However, it remains unclear how marital status may interact with religiosity on the number of depressive symptoms among breast cancer patients. Specifically, this present study will consider how spirituality and marital status interact to affect a number of depressive symptoms in patients that have been diagnosed with breast cancer. Results and discussion will be presented in the poster.

Is Adipocyte Viability Affected by Temperature During Lipoaspirate Centrifugation?

Shabana Akramy

Sponsor: David Sahar, M.D.
MED: Surgery

Centrifugation is utilized to concentrate adipocytes from a lipoaspirate during fat grafting, which can cause mechanical damage to the cells. Low temperatures can increase the integrity of the cell membranes and possibly reduce the resistance to mechanical force. This study aims to explore the effect of various temperatures during lipoaspirate centrifugation to the viability of adipocytes. Institutional Review Board approval was obtained prior to commencement of this study. Lipoaspirates from six healthy women were harvested and each sample was divided into three groups at different temperatures, i.e. Group 1, at 4°; Group 2 at 25°; Group 3 at 37°. Hematoxylin and eosin staining, immunofluorescence, glycerol-3-phosphate dehydrogenase (G3PDH) activity and MTS assays were utilized to evaluate function and viability. Group 1 retained fewer intact adipocytes significantly ($p < 0.05$) compared to Group 2 and 3, which did not differ significantly. The level of glycerol-3-phosphatase dehydrogenase absorbance value was significantly higher in group 2 compared to the others. There was no significant difference among three groups by MTS assay. Thus, 4° and 37° did not protect the viability or integrity of adipocytes during centrifugation. The group that underwent centrifugation at 25° had the best viability.

Taxonomic Classification of Yeast Using Amplicon Sequencing by Combining UNITE and DITSY Databases

Samir Akre

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

Internal Transcribed Spacer (ITS) sequencing is a current method for describing fungi in complex communities. A challenge in classifying yeasts from ITS sequencing is the database used for fungal classification, UNITE, does not focus on yeast taxonomy. A second database, DITSY, focuses on yeasts, but does not include enough information on non-yeasts to ensure accurate classification. This project compares the accuracy of UNITE, DITSY, and a hybrid UNITE-DITSY database at classifying ITS sequences. A mock community ITS sequences dominated by known yeasts was processed using Deblur in QIIME2, and taxonomy assigned with a Bayesian classifier trained with either UNITE, DITSY, or the hybrid database. The classifications were compared to expected frequencies in mock communities at each taxonomic level using the Bray-Curtis distance with 1 indicating poor performance and 0 indicating perfect performance. The Bray-Curtis distribution revealed that at the family level UNITE, DITSY and the hybrid database trained classifiers performed with a mean Bray-Curtis distance of 0.861, 0.878, and 0.734 respectively. The hybrid UNITE-DITSY database produced more accurate classifications of fungi in these tests, suggesting that it will be more effective than the current UNITE database when studying fungal communities expected to contain yeasts.

Maternal Depression and Mother-Infant Interactions in Mexican Origin Families

Cynthia Alvarado-Martinez

Sponsor: Leah Hibel, Ph.D.
Human Ecology

Detrimental effects of maternal depression and parenting stress on infant development have been established, however no study has focused solely on Mexican origin (MO) mothers and infants to examine the relationship between maternal depression, parenting stress, and infant sleep in this population (Bagner, Pettit, Lewinsohn, & Seeley, 2010; Gelfand, Teti, & Fox, 1992). We are assessing 25 mother-infant dyads (mothers' age = 18 to 25 years; infants' age = 6 months) from the California Babies Project. Sleep was objectively and subjectively recorded via actigraphy (MicroMotion Logger, AMI) and diary for 8 nights. Maternal depressive symptoms were assessed using the Center for Epidemiologic Studies Depression Scale (Radloff, 1977). Parenting stress was assessed using the Parental Stress Index Questionnaire (Abidin, 1990). We are currently coding sleep data. More than a quarter (28 percent) of the mothers were at-risk for clinical depression. Additionally, 28 percent of the mothers were found to be experiencing clinically significant parenting stress. Higher depressive symptoms were associated with increased parenting stress ($r = .485$, $p = .014$) and increased parental distress ($r = 0.620$, $p = 0.001$). Once sleep data are coded, future analyses will examine the relationships among maternal depression, parenting stress, and infant sleep.

Gut Microbe-Derived Microparticles for Controlling the Immune System

Kenneth Alvarez

Sponsor: Jamal Lewis, Ph.D.
Biomedical Engineering

According to the NIH, more than 23.5 million Americans are affected by an autoimmune disease, an illness that occurs when the body tissues are attacked by its own immune system (e.g. Rheumatoid Arthritis). Current treatments involve immunosuppressive medications which weaken the immune system, leaving the patient susceptible to infectious diseases. Evidently, there is a need for new drugs that can specifically block autoimmune responses, whilst leaving immunity intact. One potential candidate is Polysaccharide A (PSA), which has shown capability to induce Type 1 regulatory T-cells (Tr1s) in germ free mice. Our hypothesis is that PSA microparticles (MPs) can act as a regulatory agent and induce the activation of Tr1s by stimulating immature dendritic cells (iDC). An increase in Tr1 cells can help to curb autoreactive responses. Herein, PSA has been extracted from a gut microbe, *Bacteroides Fragilis*, and fabricated into MPs (diameter = 500 – 1000 nm), using a desolvation method. Flow cytometry data showed that CD4+ T-cells cultured with PSA-pretreated iDCs displayed the highest percentage of Tr1s, and secreted the highest level of IL-10, an anti-inflammatory cytokine. Future work will compare the efficacy of PSA microparticles with that of soluble PSA.

Improving Highway Work Zone Safety

Meysel Amaya Bautista

Sponsor: Bahram Ravani, Ph.D.
Mechanical & Aerospace Engr

Everyday highway workers risk their lives due to working in close proximity to high-speed traffic. According to the Federal Highway Administration work zone accidents statistics, annually there are approximately 84,721 crashes, 22,276 injuries, and 595 traveler and worker deaths in such accidents. The purpose of this research is to analyze traffic collisions in California highways work zones, identify contributory factors, and evaluating viable solutions that can increase workers' safety. Data from a total of 50 randomly selected accident reports from accidents in California in 2010 is used as a basis for this research. The accident reconstruction PC-Crash will be used to simulate these 50 accidents. This will allow identification of collisions factors as well as outcomes in these accidents. The use of simulation would allow changing the initial conditions such as vehicle speeds and time duration of braking as well as influence of mitigation methods like use of barriers and advisory signs on accident avoidance. The findings will be aimed at establishing possible mitigation methods that could prevent vehicles from intruding into work ones.

Exploring Student 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 TA's and the ES's, 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 TA's or ES's and how the teaching styles may vary between the two lab instructors. Student inquiries and TA/ES 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. The results will also be used to assess the overall success of the Emerging Scholars program and suggest improvements to enhance the role of ES's in the labs.

Preserving Cultural Identity Through the Collective: A Lacanian Perspective on Reconciling the Fractured Asian-American Identity

Abigail Aprejilio

Sponsor: Erika Strandjord, Ph.D.
University Writing Program

The Trump administration's exacerbation of anti-immigrant sentiment makes the understanding of immigration reform and its impact on an immigrant's fractured sense of identity more important. Asian Americans usually experience fractured identities resulting from being stereotyped as perpetual foreigners by western society. Studies of Asian-American behavior have argued that cultural dilution arises from how these minorities prioritize Asian American visibility by building a cultural collective with westerners (assimilation) or with other Asian Americans (panethnic aggregation). I intervene in this conversation by applying Lacan's theory of the "mirror stage" to three Asian-American creative nonfiction pieces: "Fish Maw and Crabmeat Soup," "Why I Write in English," and "Coffee Diplomacy." In doing so, I address how an individual reconciles their split identity by understanding their unique cultural background through its relation to the collective, a process vital to striving towards the idealized version of oneself formulated during the "mirror stage." Furthermore, a Lacanian examination of the cultural collective and its effects on an individual reveals how the visibility of collective cultural identities in the public sphere will compel western society to examine other cultures' influence on the acquisition of an idealized self, thus allowing marginalized communities to have a stronger voice.

Bilingual Education: Less Fallout from High-School Dropouts

Romae-Anne Aquino

Sponsor: Travis Baker, Ph.D.
UC Center Sacramento

In an era where multilingualism is essential to global markets, international relations, and diplomacy, it is imperative that American students reach a proficient level of bilingualism in order to further strengthen the United States as a successful competitor to other nations. By examining the effects of bilingual education in California, a state that would rank the sixth largest economy in the world, my findings demonstrate plausible success for the increase of bilingual education programs in the United States. My research examines the correlation between high school dropout rates and bilingual education in California public schools. The data show a general trend of dropout rates among English Language Learners (ELL students) decreasing. The concurrent increase in funding per pupil for ELL students over the same timeframe is a likely mechanism for the finding. Although several studies have demonstrated the effectiveness of bilingual education, my finding of exponentially rising academic success among California pupils may contribute to advancing the global competitiveness of the United States.

Exploring Material Balance Principles Through Interactive Simulations

Jenny Lyn Arabit

Sponsor: Brian Higgins, Ph.D.
Chemical Engineering

The concept of material balances is central for designing new chemical processes or analyzing existing ones. Chemical engineering students are required to take a material balances course to build a foundation for understanding all the other process engineering concepts. The objective of our research project is to create and to publish a free interactive/multimedia iBook that illustrates the key concepts of material balances. We will develop the scientific demonstrations using Wolfram Mathematica software and, by utilizing a ScreenFlow software, we will capture a voice overlay of an evolving computer screen that shows the interactive features of Wolfram demonstrations as a movie. This format, which is compatible with an HTML5 widget, is supported by Apple iBook, thus, allowing us to add sophisticated demonstrations that illustrate the principles of material balances. We are using iBook as our platform because it allows us to input widgets that can easily access the Wolfram demonstration movie that corresponds to a specific chapter. We hope to further develop the interactive book by utilizing users' feedback and collaborating with experts in the field of education. In the future, we hope to offer this textbook option to the introductory mass balance course, ECH51, at UC Davis.

Characterization of a Polymorphic Region of MSH3, a Mismatch Repair Protein Associated with Colorectal Cancer

Bianca Arao

Sponsor: Kenneth Hilt, Ph.D.
Molecular & Cellular Bio

Elevated Microsatellite Alterations at Selected Tetranucleotide repeats (EMAST) is a genetic signature associated with metastasis and recurrence in colorectal cancers. It is caused by a deficiency in MSH3, a DNA mismatch repair protein that contains a bona fide nuclear localization signal (NLS). The NLS, along with two export signals, allow for MSH3 cytosol-to-nucleus shuttling under cellular stress. The pro-inflammatory cytokine Interleukin-6 (IL-6) alters MSH3 localization, causing defects in DNA mismatch repair. Shuttling of MSH3 appears to be affected by a polymorphism near the NLS that contains a deletion of 27 base pairs ($\Delta 27bp$), which increases the cytosolic presence of MSH3, thereby increasing EMAST. Our aim is to explore how specific sequences within the $\Delta 27bp$ polymorphism affect MSH3 shuttling function. The polymorphic region has two regions, and we hypothesize they are critical in regulating the NLS function and have different roles in this regulation. By PCR mutagenesis and molecular cloning, we successfully generated reporter constructs of the peri-NLS MSH3 region expressing three different deletions. Continuing studies will examine the subcellular location of MSH3 for each construct, and evaluate it through immunofluorescence microscopy (IFM), using an MSH3-antibody in cells with and without IL-6 treatment.

The Role of the *Arabidopsis* Receptor Like Kinase, FER, in Coronatine-Mediated Plant Susceptibility

Juan Araujo

Sponsor: Maëli Melotto, Ph.D.
Plant Sciences

Plants rely on a critical network of proteins to perceive and respond to pathogen invaders. The membrane receptor-like kinase FERONIA (FER), a member of the Catharanthus roseus receptor like kinase1-like (CrRLK1L) family, regulates plant immunity by facilitating complex formation of the immune receptor kinases EF-TU RECEPTOR (EFR) and FLAGELLIN-SENSING 2 (FLS2) with their co-receptor BRASSINOSTEROID INSENSITIVE 1-ASSOCIATED KINASE1 (BAK1). This complex formation initiates immune signaling. Interestingly, we found that FER also contributes to stomatal re-opening and susceptibility to *Pseudomonas syringae* pv. tomato (Pst) DC3000 in *Arabidopsis*. Pst DC3000 produces a variety of virulence factors such as phytotoxin coronatine (COR). COR re-opens stomata, promotes bacterial growth and the spread of the disease to uninfected host tissue. Thus, we tested whether FER plays a role in coronatine-mediated plant susceptibility using the genetic mutants *fer-4*, *fer-5* and two bacterial strains Pst DC300 (COR+) and Pst DC3118 (COR-). These findings will be further discussed during the presentation.

Microencapsulation of Gram Negative Plant Beneficial Bacteria for Seed Coating Applications

Benjamin Arbaugh

Sponsor: Tina Zicari, Ph.D.
Biological & Ag Engineering

Gram negative plant beneficial bacteria have the potential to increase growth and increase yields of crops under a variety of environmental stresses. These bacteria, specifically those used for nitrogen fixation, must be cultured and transplanted to the soil near the root structure of the plant. In this study the gram-negative plant beneficial bacteria are encapsulated in cross-linked alginate microcapsules (CLAMs) via a spray drying process. The resulting powders contained up to 1×10^9 CFU of bacteria per gram of powder. The powders are then used to coat both treated and untreated seeds before storage and ultimately planting. The relative stability of the plant beneficial bacteria in the powders and coated seeds over the course of several weeks is monitored. The extent of crosslinking in the powders can be influenced by alginate type and calcium concentration in the feed suspension. The optimal formulation of the spray dried feed is selected based on bacteria survival.

Deep Learning for Simulation of Mass Spectra

Joshua Arnold

Sponsor: Oliver Fiehn, Ph.D.
Molecular & Cellular Bio

Mass spectrometry is employed to identify molecules by searching databases of experimental mass spectra. However, these databases are severely limited in size. Creating computer generated in-silico mass spectra directly from compound structures can assist in mediating this gap. We hereby describe an approach that utilizes deep learning to accurately simulate mass spectra from chemical compound descriptors. A three-layer artificial neural network (ANN) was employed on a dataset containing 453 alkanes that were randomly divided into an 80% train and 20% holdout set. Each layer used dropouts to avoid overfitting. The method was implemented in Python using the high-level machine learning library, Keras. Simulated spectra were compared to observed spectra via the cosine similarity dot product. In addition, the in-silico mass spectra were exported into MSP files for external validation against the NIST database. Our results achieved an average cosine similarity value of 94%. Furthermore, our simulated spectra were compared to the in-silico spectra generated by the CFM-ID application revealing our ANN excels at modeling the intensities of the spectra. In conclusion, our results present the successful implementation of a deep learning approach for the simulation of electron ionization mass spectra.

The Role of DNA Synthesis in Meiotic Double Strand Break Repair and Crossover Formation

Devra Asah

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

Meiosis is fundamental for sexual reproduction and is the process by which haploid gametes are produced from diploid cells. During meiosis, homologous recombination mediates crossing over to connect homologous chromosomes and ensure their accurate segregation. Failure to recombine and accurately segregate chromosomes can cause aneuploidy in gametes. Meiotic recombination initiates upon formation of DNA double strand breaks. Despite being extensively studied, the intermediate steps of meiotic recombination that require new 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 tools in the yeast *Saccharomyces cerevisiae* to inactivate essential DNA replication factors at will during targeted stages of meiotic recombination in synchronized yeast cultures. We aim to delineate the steps of RADS by inhibiting the DNA polymerase processivity factor PCNA, thus suppressing DNA synthesis. We are extending these findings to examine whether late rounds of DNA synthesis are required after strand invasion to complete gap filling in joint molecule formation. These studies provide the first glimpses of the mechanism of meiotic RADS in vivo.

Natural Product Inhibition of SIRT1 on Muscle Hypertrophy

Sonia Athalye

Sponsor: Keith Baar, Ph.D.
Neuro Physio & Behavior

Sirtuin1 (SIRT1) is an enzyme activated in response to cellular energy stress. Metabolic stress during calorie restriction, endurance exercise, or aging, directly activate SIRT1 inhibiting muscle growth. This project aims to determine whether natural SIRT1 inhibitors can increase overload-induced muscle hypertrophy. The hypothesis was that we can identify a combination and concentration of three SIRT1 inhibitors that maximizes muscle growth. The plantaris muscle of rats underwent functional overload, where the gastrocnemius and soleus muscle were removed. Each rat was orally gavaged daily with one combination and concentration of each inhibitor using a design of experiments (DOE) methodology. The amount of each reagent in the mixture was determined using by applying a Box-Behnken incomplete multifactorial design, which resulted in 16 different combinations and concentrations of SIRT1 inhibitors and 3 midpoint controls. The PLN muscles were collected on day 14 and muscle mass (in mg) and fiber cross-sectional area (CSA; in mm^2 determined histologically) were determined. DOE analysis of the PLN mass resulted in a significant model ($p = 0.0011$). We are currently determining the CSA of the muscle and will then validate the model to establish the concentration and combination of each compound needed to maximize muscle growth.

Observing Effects of the Cytoglobin Gene on Retinal Development in Mice

Ingrid Au

Sponsor: Ala Moshiri, M.D., Ph.D.

MED: Ophthalmology

UCD's Mouse Biology Program (MBP) knocks out targeted genes in mice to determine for what functions those genes are required in mammalian physiology. One of the knocked out genes is Cytoglobin, which when deleted causes retinal degeneration. This paper looks at the specific role of Cytoglobin on retinal survival and physiology. All mice from the MBP have the RD8 mutation, which causes slow retinal degeneration over the first year of life. When Cytoglobin is removed from these mice, the degeneration process hastens. By comparing Cytoglobin knockout mice to controls with RD8 alone, we can measure the pace of retinal cell death in both groups. The severity and pattern of retinal degeneration can be observed by staining and imaging sections of the eye. Eye samples were extracted from mice at various postnatal ages to compare retinal disease progression in mice with and without Cytoglobin. Electroretinography (ERG) was used to measure retinal function in both groups. Mice lacking Cytoglobin exhibited increased apoptosis of retinal cells and decreased retinal function when compared with controls. Although the exact mechanism is unknown, Cytoglobin is required for retinal homeostasis. By understanding how Cytoglobin works, it may result in therapeutic strategies for retinal diseases affecting human populations.

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. 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, we hypothesize that BRM plays a role in healthy aging in animals. To test our hypothesis, we will subject *Drosophila* brm mutants to several aging assays that will measure the accumulation of aging biomarkers, such as circular RNAs, poly-ubiquitinated proteins, and protein carbonyls, and monitor physical characteristics using the Rapid Iterative Negative Geotaxis (RING) assay and *Drosophila* Activity Monitoring System (DAMS). We expect that brm mutants will display premature aging compared to wild-type controls. Therefore, by enhancing the function of brm, we may be able to increase healthspan in animals. Knowing that BRM has such an influential role in aging, coupled with the knowledge that light modulates clock- and BRM-dependent chromatin rhythms, could reveal more about the deleterious effects of unnatural light at night, which is a pervasive phenomenon in modern day societies.

Synthesis and Characterization of Psychoplastogen Analogs

Arya Azinfar

Sponsor: David Olson, Ph.D.

Chemistry

Currently approved therapeutics for treating depression and other neuropsychiatric diseases take weeks to months before showing any efficacy, and even then, about a third of patients will not respond to them. Fortunately, there are several promising experimental therapeutics that are fast-acting and work in treatment-resistant populations. These molecules are believed to work by promoting neural plasticity in the prefrontal cortex and include dimethyltryptamine- and amphetamine-containing psychedelics. Unfortunately, these compounds suffer from negative side effects such as hallucinations, anorexia, and potential for abuse. Our goal is to decouple the beneficial plasticity-promoting properties of these compounds from their undesired side effects. To accomplish this, we are taking advantage of their stereochemistry by designing, synthesizing, and evaluating a variety of levoamphetamine analogs. As the levo isomer of amphetamine is known to have fewer side effects than the dextro isomer, we anticipate identifying novel, and safer therapeutics for promoting plasticity and treating neuropsychiatric disorders.

How Does Decreasing pH Affect the Anti-Predator Response in Two Species of Intertidal Snails?

Shelby Bacus

Sponsor: Brian Gaylord, Ph.D.

Evolution & Ecology

Predator-prey interactions are often complex and seemingly small disruptions in the system can have large consequences. As anthropogenic CO₂ emissions continue to increase and the ocean acidifies in a process called ocean acidification, many marine organisms are documented showing maladaptive behavioral responses. This paper studies the effect of decreasing pH on the response of two important intertidal snails, *T. funebris* and *T. brunnea*, when exposed to predator-conditioned water. Both species live at different heights in the intertidal and are exposed to distinctly different pH conditions. Five discrete pH levels were assessed in this experiment ranging from 7.7-6.5. The results demonstrate that *T. funebris* and *T. brunnea* both exhibit a degraded anti-predator response at low pH, and that their responses do not significantly vary between species. This study suggests that *T. brunnea* is more tolerant to low pH conditions than previously predicted, and that both species are at risk in a projected acidified ocean.

Functional Characterization of Epilepsy-Associated *KCNB1* in Zebrafish

Maram Bader

Sponsor: Megan Dennis, Ph.D.
MED: Biochem & Molecular Med

Epilepsy, the fourth most common neurological disorder in the United States, currently has no effective treatment. Our research focuses on using zebrafish as a model organism to characterize a gene mutation that has been recently found in cases of children with epileptic encephalopathy, *KCNB1*. The gene encodes for voltage gated potassium channel Kv2.1, an important regulator of neuronal excitability and neurotransmitter release. Using CRISPR/Cas9 gene editing, our group generated a zebrafish line null for its ortholog *kcnb1*. Through Illumina sequencing, we identified our mutant allele as a 23-bp deletion of exon 1 of *kcnb1*. To understand the impact of this putative loss-of-function allele on fish survival, we genotyped the offspring of two heterozygous parents ages 2, 5, and 40 dpf. From this, we found no correlation between genotype and mortality rates. In addition, we are currently performing behavioral assays to identify epileptic phenotypes via video motion tracking and hypothesize that mutant fish will exhibit behavior indicative of seizures, as shown in a mouse *Kcnb1* knockout model. The results of this study will allow us to identify phenotypic alterations of *kcnb1* mutation in zebrafish and identify drugs that could be used to reverse the epileptic phenotype.

Testing the Efficacy of a Zika Vaccine in a Pregnant Rhesus Macaque Model of Congenital Zika Syndrome

Pablo Badra

Sponsor: Koen Van Rompay, D.V.M., Ph.D.
Primate Center

Following the 2015-2016 Zika Virus (ZIKV) outbreak, thousands of infants suffering from congenital Zika syndrome have been born, including many with microcephaly. Although the prevalence of ZIKV in the Americas has decreased since 2016, the development of a vaccine which prevents harm to fetuses and newborns still remains important, as the virus is endemic to equatorial regions and will likely see a resurgence. Rhesus macaques are a relevant animal model of ZIKV infection to test vaccines. This project assessed the efficacy of a ZIKV DNA vaccine in pregnant macaques. Twenty-three pregnant animals, including 11 previously vaccinated animals and 12 unvaccinated controls, were exposed repeatedly to ZIKV. At the end of the pregnancy, extensive measurements and tissue samples were collected from mothers and fetuses. Our preliminary data show the vaccine effectively induced antibodies and lowered the amount of virus in the blood of the mothers. Vaccinated animals displayed significantly higher placenta weights than unvaccinated animals, and their pregnancies resulted in fewer fetal losses. Further laboratory and statistical analysis of samples is currently in progress to assess whether the vaccine protected the fetuses against infection. The data generated in this study will guide clinical trials of the vaccine in humans.

Characterization of Ovarian Stem Cells (OSCs) by Expression of Germ Cell Marker Proteins

Sarina Baker

Sponsor: Anna Denicol, D.V.M., Ph.D.
Animal Science

The idea that female mammals are born with a finite population of germ cells in their ovaries was recently challenged by the identification of progenitor cells of the germ lineage (ovarian stem cells - OSCs) in the ovaries of adult mice, rats, primates and humans. This project aims at evaluating whether cells isolated from adult bovine ovaries express markers of the germ cell lineage. Isolation of OSCs was accomplished using flow cytometry based on expression of Dead-box helicase 4 (DDX4) protein. Cells were propagated for several passages and harvested for immunostaining. We are using non-confocal and confocal fluorescence microscopy and testing different immunostaining conditions to evaluate expression of DDX4 and DAZL (deleted in azoospermia-like protein), another marker of germ cells, and to test whether OSCs express DDX4 in the plasma membrane, a feature that distinguishes the OSCs from oocytes (where DDX4 protein is localized to the cell cytoplasm). Preliminary results indicate that cells isolated from bovine ovaries can be propagated in vitro and express the germ cell marker proteins DAZL and DDX4. This research is important to the cattle industry; moreover, bovine OSCs could serve as a valuable model for the study of female gametogenesis and human fertility.

Boys Will Be Boys: Temperament and Attachment in the Apocryphal Childhood of Jesus Christ

Gabrielle Banathy

Sponsor: Naomi Janowitz, Ph.D.
Religious Studies

Jesus Christ is objectively one of the most recognizable names and characters in history. This paper looks to explore the lesser known available evidence of Jesus Christ's early childhood to analyze characteristics congruent with modern theories of childhood psychological development. The main source of Jesus' early childhood available today is the Infancy Gospel of Thomas found in the Biblical Apocrypha, a section of books named after the Greek work for "hidden" that is not included in the Hebrew canon but is placed between the Old and New Testaments in the Septuagint and the Vulgate. This current study looks to consider this record of the developmental years of Jesus Christ as a psychological case study in an attempt to apply modern analytical tools such as the Stages and Theories of Attachment from John Bowlby and Mary Ainsworth as well as Temperament and Personality Scales from Alexander Thomas and Stella Chess. These findings are then compared to the Hebrew canonical record of Jesus Christ in the Gospel of Luke to see how well the two texts align in presenting the character of Jesus as well as if the record of his adult behavior matches the predictions of attachment and behavior theories.

Exploring Student Interactions with Graduate and Undergraduate TAs in Chemistry Laboratories

William Barnedo

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 TA's and the ES's, 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 TA's or ES's and how the teaching styles may vary between the two lab instructors. Student inquiries and TA/ES 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. The results will also be used to assess the overall success of the Emerging Scholars program and suggest improvements to enhance the role of ES's in the labs.

Recruitment-Based Approaches to Epigenetic Editing of *HER2*

Sofie Bates

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

Epigenetic marks are capable of regulating gene expression. CRISPR-Cas9 uses guide RNAs (gRNAs) that base pair with DNA sequences to recruit Cas9 to a target locus. Many studies have fused complexes of catalytically inactive dCas9 to epigenetic effector domains (EDs) and have shown that dCas9-ED/gRNA complexes are capable of depositing epigenetic marks at specific genomic loci either transiently or persistently. This study aims to deposit repressive epigenetic marks at the *HER2* target locus, which is overexpressed in ~25% of breast cancers and is thus a good target for epigenetic repression. This study will use recruitment-based approaches to recruit repressive EDs—KRAB, Ezh2, and DNMT3A/3L—to the *HER2* locus. These EDs will be recruited via two approaches: MS2-MCP RNA-protein interactions and the SunTag system. Interactions between MS2 RNA loops in gRNAs and MCP proteins fused to EDs will recruit these EDs to a dCas9 protein bound at *HER2*. The SunTag system relies on complementarity of antibody binding sites and antibodies in order to recruit EDs to a dCas9 protein bound at *HER2*. This recruitment will allow EDs to deposit repressive marks at *HER2* and decrease expression. Success of epigenetic editing will be determined by assessing transcription levels of *HER2* using RT-qPCR.

Role of Leaf Trait Plasticity in Local Adaptation of a Native California Wildflower

Helena Bayat

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

Leaf size, shape, and area indicate functional differences in plants, and therefore their ability to survive and reproduce. In a widely dispersed species such as native wildflower *S. tortuosus*, differences in leaf morphology across subpopulations, known as ecotypes, indicate functional differences that may follow an elevational or latitudinal cline. The environment and climate affect functional traits like leaf morphology, but these influences may be offset by genetic plasticity. This study quantitatively analyzed differences in leaf morphology of fourteen ecotypes using imaging software to measure area, length, and width parameters. The leaves were harvested from greenhouse grown plants and corresponding sites in the field to gauge the influence of environmental effects and plasticity on leaf morphology. Statistical analysis will be performed to determine whether significant differences in size parameters and leaf mass per area exist, across ecotypes and between greenhouse and field leaves. The results will clarify whether differences follow an elevational cline and to what extent they are due to genetics or environmental conditions. These findings will support research to determine how different ecotypes might respond to future changes in climate.

Determining the Role of Rad51 Paralogs in DNA Repair

Jeffrey Bellinder

Sponsor: Wolf Heyer, Ph.D.
Microbiology & Molec Genetics

A variety of exogenous and endogenous threats such as radiation or genotoxic chemicals frequently threaten the integrity of our genomes by causing double-stranded DNA breaks (DSB). To repair DSBs, cells utilize a heavily regulated pathway called homologous recombination (HR). Central to this pathway is Rad51, as well as a group of proteins that is collectively known as the Rad51 paralogs. In yeast, the Rad51 paralogs are comprised of Psy3, Csm2, Rad55, and Rad57. These proteins, along with their human variants, are indispensable for the HR pathway. Gene knockouts of the Rad51 paralogs have been shown to lead to embryonic lethality in mice and increased cancer disposition in humans. Despite a clear link between the Rad51 paralogs and cancer disposition, their exact functions and mechanisms remain unclear. Within Psy3, Rad55, and Rad57 are highly-conserved ATP binding regions, known as Walker motifs. Mutations in these regions lead to decreased viability in yeast when exposed to methyl methanesulfonate, a DNA damaging agent. Our studies reveal decreased protein levels in yeast strains harboring Walker motif mutations, possibly due to protein misfolding. With a better understanding of Rad51 paralog function, future research will have a better foundation to combat human cancer and disease.

Mortality and Complication Rates in Injured Adults Receiving TXA

Simranjeet Benipal

Sponsor: Daniel Nishijima, M.D.

MED: Emergency Medicine

Hemorrhage, also known as bleeding, is the primary cause of death in the first 24 hours after trauma and is responsible for 40% of all trauma related deaths. The CRASH-2 trial, a multicenter, pragmatic, randomized controlled trial, demonstrated a reduction of mortality with tranexamic acid (TXA) compared to placebo in adults with hemorrhagic injuries (14.5% vs. 16.0% respectively). However, the CRASH-2 trial was conducted in primarily developing countries where transfusion practices and identification of adverse events may differ compared to developed countries. Our objective was to evaluate mortality and complication rates in studies reported after the CRASH-2 trial. We will systematically review prior literature using PubMed, Embase and MicroMedex databases, and retrospectively collect background data at the UC Davis Medical Center Emergency Department for characteristics and outcomes in adults with trauma who have received TXA. Further work evaluates mortality, thrombotic complications (blood clots), and other adverse events in this population.

Mount Saint Helens : Modeling Thermal Constrains on the Subsurface Magma Prior to the 1980 Eruption

William Bennett

Sponsor: Kari Cooper, Ph.D.

Earth And Planetary Sciences

The temperature at which a magma is stored before eruption is a critical variable controlling the physical properties of magma bodies and therefore how easy it is for them to erupt. A major outstanding question in volcanology is how long hot, mobile magma bodies are present in the subsurface before eruption, with estimates ranging from weeks to hundreds of thousands of years. A greater comprehension of magmatic thermal histories can lead to more accurate assessments regarding future volcanic hazards. We are studying the thermal history of magma erupted during the Mount Saint Helens (MSH) 1980 eruption. Mineral grains erupted in 1980 have variations in chemical composition which indicate growth in disequilibrium. Over time, the different zones within a crystal will equilibrate via diffusion of trace elements. The diffusion rate across the crystal is strongly controlled by the temperatures at which the crystal is stored. The degree of equilibration can therefore be used to constrain subsurface temperatures. We use electron microprobe data in conjunction with computer modeling to model the amount of time crystals from the MSH eruption spent in a hot and mobile state prior to eruption. Preliminary results suggest residence of decades to millennia in an easily mobilized state.

Exploring Changes in College Students' Self-Efficacy with the Integration of a Socio-Scientific Phosphate Module into General Chemistry Curriculum

Ashley Mae Bernardo

Sponsor: Ozcan Gulacar, Ph.D.

Chemistry

Chemistry may seem irrelevant to the college chemistry student, and this can affect their desire to learn or their ability to apply their learning to real-world situations. Most course content is taught abstractly so it can be challenging for students to see the value of chemistry in their everyday lives. This study investigates changes in students' self-efficacy by incorporating a socio-scientific problem into the general chemistry curriculum. The students explore the issue of phosphates as a limited resource with a digital Prezi presentation module. The module teaches the students the chemical properties of phosphate, its uses, and waste management strategies that can help preserve this limited resource. The students will take a pre- and a post-test to determine the effectiveness of the module with statistical tests. In addition, students' perceptions on their own willingness and capacity to learn chemistry will be collected through a questionnaire. NVivo, a qualitative analysis program, will be utilized to analyze the questionnaire data. This study provides insight for chemistry educators on how they can introduce socio-scientific problems into their curriculum, making the subject more relevant to students and changing the way they perceive their own abilities to learn the material.

Characterizing the Sesquiterpene Synthase Family of *Setaria italica*

David Berrios

Sponsor: Philipp Zerbe, Ph.D.

Plant Biology

Foxtail millet (*Setaria italica*) is an important crop in East Asia and Africa for its nutritional value and use as fodder feed. *S. italica* is also an emerging model system to study mechanisms underlying stress tolerance in related biofuel grasses like switchgrass (*Panicum virgatum*). In related crops, sesquiterpene metabolites have been shown as key mediators in the plant's response to pests, pathogens, and environmental stressors. To understand the role of sesquiterpene metabolism in stress tolerance in *S. italica*, I investigated its sesquiterpene synthase family. *S. italica* sesquiterpene synthase candidate genes were synthesized and biochemically characterized using *Agrobacterium*-mediated co-expression assays in tobacco (*Nicotiana benthamiana*). We identified eleven functional sesquiterpene synthases. I am currently cloning these sesquiterpene synthases into *E. coli* expression vectors for large-scale production and structural analysis of the purified enzyme products. Due to the lack of authentic GC-MS standards available, the sesquiterpene products will be structurally elucidated by nuclear magnetic resonance (NMR) analysis. NMR data collected will be compared to published spectra or analyzed *de novo* to identify the sesquiterpene products. Ultimately we aim to discover novel sesquiterpenes and use plant-stress studies to determine the role of these metabolites in the plant's stress response.

Effects of Bifenthrin on Susceptibility of Japanese Medaka (*Oryzias latipes*) to *Edwardsiella piscicida*

Elizabeth Berry

Sponsor: Swee Teh, Ph.D.
VM: Anat Physio & Cell Biology

The substantial application of pesticides in Northern California's agricultural industry generates considerable ecological concerns due to runoff, which exposes non-target organisms, such as fish and other aquatic organisms, to potentially harmful pesticides. Pesticides can increase the production of reactive oxygen species in fish, leading to oxidative damage, which can have indirect and direct effects such as neurotoxicity, cancer, birth defects, organ damage, and suppression of the immune system. Therefore, I wanted to test if fish exposed to a pesticide that causes oxidative stress, would be more susceptible to infectious pathogens. The model organism Japanese Medaka (*Oryzias latipes*) will be used to examine whether exposure to the pesticide bifenthrin enhances the mortality induced by the bacteria *Edwardsiella piscicida*. The preliminary results show, sub-lethal doses of bifenthrin inhibited the activity of several enzymatic antioxidants. I am currently performing the subsequent test to determine if the bifenthrin-exposed fish subsequently exposed to *Edwardsiella piscicida* will result in increased mortality. I will present the results of this test at the conference as well as discuss the ecological impacts of pesticides on non-target organisms.

UC Davis Student-Run Clinics: Improving Patient Care to an Underserved Community

Julia Betchart

Sponsor: Lorena Garcia, Ph.D.
MED: Public Health Sciences

UC Davis is unique in that it is home to the most student-run clinics (SRCs) of any institution in the country. These clinics, which are primarily managed by undergraduate student volunteers, provide culturally-sensitive primary care to uninsured and underserved communities in Sacramento. Currently, there is limited information concerning patient demographics at each of the SRCs. The purpose of our study was to identify patient needs and demographic data to improve healthcare practices and foster interclinic collaboration. From 2014-2015, we administered over 1000 surveys to patients during clinic hours, using an 18-question survey that collected patient feedback and demographic information. Drawing from these responses, in addition to interviews with SRC leaders, has allowed our team to establish relationships between social and economic factors influencing an individual's experience within the healthcare system. We aim to use our research to identify SRC strengths and deficiencies to best tailor patient care within target populations.

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 witnessing massive growth in pistachio that necessitates increased resource diversion. Rising demand coupled with soil salinization and temperature increase caused by climate change requires that crop improvement match its expansion. With this research project we aim to understand at the cellular and structural level the root adaptability of the UCB-1 rootstock in response to salinity stress. We are currently utilizing confocal microscopy combined with chemical staining to map sodium sequestration and identify root structural differences under salinity stress. We identified increased deposition of Suberin and Lignin at the root endodermis of salt stressed plants. The endodermis compartmentalizes the root and allows control of nutrient transport from the soil to the vasculature, as well as preventing backflow of nutrients from the stele thereby fine-tuning nutrient acquisition. The changes hold true for at least one of the UCB-1 parental lines, P. integerrima under salinity stress. Further identification of the trait in the parental line, P. atlantica, can provide a basis to identify the genetic component for this trait. Given that UCB-1 is the most popular grown rootstock, insights gained will aid in the development of better agricultural practices under biotic and abiotic stress conditions.

College Students' Perception of Social Mobility in American Higher Education

Jee Young Bhan

Sponsor: Jacob Hibbel, Ph.D.
Sociology

College degree attainment provides a vehicle for upward social and economic mobility. However, students' college experiences, including interactions with faculty and peers, can change their aspirations and expectations and potentially impact students' likelihood of social mobility following college completion. This research uses surveys and in-depth interviews with degree-seeking, first-year, international and non-international students to examine: 1) changes in college students' perception of their expected post-college social mobility over the course of their first quarter of college enrollment, 2) specific experiences with the institution, faculty, and peers that may have influenced those changes in students' post-college mobility expectations, and 3) the potential role of students' migration experiences prior to college in shaping their expected future mobility trajectories. Findings from this study will both inform our understanding of American higher education's role in social and economic mobility as well as provide information to help higher education professionals foster rather than diminish students' aspirations.

How Significant is Psychology in User Interface/User Experience Profession?

Nandini Bhandari

Sponsor: Barbara Molloy, M.F.A.
Design Program

User Interface/User Experience is a critical part of web design and mobile based applications such as Facebook, YouTube etc. It is a community of people interested in making applications more interactive and user-friendly. In order to make apps more user-friendly, UI/UX designers need to understand the importance of psychology in their profession. Psychology plays a significant role for UI/UX designers, as it is people for whom they design. Studying more about the human cognitive thought process can enable designers to produce better designs for a better world. To understand the importance of human behavior, the designer should understand the thought process used behind each UI/UX rule before applying it. Currently, I am researching which principles/methods of psychology are involved and how each principle relates in making user interactive applications. During my research, I have found Gestalt's principals such as proximity, similarity, continuity, symmetry, figure-ground are some of the most important principles used in comprehending human behavior. This concludes that including psychology as a part of UI/UX curriculum would help the designer in designing better user interactive applications.

3D Modelling of Objects for Studying Different Features Not Clearly Depicted in 2D Images

Yash Bhartia

Sponsor: Steven Knapp, Ph.D.
Plant Sciences

Morphometric parameters, such as volume, surface area, and shape, have a great significance in many fields of study, including human anatomy, archaeology, and whole plant architecture, which have relied on advances in laser scanning and computer vision techniques to generate accurate 3D models for study. The study of fruit morphology is critically behind in the adoption of these modern techniques. However, the high cost of 3D scanning equipment and the low throughput of data acquisition posits a serious dilemma for imaging 100s to 1000s of objects in a reasonable amount of time. Our work focuses on the rapid acquisition of 2D images using digital cameras from multiple views and using this information to reconstruct 3D models. This method of image acquisition is faster and much less expensive than scanning technologies. The software that we are developing currently recreates 3D models through the discovery of local keypoints, using the Scale-Invariant Features Transform (SIFT) algorithm, and employing those key features to determine the relative orientation of the camera in the subsequent frame. We then interpolate a mesh surface model which we use to estimate volume, surface area, and several other morphometric parameters.

Improving Memory Through Mindfulness Practice

Aditi Bhatnagar

Sponsor: Andrew Yonelinas, Ph.D.
Psychology

Mindfulness practice has been shown to be beneficial to overall health and cognition, but the effects on working memory and false memories remain controversial. Although there is some indirect evidence that mindfulness training improves working memory and decreases the propensity for false memories, other studies have reported contradictory results. As the mindfulness research on working memory and false memory has thus far been reported in separate studies, the current study investigates the effects of short mindfulness exercises on these memory processes together. Participants were tested on their working memory ability and their propensity for false memory before and after a short, guided mindfulness audio recording. For testing working memory, the backward digit span and color wheel tasks were used whereas the Deese-Roediger-McDermott Paradigm was used for evaluating false memory. We hypothesize that participants will show an increase in their working memory after the exercise, but their likelihood of recalling false memories will remain unchanged.

Study of Radiation Hard Dielectric Materials for the High Luminosity LHC

Derikka Bisi

Sponsor: Sudhindra Tripathi, Ph.D.
Physics

The Large Hadron Collider (LHC) in CERN, Geneva, Switzerland, will soon undergo an upgrade to increase its luminosity. In order for the next generation of particle tracking detectors to function in this high radiation environment, a suitable dielectric material will be needed to provide electrical isolation between the silicon detectors and readout electronic chips. Electrical isolation is necessary to prevent unwanted electrostatic discharge. An ideal dielectric candidate should have good radiation hardness in order to withstand radiation damage in the LHC, high resistivity to provide electrical isolation, a high breakdown voltage to lower the chance of electrostatic discharge occurring, a low dielectric constant, and easy-processing properties for convenient application to semiconductor chips. Dummy assemblies were built and experimentally tested with the dielectric materials that fit the above criteria after surviving exposure to various levels of radiation. Details of the testing apparatus, measurement sequences, and radiation exposures will be presented along with some preliminary results on a set of materials.

Detecting Local Adaptation in Gene Expression in Maize

Jennifer Blanc

Sponsor: Graham Coop, Ph.D.
Evolution & Ecology

Gene expression is not only a source of trait variation that affects fitness, but also important in local adaptation. Two main evolutionary forces, genetic drift and natural selection, govern the variation in gene expression levels across populations. Traditionally our ability to detect selection on expression levels has been biased towards studying single loci with large phenotypic effect sizes. The advancement of high-throughput genomic studies has allowed us to better detect selection on a large number of transcripts, each exhibiting a small phenotypic effect. Here we adapt a Qst/Fst framework to compare gene expression levels of 37,000 genes across 263 Maize lines. By comparing within population variance to among population variance we aim to identify genes whose expression levels are under selection. Our data set allows us to compare the number and types of selected genes across a wide range of Maize populations as well as across different tissue types within these populations. Due to its history of intense selective breeding and domestication, Maize evolution has long been of interest to researchers and our study provides insight into the role selection on gene expression has played in local adaptation of Maize.

Investigating the Effect of Neighborhood Context in Predicting Native Bee Visitation to Wildflowers

Katherine Borchardt

Sponsor: Neal Williams, Ph.D.
Entomology/Nematology

Historically, scientists have most often predicted species interactions only considering the traits of the involved organisms. For example in pollination it has been tested that pollinator visitation depends on the floral resources and traits of a particular plant. However, recent studies have begun to recognize the effect of neighboring floral and pollinator community on bee visitation to a focal plant. For example, bees that visit multiple plant species (generalists) prefer plants whose neighborhoods are also attractive. Using data from a grid-like experimental design of native wildflower plots, I created models to test the effect of focal plant and neighborhood variables on generalist and specialist native bee visitation to the focal plant: (1) focal plant resources, (2) neighboring plant resources, (3) native bee visitation to neighboring plants, and (4) the foraging styles of native bees visiting neighboring plants (generalist, focal specialist, or non-focal specialist). Neighborhood context appears to influence generalist-foraging bees, but not specialist-foraging bees. Generalist-foraging bees were significantly influenced by bee visitation to neighboring plants possibly from competition or common foraging patterns. Using this information, scientists researching how to attract native bees can alter the plant species composition to attract specific specialist or generalist bees for restoration or pollination services.

Distinct Molecular Mechanisms of Lipotoxic Damage to Brain Hippocampus Microvasculature in Low-Density Lipoprotein Receptor Knock Out Male and Female Mice Models

Ryan Borden

Sponsor: Amparo Villablanca, M.D.
MED: Div Of Internal Med

Alzheimer's disease (AD) is the most common form of dementia, making up 80% of the cases. Altered neurogenesis of hippocampal neurons is an important early event in AD, causing the brain to be more susceptible to cerebrovascular injury. Hyperlipidemia causes cerebrovascular injury, which likely contributes to AD pathogenesis. Very little is known about the mechanisms of lipotoxic damage to brain microvasculature in males, and no studies have been done on females. Women have higher risk of AD than men. Using hyperlipidemic male and female low-density lipoprotein receptor knock out (LDLR KO) mice, we showed that hyperlipidemic stress and western diet causes up-regulated activating transcription factor 3 (ATF3)-dependent inflammatory, oxidative stress, vascular inflammation and apoptotic pathways specifically in hippocampus brain microvessels of males but interestingly not in females. Hence in order to study the molecular mechanism of lipid-induced cerebrovascular injury in female hippocampus microvessels, we did microarray analysis and showed that among 34,472 genes, 3369 genes were differentially expressed (DE) between the different diet and genotype groups. We categorized the top 20 DE genes from these groups and found that most were epigenetic genes.

Role of River Topography in Controlling Erosion and Deposition

Darcy Bostic

Sponsor: Gregory Pasternack, Ph.D.
Land Air & Water Resources

In mountain rivers there are reciprocal interactions between river topography, or the shape of the land under the river, and water flow conditions such as velocity and depth. The relationships between natural mechanisms that cause channel change are not well understood, but are important because of their impact on sediment transport and deposition, river management and fish habitat. This research examines linkages between the distribution of geomorphic landforms and observed spatial patterns of erosion and deposition in a gravel/cobble river. The study has two data inputs acquired from a 37.1 km section of the lower Yuba River in California: a map of river landforms in 2008 at each of 5 discharges and a map of how the river has changed in two periods of time, 1999-2008 and 2008-2014. Given the two inputs, the method for data analysis involved comparing the percent of river change that occurred in a landform to the percent of area of that landform. Clear differences were observed in the degree of control that the landforms had on erosion and deposition between different landforms in the same study period and the same landforms over both periods.

Adult Speech Variability Between Infants and Adults

Maya Bowen

Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Adults tend to speak differently to infants than to other adults; for example, they exaggerate some speech sounds and their pitch patterns when communicating with infants. The current study further explores this phenomenon by investigating whether parents hyperarticulate, meaning how they exaggerate sounds in speech. We are examining how parents produce “t” sounds that occur within words because these change significantly between hyperarticulated and casual speech (e.g. “boddle” for “bottle”). We are also examining productions of “t” at the ends of words (e.g., hyperarticulated “hat” as “hat-tuh”, with a slight burst). Parents engage in a task with their infant and another task with an experimenter. The sessions are recorded and later analyzed for the target words. We expect hyperarticulation may highlight important elements and possibly function as a language teaching tool. Our preliminary data with 7 parents support that parents hyperarticulate more and show greater pitch variation when talking to infants than adults.

The Role of Law in Climate Change

Tatiana Boyle

Sponsor: Tracy Winsor, J.D.
Environmental Science & Policy

In this report, I have put together a written collection of the historical events, lawsuits, and policy shifts that have contributed to society's knowledge about climate change and to climate change itself. I have analyzed how shifts in law have affected how we as a society respond to environmental degradation caused by human activity, and what steps we still need to take as a society to help prevent increased negative effects on our environment. In today's political climate, the role of law in climate change is an ever-changing and relevant topic, which is the reason I have chosen it as the focus of my research. I have put together a comprehensive progression of the history of climate change becoming public knowledge, subsequent actions taken from this understanding, and where we are today in regards to this problem. My aim is to detail the effects of these law developments in climate change and our understanding of the topic.

A Union of Conflicts: Tulare County in the Civil and Indian Wars, 1861-1865

Louisa Brandt

Sponsor: Rachel St John, Ph.D.
History

The words "California" and "Civil War" rarely are raised as a single topic in either western Americana studies or Civil War history courses. While it is true that there were no battles fought as far west, California's loyalty was not secure as its white citizens, who continued to arrive since discovery of gold in 1848, brought their sectional attitudes towards the issues of slavery and state's rights. My paper considers Tulare County, located in the San Joaquin Valley, with its county seat of Visalia, because of its high concentration of immigrants from states which joined the Confederacy, and the dramatic confrontations with those from Northern states; these events were so concerning that a US military post was established to calm a restless population. At the same time, US soldiers were sent east into the Owens Valley region to address complaints of white residents, most of them of Southern sympathy, to Indian attacks on their livestock. Treated as a single issue, Tulare County's experiences with political and racial violence reveal how the Civil War may have represented, for California, its turbulent and violent territorial period that other regions in the West underwent during much of the latter nineteenth century.

Exploring Amide Catalysts for Selective Preparation of Chiral Silanols

Noreen Brar

Sponsor: Annaliese Franz, Ph.D.
Chemistry

Creating small molecule chiral catalysts of high enantiomeric purity is central to modern chemical synthesis. The Franz Lab has demonstrated that disiloxanediols are effective for use as hydrogen-bonding catalysts, but enantioselective variants remain elusive. My project focuses on exploring hydrogen-bonding interactions between an amide and silanediol to access enantioenriched silicon catalysts via desymmetrization. The desymmetrizing agent being studied is a recoverable small molecule amide synthesized in four steps. The ability of the imidazole ring to act as a hydrogen-bond donor and the amide as a hydrogen-bond acceptor is a design feature of the amide catalysts' ability to impart enantioselectivity during silylation. Steric and electronic modifications of three different amine substituted groups will be explored: (R)-3,3-dimethylbutylamine, aniline and 4-(trifluoromethyl)aniline. (R)-3,3-Dimethylbutylamine is investigated to determine the effects of steric bulk on binding interactions, aniline is used as an unsubstituted aryl reference, and the effect of different electron-withdrawing groups will be compared using 4-(trifluoromethyl)aniline. In four synthetic steps, my goal is to achieve an enantiomerically pure amide catalyst that imparts selectivity by improving the binding interactions during the silylation process. Analysis using NMR binding studies will be performed to gain insight on the interactions between the amide reagent and silanols.

Modeling Calcium Dynamics in Cardiac Myocytes Using Cellular Automata

Sarah Brashear

Sponsor: Daisuke Sato, Ph.D.

MED: Pharmacology

Calcium dynamics, specifically calcium sparks and waves, in cardiac myocytes has been studied previously using partial differential equations and random walks. This project shows that these phenomena can also be modeled using cellular automata. Cellular Automata allows us to set rules for the opening, closing, and inactivation of the calcium release units (CRU) in the cell. For our initial conditions we stochastically allowed CRUs to open and release calcium, and if there was a high enough concentration of calcium around a closed CRU, it could open through calcium-induced calcium release (CICR). These clusters of open CRUs created calcium sparks that can sometimes spread and result in calcium waves. We also modeled spiral calcium waves that occasionally occur due to the calcium wave being affected by obstacles, such as organelles, or irregularities in the cell. Lastly, we looked briefly into other areas where this model could be used in future studies to mimic other natural phenomena.

Analyzing Electromyography (EMG) Signal Quality of a New, Inexpensive EMG Electrode Approach Compared to Commercial EMG Systems

Karen Bretz

Sponsor: David Hawkins, Ph.D.

Neuro Physio & Behavior

Researchers and clinicians use surface electromyography (EMG) to study human movement. EMG captures muscle activation information from electrodes on the skin. EMG electrode cost and application time can be an important consideration in clinical and research applications involving many subjects. We have shown that a new dry, reusable electrode approach can reduce costs; however, the signal quality obtained from these electrodes has not been tested. The purpose of this study is to compare the signal quality of the new electrode approach with three commercial electrode systems. For each electrode system, a signal simulating human muscle activity will be applied through a simulated skin-electrode impedance and the outputs from the EMG system will be recorded. Differences between input and output will be used to quantify frequency and amplitude distortion, time delay, and signal-to-noise ratio of each electrode system. These quantities will be compared between EMG electrodes to determine if the proposed dry, reusable electrode provides comparable signal quality to commercial electrode systems. Aspects of signal quality will be summarized to allow researchers and clinicians to determine the best EMG electrodes to use for their application.

Modeling Repeat Mild Traumatic Brain Injury in Adolescent Rats

Olga Brevnova

Sponsor: Gene Gurkoff, Ph.D.

MED: Neurological Surgery

Mild repeat traumatic brain injury is prevalent in adolescence, and we lack an adequate rodent model of repeated sports-related concussion. Adolescent male Sprague Dawley rats had a 10mm metal disk surgically implanted onto their skulls. Animals were randomly assigned to a group: sham, single or repeat injury (3 injuries over 6 days). For injury, a metal piston moving exactly 5m/s strikes the disk, distributing force equally around the skull to prevent fractures. Motor ability was assessed using Rotarod after each injury and normalized to pre-injury baseline measures. Spatial learning was tested with a Morris Water Maze task and behavior was analyzed for ability to both acquire and recall (probe trial) the location of a hidden platform. Multiple injuries resulted in longer latencies to recover the toe-pinch reflex ($p < 0.05$) but no lasting motor deficits as compared to a single injury. While all animals learned to find the platform on the water maze, animals with repeat injuries spent significantly less time searching the correct quadrant ($21s \pm 3s$) as compared to shams ($29s \pm 3s$; $p < 0.05$) on the probe trial. It is critical to develop relevant models of sports-related concussion to identify mechanisms and treatments for this prevalent and potentially devastating condition.

Fighting For a Better Life: Farmworker Advocacy in Yolo County

Matthew Bridges

Sponsor: Jonathan London, Ph.D.

Human Ecology

Farmworker populations are among the most vulnerable populations to facing systemic inequality due to historical immigration policies, employment structures of large scale agriculture, and language barriers, among many others. It is estimated that the farmworker population of Yolo county is about 6,700, or approximately 3% of the total population. The university is engaged in farmworker related research in regional communities, however the efforts are disparate in their collaboration with community oriented organizations, legal and policy advocates, and farmers. A student planned Farmworker Advocacy Training was carried out to increase the capacity of students and professionals to address issues facing farmworkers through increased collaboration. Another purpose of the training was to create a safe space for students and professionals to engage in dialogue directly with farmworkers regarding their experiences and needs. In this presentation, specific issues facing farmworkers in Yolo County will be discussed alongside solutions currently being implemented. Video segments from the training day will be shown, and further steps being taken to address farmworker issues in Yolo County will be discussed.

Simulation of Light Yield and Collection Efficiency in a Liquid Xenon Detector

Alexander Broughton

Sponsor: Sudhindra Tripathi, Ph.D.

Physics

Detectors that employ liquid xenon as their target material are the most sensitive devices in direct detection of dark matter particles. The Davis Xenon Experiment (DAX), developed at UC Davis is a small dual-phase xenon time projection chamber, which serves as a test bench for the LUX-Zeplin (LZ) project. Understanding the response of liquid xenon to incident charged particles and gamma-rays is crucial for precise calibrations of such detectors. We can model the photon detection efficiency and light yield from these events by simulating the energy deposition, extraction, and scintillation processes for various external electric fields. We have been able to model the energy deposition process, light-collection efficiency, and photon detection efficiency accurately by implementing the GEANT4 and NEST (Noble Element Simulation Technique) software packages for our own detector. This data will be useful for detector calibrations and understanding the behavior liquid xenon. Simulated detector response of gamma-rays in liquid xenon from a Cobalt-57 source will be presented.

Associations Between Children's Diet Quality and Antisocial Behavior at School

Ty Brownridge

Sponsor: Lenna Ontai, Ph.D.

Human Ecology

Studies investigating the relationship between diet and social development in childhood suggest that chronically consuming a poor-quality diet may increase the likelihood of engaging in antisocial behavior. Links have been found between poor quality nutrition and childhood antisocial behavior (Jackson, 2016). Food insecurity is associated with fewer social interactions (Jyoti, Frongillo, & Jones, 2015). Conversely, good diet quality is associated with increased social well-being and decreased behavior problems (Overby and Hoigaard, 2012). While studies have investigated the association between diet quality and antisocial behavior over time, little is known about the short-term effects. This study will investigate the relationship between diet quality at lunch, and peer interactions after lunch. Data from this study will be drawn from the Parents to Peers project among a sample of students in grades 4-6 (N = 315). Diet quality was measured using an observation-based approach, and peer interactions were measured through a self-report survey. Associations between diet quality and peer interactions will be examined using Chi-square analyses. We hypothesize that lower diet quality will be associated with more antisocial peer interactions. Studying the short-term effects will allow for a better understanding of daily implications of poor diet.

The Influence of Reader's Political Identity on the Perceptions of Media Bias

Oliver Bublitz

Sponsor: Jaeho Cho, Ph.D.

Communication

Contemporary claims of political biases, most notably "fake news", of media outlets have saturated the political discourse. These claims allege unfair treatment and biased portrayal of political figures and ideological issues in media outlets that are purportedly slanted unfairly in the opposite ideological direction. The potential detrimental effects of these allegations include mistrust of contemporary and traditional media outlets as well as lost trust in the political system. This lost trust results in the dismissal of factual breaking news and poisons political discourse. This study seeks to understand how people perceive political bias in news by focusing on their individual political identification and news outlet identification. In order to evaluate latent biases on the behalf of readership, this study compares the self reported political identity of readers with their individual ratings of political bias that they perceived in example articles provided. This study uses a 7-point political scale to evaluate individuals' self reported political ideology. The news articles participants are asked to evaluate contain identical information but differ in their news media letterheads. Comparing the readers' ratings of bias in the presented articles to their political identification will illuminate the relationship between political identification and consumption of news media.

Gaps in Representation: Evaluating the Effectiveness of Nonpartisan Redistricting Commissions in Curbing Gerrymandering

Taylor Buck

Sponsor: Benjamin Highton, Ph.D.

Political Science

Manipulating voting district boundaries in favor of one party or candidate, through a process known as gerrymandering, eliminates fair competition within elections and reduces electoral responsiveness. A recurring policy proposal to alleviate gerrymandering is the formation of nonpartisan redistricting commissions, which place voter redistricting under the authority of a neutral body, rather than allow partisan majorities in state legislatures to draw district lines with partisan gains in mind. Since these commissions are not present in every state, and their processes vary so greatly, the question that arises is: do nonpartisan redistricting commissions effectively reduce instances of gerrymandering? In order to evaluate this question, I employ a measure called the efficiency gap, which has been presented to the Supreme Court as a proposed standard to identify gerrymandered districts. The efficiency gap assigns a numerical value to a party's advantage in an election by measuring "wasted" votes: those earned by a losing candidate or votes earned by a winning candidate in excess of a fifty percent majority. Through an efficiency gap analysis of the 1972-2014 Congressional elections, I aim to determine whether states with nonpartisan redistricting commissions experienced a reduction in gerrymandering over time, and whether one state's system was more effective.

Adult Speech Variability Between Infants and Adults

Prachi Bulsara

Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Adults tend to speak differently to infants than to other adults; for example, they exaggerate some speech sounds and their pitch patterns when communicating with infants. The current study further explores this phenomenon by investigating whether parents hyperarticulate, meaning how they exaggerate sounds in speech. We are examining how parents produce “t” sounds that occur within words because these change significantly between hyperarticulated and casual speech (e.g. “boddle” for “bottle”). We are also examining productions of “t” at the ends of words (e.g., hyperarticulated “hat” as “hat-tuh”, with a slight burst). Parents engage in a task with their infant and another task with an experimenter. The sessions are recorded and later analyzed for the target words. We expect hyperarticulation may highlight important elements and possibly function as a language teaching tool. Our preliminary data with 7 parents support that parents hyperarticulate more and show greater pitch variation when talking to infants than adults.

Enhancing Photocatalytic Water Oxidation of BiVO₄ Microparticles via Mo-Doping

Sonja Bumann

Sponsor: Frank Osterloh, Ph.D.
Chemistry

Bismuth vanadate (BiVO₄) microparticles were doped with 3% molybdenum ions to improve the n-type behavior of the material. The oxygen production abilities of both Mo:BiVO₄ and BiVO₄ crystals will be tested under illumination with a 300-watt xenon lamp in the presence of sodium metaperiodate (NaIO₄) as a sacrificial electron acceptor and the results will be compared. Although these results are currently pending, previous experiment suggests that molybdenum-doping enhances the water oxidation ability of BiVO₄ by improving electron transport in the material. To account for the discrepancies between the performances and quantitatively explain the electron transfer in both Mo:BiVO₄ and BiVO₄, surface photovoltage spectroscopy (SPS) and photoelectrochemical (PEC) measurements will be performed on both materials to evaluate their charge separation and charge extraction efficiencies, respectively. Tandem photocatalysts consisting of ruthenium-modified rhodium-doped strontium titanate (Ru/Rh:SrTiO₃) nanocrystals will also be assembled with both Mo:BiVO₄ and BiVO₄ and their abilities to perform overall water splitting will be tested. These results are an important step towards the understanding of charge transfer in particle-based solar water splitting systems by photoillumination.

Exploring Changes in College Students' Self-Efficacy with the Integration of a Socio-Scientific Phosphate Module into General Chemistry Curriculum

Sally Burke

Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Chemistry may seem irrelevant to the college chemistry student, and this can affect their desire to learn or their ability to apply their learning to real-world situations. Most course content is taught abstractly so it can be challenging for students to see the value of chemistry in their everyday lives. This study investigates changes in students' self-efficacy by incorporating a socio-scientific problem into the general chemistry curriculum. The students explore the issue of phosphates as a limited resource with a digital Prezi presentation module. The module teaches the students the chemical properties of phosphate, its uses, and waste management strategies that can help preserve this limited resource. The students will take a pre- and a post-test to determine the effectiveness of the module with statistical tests. In addition, students' perceptions on their own willingness and capacity to learn chemistry will be collected through a questionnaire. NVivo, a qualitative analysis program, will be utilized to analyze the questionnaire data. This study provides insight for chemistry educators on how they can introduce socio-scientific problems into their curriculum, making the subject more relevant to students and changing the way they perceive their own abilities to learn the material.

Addressing Health Communication in Nutrition

Meyhaa Buvanesh

Sponsor: Daniel Melzer, Ph.D.
University Writing Program

From fitness bloggers to the thousands of articles written about what it means to be healthy, information is more accessible than ever. But with such widespread use of the internet comes the challenge of educating the general public regarding the reliability and factuality of information. Researchers have investigated health communication campaigns and their impact on nutritional behavior and concluded that nutrition campaigns are able to shape lifestyle interventions. Health literacy rates go beyond the individual and depend on a multitude of systemic factors. So researchers and practitioners need to evolve their role in the lives of the general public and see themselves as health communicators to make additional efforts to connect with their audiences. My study explores perceptions of health and medical related forms of communications in nutrition. And by analyzing nutrition-literacy related communication papers, my paper examines how health and medical professionals can best bridge the gap of communication and increase the overall nutrition health literacy of the average person.

Effect of Ibuprofen on Mouse Brain Proteasome Function.

Meena Calaimany

Sponsor: Aldrin Gomes, Ph.D.
Neuro Physio & Behavior

Ibuprofen is a non-steroidal anti-inflammatory (NSAID) drug commonly administered as medication to alleviate symptoms of pain, fever, and inflammation by reducing the levels of prostaglandins. Previous results by other investigators suggest that treatment with ibuprofen alters heat shock protein and ubiquitin levels in mouse models and is hypothesized to have positive effects on the brain as the results of these varying levels. Ubiquitin is part of the ubiquitin-proteasome system (UPS) which degrades 60-80% of intracellular proteins. The proteasome is the main proteolytic component of the UPS and proteasome dysfunction is associated with many diseases including Alzheimer's and Parkinson's disease. In our study mice treated with ibuprofen showed decreased levels of proteasome function in the brain of female mice compared to the vehicle (control) group. Interestingly, male mice did not show any change in proteasome activity, suggesting gender specific differences in the mode of action of ibuprofen on the brain. Overall, these results suggest that chronic use of ibuprofen may be associated with altered brain in female mice.

Imperial Consciousness: Japanese Colonial Architecture in Seoul

Gary Calcagno

Sponsor: Katharine Burnett, Ph.D.
Art

During the early 20th century, Japan began the process of colonizing Korea that included an architectural program which would contribute to Korea's rapid modernization. Through the erection of European style structures within Gyeongbokgung Palace, a key site of Korean identity, Japan transforms the Korean dynastic space into an exhibition space and a spectacle of Korean visual identity. The Governor General's Office was a key structure in this program that served as the headquarters of the Japanese Imperial Government in Korea until 1945 when the U.S. government received the surrender of the Japanese on its steps. Yet, this building was demolished in 1995 behind a decorative screen prompting this examination of Korean visual identity and historiography. This project seeks to understand the ways in which exhibition, architectural space, and photography contributed to the split consciousness of Korean and Japanese identity in the first-half of the 20th century by examining key exhibitions and architecture in Seoul from 1900-1945. Not only will this project examine the historiography of Korean art and architecture by the Japanese but will also contribute to the scant research in English on Korean and Japanese visual culture of the 20th century.

Analyzing the Social Network Structure of a Community College STEM Academic Success Program

Jan Tracy Camacho

Sponsor: Rebecca Ambrose, Ph.D.
Education

Science, technology, engineering, and mathematics (STEM) educators often encourage students to form study groups and make connections with their peers. Studies in collaborative learning have shown that connectedness plays an important role in helping students succeed. Using methods of social network analysis, we observe the connections in a community college academic success program focusing on STEM students. The students come from underserved communities and are typically first-generation college students with financial need. The expected grouping would be a large connected network with possible offshoots of compartmentalized groups by coursework/major. There is also an expectation that there would exist nodal connections to help-givers within the network. We want to highlight the advantages of being a part of this type of network and organization. Possible applications can give other academic support programs ideas on how to evaluate the social networks within their organization that can help them foster connections, build social capital, and boost student success.

Refocusing Student Perspective in Higher Education Through Co-Curricular Involvement

Travis Candieas

Sponsor: Francisco Martorell, Ph.D.
Education

Increases in persistence and retention in higher education can be seen when students participate in co-curricular activities early on in their college career, compared to those who don't. Combining persistence and retention is problematic because the former seeks to describe student ability while the latter provides outcome measures for universities. This paper seeks to redefine the ways in which persistence and retention are measured through clearer foundational definitions, re-center the students' perspective surrounding persistence, and formalize a definition of 'community' within higher education. While the data shows correlations between persistence and retention, differences between the two can be found through analysis of the perceptions of students compared to universities', respectively. Students who are involved during their first year tend to have better self-perceptions of student persistence while students not involved during their first-year experience more of a disconnect during their college career. Surveys of students involved on campus during their first year in higher education yield an increase in their sense of belonging through community building through social integration within co-curriculars, which leads to greater measures of student persistence; conversely, students not involved in co-curriculars during their first-year experience lower measurements of persistence.

Experimental Investigation of the Impact of Processing Variables on Fracture Properties of Almonds

Xiaohan Cao

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

Food texture and fracture during mastication influence consumer preference and health outcomes. The objective of this study was to understand the impact of roasting time and temperature on fracture properties of almonds. Almonds were dry roasted using a kitchen oven for 5 or 15 minutes at 175°C. Raw (no heat treatment) and roasted almonds were subjected to two texture tests: uniaxial compression and three-point bending. Ten parameters were extracted from texture curves during both tests, and image analysis was conducted on almond fragments after uniaxial compression. Texture analysis showed the work of fracture for almonds roasted for 5 minutes ($837 \pm 95 \text{ N}\cdot\text{mm}$) was higher than that of almonds roasted for 15 minutes ($557 \pm 63 \text{ N}\cdot\text{mm}$). Image analysis showed that almonds roasted for 5 minutes fractured into an average of 6 particles, of median size 337 mm^2 . Almonds roasted for 15 minutes fractured into more numerous, smaller particles (average of 174 particles, median size 23 mm^2). Results showed that roasted almonds were more brittle, indicated by the low work of fracture and numerous, small particles. Quantification of these factors may be utilized to optimize processing conditions and control fracture behavior of almonds.

The Tripartite American Judiciary: The Influence of Rome's Mixed Constitution Upon the Founding Fathers

Samantha Carey

Sponsor: John Scott, Ph.D.
Political Science

In this paper, I seek to explore the historical examples that influenced the American Founders during the creation of the judicial branch in the United States Constitution. Because previous research has suggested that Rome did not influence the Founders' system of separation of powers into three branches, I want to discover to what extent Rome was an anti-model to the Founding Fathers in the creation of the judiciary. To answer this question, a qualitative research method is used to cover a wide-range of literature including classical texts, essays from the Founders, and scholarly discussions on this subject. In my research, I had to explore the Roman example, or lack thereof, as well as the British model due to its extensive influence on our common law court system. The answer to my question centers on the idea that the Founders only knew enough about the Roman legal system to desire the United States' judiciary to serve as a check on legislative and executive power. The Framers saw the need to prevent the people's involvement in government by implementing representation and dividing the government into three branches that neither the Romans nor the English sought to do.

Uranium-Lead Detrital Zircon Geochronology of Sierra de Maz: Implications for Basin Depositional Setting and Paleogeography

Derek Caro

Sponsor: Sarah Roeske, Ph.D.
Earth And Planetary Sciences

The Sierra de Maz range of northwestern Argentina lies in the MARA block containing units of differing metamorphic histories. The MARA block is proposed to originate on Laurentia, but the timing of accretion to Gondwana, and the location of the boundary between these two is unknown. The Maz shear zone within the range separates western units of dominantly lower amphibolite facies metapelites and quartzite from eastern units of upper amphibolite to granulite facies meta-igneous and lesser pelitic rock. I present U-Pb dates of detrital zircon from four quartzite samples: two samples within (or in very close proximity) the Maz shear zone, and two samples that lie roughly 5 km to the west of the shear zone. All samples resulted in small populations of Neoproterozoic grains as well as dominant peaks of 1.0Ga-1.2Ga grains that make up 50-90% of the sample populations. Although the 1.0-1.2 Ga peak is very common throughout the western margin of Argentina, our samples display similarities and differences to detrital zircon data in comparable units to the north and south of Sierra de Maz. Further interpretation of this new data is necessary to determine the depositional setting of the MARA block.

Effect of Colony Stimulating Factor 1 Receptor Antagonism on Myeloid Subsets in Neuroinflammatory Conditions

Sofia Caryotakis

Sponsor: Athena Soulika, Ph.D.
MED: Dermatology

Neuroinflammatory disorders, such as multiple sclerosis and its animal model experimental autoimmune encephalomyelitis (EAE), are characterized by infiltration of central nervous system (CNS) tissue by peripheral immune cells, and persistent microglia activation. In EAE clinical symptoms manifest as progressive neurological deficits. Although peripheral myeloid cells and microglia derive from different sources, both express colony stimulating factor receptor-1 (CSF1R). Previous studies demonstrated that a specific CSF1R antagonist, administered ad libitum, ablates microglia from the CNS. However, the effect of the CSF1R antagonist in peripheral immune organs is not well understood. Our preliminary studies show that mice with EAE treated with the CSF1R antagonist displayed delayed disease onset and milder neurological symptoms compared with mice given a standard diet. Although we initially speculated that the milder clinical disease is due to microglia depletion, we also observed impaired peripheral response. This suggests treatment with the CSF1R inhibitor resulted in depletion or inactivation of a CSF1R-expressing cell type in the periphery, crucial for disease onset and severity. By analyzing myeloid subsets and CNS tissue damage, we examine if EAE disease course is attributed to peripheral immune responses or microglia exerting inflammatory effects from within the CNS.

Probing the Function of the Kif26 Gene Family in Wnt5a-Ror Signaling Using Conditional Mouse Genetics

Timothy Casey-Clyde

Sponsor: Hsin-yi Ho, Ph.D.

MED: Cell Biology & Human Anat

Noncanonical Wnt5a-Ror signaling is involved in cell polarity, adhesion, and morphology during embryogenesis and adult homeostasis. Signaling dysfunction has been implicated in birth defects and metastatic cancer. Recent studies have elucidated Kif26b as a robust degradation target downstream of Wnt5a signaling. However, Kif26b knockout mice do not phenocopy the full complement of phenotypes seen in Wnt5 or Ror knockout mice, including body axis truncation and short limb/cranial phenotypes, indicating possible functional compensation by the closely related protein Kif26a. The role of Kif26a in noncanonical Wnt signaling remains poorly understood. To elucidate a possible functional redundancy between Kif26b and Kif26a, we used *in vivo* mouse genetics to create a novel Kif26a conditional knockout mouse strain. By co-utilizing the Cre-lox and FLP-FRT recombination systems, we have successfully generated Kif26a conditional knockout mice. By crossing our new Kif26a mutant animal to an established Kif26b knockout line, we will create a Kif26a/Kif26b double knockout animal and identify new mutant phenotypes in noncanonical Wnt signaling. To validate the Kif26a null mice, we successfully raised a polyclonal Kif26a antibody in rabbits and confirmed antigen specificity via western blotting. The elucidation of Kif26a/Kif26b redundancy will help accurately characterize and model Wnt5a-Ror signaling.

Possible Compensatory Effects Lead to Phenotype Variability in Zebrafish *PCNT* Mutants

Noemi Castro

Sponsor: Li-en Jao, Ph.D.

MED: Cell Biology & Human Anat

Microcephalic osteodysplastic primordial dwarfism type 2 (MOPD II) is an autosomal recessive human disease characterized by a small head size, skeletal abnormalities, and short stature. Mutations in the *PCNT* gene cause MOPD II. To better understand how the loss of *PCNT* function leads to MOPD II, we established a zebrafish animal model with mutations in *pcnt*. As the embryos developed, we observed shortened trunks and abnormal somites in the embryos lacking *Pcnt* activity, resembling some MOPDII syndromes. However, the severity of the abnormalities varied. To account for this variation, we hypothesize that other centrosomal proteins such as Cep152, Cep192, and Cep215 may compensate for the loss of *Pcnt*. Another source of compensation could come from *pcnt* isoforms; the isoforms may not be affected by the mutations and could still be functional. To test these possibilities, I will perform RNA *in situ* hybridization using probes for the mRNA encoding centrosomal proteins to see if some of those RNAs are upregulated. I will also use different *in situ* probes against *pcnt* to detect possible isoforms. These experiments would help us understand the cause of the phenotype variations we observed and shed light on the variable symptoms observed in MOPD II patients.

Testing Empathically Motivated Prosocial Behavior in Rats With Neurodevelopmental Disorders

Christine Cavarlez

Sponsor: Robert Berman, Ph.D.

MED: Neurological Surgery

Core features of autism include deficits in social interactions, social communication and repetitive behaviors. Rat modeling has proven useful in the study of developmental disabilities such as autism, but modeling social behaviors has been difficult. Recently a new test of prosocial motivation in rats has been developed that may be useful for studying deficits in social behavior. My project established this new procedure in the UC Davis IDRC Rodent Behavioral Phenotyping laboratory that modified and validated the protocol for reliability. I am now examining rat offspring of dams who were exposed to autoantibodies to brain proteins isolated from the serum of mothers of children with autism for deficits using this test. I hypothesize that the offspring of these dams will display low motivational behavior towards familiar conspecifics in distress. To promote social interaction and contact, the offspring will be weaned and paired with untreated rats. Treated rats will undergo this new test that confines their cage mate in an open field arena. The time it takes for the test rat to free their confined cage mate from the outside within a given time will be recorded and compared to unstimulated rats who display normal social communicative behaviors.

Characterization of Epigenetic Properties of *Arabidopsis* Centromere Protein

Yoomin Chae

Sponsor: Luca Comai, Ph.D.

Plant Biology

A centromere is a specific region on a chromosome where chromosome segregation occurs during cell division. Incorporation of nucleosomes containing CENH3 (a centromere-specific histone H3 variant) epigenetically specify and propagate the centromere position across cell divisions on a chromosome rather than the underlying DNA sequence. In the model plant *Arabidopsis thaliana*, a wide range of genetic modifications to the CENH3 protein appears to alter the epigenetic properties of the centromere. Crossing such modified strains with a wild-type strain of *Arabidopsis* results in selective elimination of chromosomes inherited by the modified plants and generates haploid progeny carrying chromosomes exclusively from the wild-type parent. This approach of creating haploids has a high potential in crop breeding applications. Nevertheless, the nature of the underlying epigenetic change induced by the genetic modification of CENH3 is unknown. The current project is designed to characterize the epigenetic change induced by the modified CENH3 in comparison with the wild-type CENH3. The strategies involve characterizing the wild-type and various modified CENH3s expression in the different growth stages of gamete development and after fertilization. The data collected from this experiment will be applied to develop a haploid induction system with better efficiency.

The Impact of Acculturation and Enculturation on Physical Health Outcomes

Jacinda Chan

Sponsor: Nolan Zane, Ph.D.
Psychology

Previous research suggests that acculturation to one's mainstream culture is associated with better mental health in students, while enculturation to one's heritage culture is associated with problems in mental health (Shim, Freund, Stopsack, Kammerer, & Barnow, 2014). However, little is known about the effects of acculturation and enculturation on physical health. By gathering online survey data from 11 male and 49 female ethnic minority UC Davis students (age: $\mu = 20.23$, $s = 3.56$), this study examined the effect of acculturation and enculturation on two aspects of physical health--physical functioning and vitality (energy), in addition to emotional well-being. Enculturation to one's heritage culture was positively associated with physical functioning, vitality, and emotional well-being. However, acculturation was only positively correlated with vitality and emotional well-being, but not significantly related to physical functioning. When acculturation and enculturation were included in the same regression model, only enculturation emerged as a significant predictor of physical functioning and emotional well-being. Neither acculturation nor enculturation appeared as significant predictors of vitality when both were accounted for in the same model. Future research should investigate how different ways of incorporating enculturation and strengthening one's heritage identity can enhance health outcomes.

Synchronization of Mechanical Systems Using Entrainment

Priscilla Chan

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

Entrainment is the synchronization of activity, and it is a universal phenomenon that often occurs in biological processes. Famous examples include the flashing of fireflies and beating of pacemaker cells in the heart. These phenomena can be modelled as a collection of nonlinear oscillators. In this study, we controlled mechanical systems by using entrainment. We used the Fitzhugh-Nagumo equations to implement a nonlinear oscillator in the mechanical system and investigated the synchronization process. The mechanical system was built using Arduinos, light sensors, LEDs, motors, and C/C++ programming. We varied the coupling constant, intrinsic frequency, fluctuation of the oscillation, and found these parameters to be crucial factors in entrainment. Our results demonstrate that entrainment is effective in synchronizing multiple systems and has a few advantages over traditional feedback and feed forward control. (1) The system is inherently robust as there is no need for a central controller, i.e., one point of failure does not impair the entire network. (2) Synchrony can emerge with widely different units, so less reliable devices can be part of the system. The mechanism shown in this study can be potentially used to build a novel machine-machine interface and human-machine interface.

Ethnic and Gender Differences in Emotion Regulation Strategies: The Mediating Role of Face Concern

Nathan Chan

Sponsor: Nolan Zane, Ph.D.
Psychology

Past research on emotion regulation strategies (ERS) has explored the benefits of different ERS and their relationship with mental health outcomes. However, little research has examined ethnic and gender differences in ERS and identified potential mechanisms that explain these disparities. In this study, we examined ethnic and gender differences in the utilization of nine ERS from a sample of 425 college students. Results indicated Asians engaged in more self-blame, positive refocusing, catastrophizing, and other-blame in response to adverse events, whereas Whites had a greater tendency for perspective taking. There were no ethnic differences in acceptance, rumination, refocus on planning, and positive reappraisal. Face concern, or the interest in maintaining one's face or the face of others, mediated ethnic differences in the use of self-blame and positive refocusing. Asians had higher face concern than Whites, and individuals with higher face concern were more likely to engage in self-blame and positive refocusing. Males were more likely to report acceptance, refocusing on planning, and other-blame than females; however, face concern did not mediate gender differences in ERS. Our findings suggest that when Asians attempt to cope with adverse events, they may focus on unfulfilled roles and how to repair or improve role performance.

Optimizing the Extraction of Recombinant Butyrylcholinesterase From Transgenic Rice Cell Suspension Culture

Benjamin Chang

Sponsor: Karen McDonald, Ph.D.
Chemical Engineering

Butyrylcholinesterase (BChE) is a native human enzyme which serves as a therapeutic treatment for exposure to organophosphorus nerve agents found in chemical weapons. BChE can be purified from outdated human blood plasma donations, but these donations are limited in abundance, and the cost of purification is prohibitively high (>\$10,000 per dose). As a solution, a recombinant form of BChE has been produced in transgenic rice cell suspension cultures, which promises to be a cost-effective alternative to human BChE. As part of this process, we must extract BChE from the rice cells by homogenizing them in an extraction buffer. We have optimized this process by investigating 3 important parameters: the ratio of extraction buffer to cell mass, the buffer pH, and the salt (NaCl) concentration in the buffer. Results from these experiments show that to optimize the amount of functional BChE extracted in relation to total extracted soluble protein, a 1:3 biomass to buffer ratio with a pH 7 or 8, and 300 mM NaCl in the buffer should be used. By using these conditions, the BChE yield will increase, which will decrease the cost of the protein and help develop affordable treatments for patients in need.

Identifying Force-Sensitive Protein Interactions in Cell Migration

Joleen Cheah

Sponsor: Soichiro Yamada, Ph.D.
Biomedical Engineering

Cells constantly experience forces from their environment. Fluid flow generates shear forces, neighboring cells exert tensile forces, and the cell itself produces contractile forces internally from its cytoskeleton. These forces initiate signaling pathways mediated by protein-protein interactions. Understanding how cells sense and respond to these external mechanical cues is especially crucial to elucidate the internal processes of migrating cancer cells. During migration, cancer cells must maneuver through various environments and encounter numerous physical obstacles. Therefore, discerning relevant activated pathways can provide potential therapeutic targets to counter the spread of cancer. However, traditional methods for identifying protein interactions are probed in force-free environments and are thus, unable to specify interactions that are force-sensitive. We developed a unique biochemical screen using proximity-based biotin identification (BioID) to label potential binding partners of known force-sensitive proteins *in vivo*, during which a force-sensitive response can be induced. By comparing the proteins labeled in cells under force-free and force-bearing conditions, we identified potential force-sensitive proteins to be further verified and characterized using various biochemical analysis and genetic manipulations. Overall, this approach can resolve the force-sensitive protein interactome to ultimately deter cancer progression.

Determining the Genetic Relationship Between *GI*, *ZTL*, and *RVE8* in the Circadian Clock Through Mutant Analysis

Xinna Chen

Sponsor: Stacey Harmer, Ph.D.
Plant Biology

The circadian clock is a biological timing mechanism that couples physiological and metabolic rhythms to environmental cues. Although the genetic components are not orthologous, the core network structure of coupled transcriptional feedback loops is conserved across eukaryotes. *REVEILLE8* (*RVE8*) is a core clock transcription factor, and *rve8* mutants are known to show longer circadian periods than wild type. Previous research in *Arabidopsis thaliana* shows that *RVE8* is post-translationally regulated and *GIGANTEA* (*GI*) or *ZEITLUPE* (*ZTL*) might be involved in this regulation. Luciferase assay experiments are in progress with *rve8 gi* and *rve8 ztl* double mutants to understand whether the *GI* or *ZTL* genes interact with *RVE8* in the regulation of the clock. Experimental results will show if *RVE8* has an epistatic relationship to *GI* or *ZTL*. This experiment will expand our understanding of clock gene regulation by analyzing circadian period differences in a model organism, *Arabidopsis thaliana*. Given that *RVE8* is conserved across land plants, understanding specific pathways involved in the complexity of *RVE8* regulation can give further insights into plant circadian clock regulation.

A Software Package for Decomposing Affine Semigroups

Madeline Chen

Sponsor: Christopher O'Neill, Ph.D.
Mathematics

An affine semigroup is a set of non-negative integer vectors that is closed under addition. Affine semigroups are central objects of study in algebraic combinatorics, discrete geometry, and optimization. Many noteworthy functions that are defined on an affine semigroup restrict to polynomials on subsets of the respective semigroup, called cones. Many of the proofs that such decompositions exist are existential, meaning that no precise collection of cones is known. By better understanding a precise decomposition into cones, we can gain further insight into its original function. This paper introduces the software package, *AffineSemigroup*, designed to ease the process of finding a semigroup decomposition as a union of cones. Utilizing the existing graphics system in Sage, an open source computer algebra system comparable to Mathematica or Matlab, our software package automates the process of defining cones one-by-one in succession until a complete decomposition of the semigroup is obtained. We provide a clear and intuitive interface allowing the user to choose the basepoint and generators that define each cone, at each step updating the graphic representation to aid the user in placing the next cone.

The Role of Individual Identification in Studies of Fission-Fusion Societies

Jessica Chen

Sponsor: Timothy Caro, Ph.D.
Wildlife & Fisheries Biology

Bottlenose dolphins (*Tursiops truncatus*) are a species widely known for their intelligence, complex behaviors, and social groups. They typically live in fission-fusion societies which involve fluid subgroups varying in size and composition that divide and reform on a daily or hourly basis. This allows them to balance the cost and benefits of living in groups such as feeding competition and socialization, respectively. Studies of fission-fusion societies demand that observers recognize individuals, however. I studied a wild population in the Ría Arousa in northwestern Spain collecting boat-based observational data on behavior patterns, group sizes, and group composition but I could not identify individuals. While I could gather the other information quickly and efficiently, it was difficult to uncover the intricacies of sociality. My study presents data to demonstrate the shortcomings of failing to recognize individuals and highlights the necessity of time consuming habituation and identification to investigating complex mammalian breeding systems.

Overcoming Therapy Resistance in Breast Cancer with Hexamethylene Amiloride

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 early stage cancer eventually develop recurrent disease in metastatic sites. Standard chemotherapeutics work by disrupting the cell cycle, which causes damage to the cell and induces apoptosis, a form of programmed cell death. However, cells within a tumor can become apoptosis resistant, leading to therapeutic failure. Hexamethylene amiloride (HMA), a derivative of the FDA-approved diuretic amiloride, is a promising new anticancer therapeutic, because it triggers a non-apoptotic cell death pathway called programmed necrosis, potentially allowing circumvention of apoptosis resistance. Through initial experiments, we have discovered that HMA is highly cytotoxic toward breast cancer cells but does not kill normal breast cells. Moreover, based on preliminary viability assays, HMA is capable of depleting breast cancer cells demonstrating resistance to apoptosis caused by the chemotherapeutic Docetaxel (DTX). We hypothesize HMA induces a form of programmed necrosis to kill heterogeneous breast cancer cells, particularly DTX- and other therapy-resistant populations. If HMA is indeed a viable anticancer therapeutic that can effectively wipe out apoptosis and therapy resistant tumor cells, it holds promise to prevent cancer recurrence and extend survival in patients.

Fluorescent Approaches to Study CaMKIIdelta Activation

Catherine Chen

Sponsor: Julie Bossuyt, D.V.M., Ph.D.
MED: Pharmacology

Calcium/calmodulin dependent protein kinase II delta (CaMKIId) is an important regulator of cardiac function via effects on ion channels, Ca handling proteins, and myofilaments. A clear link between sustained CaMKIId activity and cardiac disease such as heart failure and arrhythmogenesis have made CaMKIId an important therapeutic target. Recently, activating post-translational modifications [PTM] (oxidation at MM281/282, O-GlcNAcylation at S280, S-nitrosylation at C273 & C290) have been discovered and linked to disease states but it is unknown how these PTMs integrate at the level of CaMKIId. In this study, we aim to investigate mechanisms of PTM integration on CaMKIId by developing two novel approaches utilizing 1) a fluorescence polarization assay to measure CaMKIId kinase activity in vitro and 2) a GFP-CaMKIId-RFP FRET biosensor (Camuid-GR) as a readout of CaMKII activation state in live cardiac myocytes. PTM-resistant mutant CaMKII variants will be used to assess the contribution of each PTM. Our results are expected to provide key insights on how CaMKIId integrates different activating signals in physiological cardiac function at the cellular level. Understanding how CaMKII PTMs integrate may also provide valuable perspectives on clinical strategies for preventing and treating heart disease.

Biochemical Activities of Human MutLy and its Role in Processing Recombination Intermediates

Lan Chen

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

The repair of programmed DNA double-strand breaks by homologous recombination promotes chromosome pairing during meiosis. While most breaks are repaired as noncrossovers by reuniting the original broken ends, a subset of recombination events yield crossovers. MutLy, a complex of the MutL homologues MLH1 and MLH3, specifically localizes to crossover-designated recombination sites and is required for the biased resolution of recombination intermediates into crossovers. MutLy is also involved in a subset of DNA mismatch correction reactions that involve the processing of insertion/deletion loops. Biochemical studies of budding yeast MutLy have revealed endonuclease and Holliday junction binding activities suggesting a direct role in resolving recombination intermediates. Here we show that human MutLy is a metal-dependent and ATP-stimulated endonuclease that can bind a variety of branched DNA structures that correspond to recombination intermediates. Human MutLy stably binds a variety of DNA junctions in the presence of both magnesium and physiological concentrations of salt. The highest binding affinities are seen when human MutLy binds structures containing both Holliday junctions and regions of single-stranded DNA (ssDNA). This result is reconciled by our observation that human MutLy can independently and simultaneously bind both ssDNA and Holliday junctions.

Characterization of *Bifidobacterium* Isolates with Inulin-Type Fructan Fermentation Capability from Nursing Dairy Calves

Dongxiao Chen

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

Oligosaccharide-fermenting bifidobacteria commonly colonize the gut of human newborns. These bacteria promote gastrointestinal health by inhibiting pathogenic bacteria and beneficially modulating the host immune system. However, the saccharolytic capability of bifidobacteria from non-human neonates and their relationship to the host health is largely unstudied. To address this gap, fresh fecal samples were collected from nursing dairy calves and a total of 87 bifidobacterial isolates were obtained by culturing samples on selective media. These isolates were identified by sequencing the 16S rDNA gene and then screened in a growth assay for the ability to utilize inulin as the sole carbon source. While most strains did not grow on inulin, fifteen isolates demonstrated vigorous growth. This includes one *Bifidobacterium aerophilum* strain, one *Bifidobacterium animalis* subsp. *animalis* strain, two *Bifidobacterium choerium* strains, 11 *Bifidobacterium pseudolongum* strains. *B. aerophilum* strain JL0026, which showed the most vigorous growth on inulin, was further shown to be sensitive to a number of clinically important antibiotics. This work provides the conceptual basis for the design of symbiotic applications (probiotic + prebiotic) in dairy calves to improve gut health in early life.

Stable Isotope Chemistry Shows that High Elevation Foragers of the Andes Mountains Primarily Ate Meat 7ka

Jennifer Chen

Sponsor: William Haas, Ph.D.
Anthropology

The South American Andes were one of the last places on the planet for early humans to settle because of its high elevation environment. Despite such challenges, early hunter-gatherer populations paved the way for state formations later on in the Lake Titicaca Basin of southern Peru. We currently do not understand how early hunter-gatherer populations began the adaptive process. Located at 3800 meters in elevation, Soro Mik'aya Patxja is an archaeological site east of Lake Titicaca and provides a unique opportunity to examine early dietary habits. Recent excavations have recovered 16 individuals of varying sex and age dating to 7000 years ago. I examine the dietary patterns of these individuals through stable carbon and nitrogen isotope chemistry. Stable carbon and nitrogen isotopes can lend insights into trophic levels and protein sources of consumed foods. The data reveals that Soro Mik'aya Patxja diet was dominated by hunted terrestrial mammals and that plant and fish were relatively minor dietary components.

Interaction of C-peptide with Biologically Important Metal Ions

Ting Chia Chen

Sponsor: Marie Anne Heffern, Ph.D.
Chemistry

C-peptide is a 31-residue bioactive peptide of growing interest for its potential therapeutic benefits. It is generated as part of proinsulin, the precursor to the hormone insulin, which regulates glucose levels in the bloodstream. In proinsulin, C-peptide connects the A-chain and B-chain of insulin and is cleaved in the secretory vesicles during the maturation of insulin. As such, it is released in equimolar amounts of insulin by the pancreas. While initially believed to be biologically inert, increasing work suggests possible therapeutic applications of C-peptide in ameliorating illnesses such as kidney disease and diabetes. Studies show support the beneficial role of C-peptide when coupled with metal ions such as zinc, iron and chromium in diabetic patients, but the molecular mechanisms that govern these metal-dependent activities remain unclear. To this end, we seek to untangle the metal-mediated functions of C-peptide. We will use spectroscopic techniques to assess interactions of C-peptide with transition metal ions to discover and understand their binding, the structure of C-peptide after metal binding, and how the adopted structure affects physiological function.

Developing Oncolytic Strategies for KSHV-Associated Malignancies

Christopher Chen

Sponsor: Yoshihiro Izumiya, D.V.M., Ph.D.
MED: Dermatology

Kaposi's Sarcoma-associated Herpes Virus (KSHV) is responsible for some AIDS-associated malignancies, such as Kaposi's sarcoma, primary effusion lymphoma, and some types of Castleman's disease. Like other herpesviruses, KSHV rotates between latency and lytic replication. In a latently infected cell, KSHV exists as multiple episomes attached to the host's DNA, where most of its viral gene expression is silenced. After specific stimulation, KSHV 'wakes up' and enter its lytic stage, where the virus replicates its genome and synthesizes the necessary proteins to produce progeny. We examined the possibility of activating "sleeping" viruses with chemotherapeutic drugs to kill KSHV harboring cancer cells. Accordingly, I have examined a set of currently used chemotherapeutic drugs for reactivating KSHV. We found that some drugs strongly stimulate KSHV reactivation in vitro. Importantly, we identified drugs that were able to inhibit viral replication, although they triggered viral gene expression. Among them, we found that Bortezomib and OTX015 are an effective drug combination in reactivating KSHV while simultaneously preventing efficient viral progeny production. We are currently investigating the molecular mechanism of how the drug combination stimulates expression of viral antigens without producing viral progeny. The drug combination might be suitable for cancers with oncogenic herpesvirus etiologies.

Using Color to Identify Moisture Exposed Almonds After Storage

Honglin Chen

Sponsor: Alyson Mitchell, Ph.D.
Food Science & Technology

Undesirable color darkening of roasted almonds can affect customer acceptances, and lead to increased food wasted. Post-harvest moisture in raw almonds has been shown to cause a dark brown color in kernels after roasting¹. To date, there are no methods available to screen moisture exposed almonds. To address this, raw almonds were exposed to moisture and subsequently dried, roasted then stored under controlled condition up to 12 months. One hundred almond kernels in each treatment were measured monthly using colorimeter and CIELAB color value to objectively measure and quantify the value of color. ANOVA was used as statistical analysis to determine statistically significant differences between samples. The results showed that there are no significant differences between the same treatment during storage. However, significant differences were observed between non-moisture exposed almonds and moisture exposed almonds in L* and b* values. Results demonstrate that moisture exposure may cause the darker brown color appearing in almond kernels, but the color does not change over storage time.

Simulation of Electric Fields in Detector Configurations for the High Luminosity LHC

Selene Cheung

Sponsor: Sudhindra Tripathi, Ph.D.
Physics

The Large Hadron Collider (LHC) in CERN, Geneva, Switzerland will be undergoing an upgrade to increase its beam intensities. The resulting high radiation environment will damage the silicon detectors used at the LHC for tracking charged particles. This damage is compensated for by increasing the applied voltage on the detectors, which helps maintain full efficiency. However, such high voltages can result in breakdown between the sensor and its readout integrated circuit (ROIC). Experimental device configurations are being studied to eliminate the weak points that result in breakdown. To this end, the COMSOL Multiphysics software package is being used to model the electrostatic structure of sensors and readout electronics to determine the magnitude of the electric fields in the susceptible regions. This allows a detailed understanding of material choice for and breakdown mechanics of the regions of interest. By analyzing the simulation results, electrostatically analogous experimental configurations can be constructed. Preliminary findings from this exercise will be presented.

Ethnic and Gender Differences in Emotion Regulation Strategies: The Mediating Role of Face Concern

Laurie Chin

Sponsor: Nolan Zane, Ph.D.
Psychology

Past research on emotion regulation strategies (ERS) has explored the benefits of different ERS and their relationship with mental health outcomes. However, little research has examined ethnic and gender differences in ERS and identified potential mechanisms that explain these disparities. In this study, we examined ethnic and gender differences in the utilization of nine ERS from a sample of 425 college students. Results indicated Asians engaged in more self-blame, positive refocusing, catastrophizing, and other-blame in response to adverse events, whereas Whites had a greater tendency for perspective taking. There were no ethnic differences in acceptance, rumination, refocus on planning, and positive reappraisal. Face concern, or the interest in maintaining one's face or the face of others, mediated ethnic differences in the use of self-blame and positive refocusing. Asians had higher face concern than Whites, and individuals with higher face concern were more likely to engage in self-blame and positive refocusing. Males were more likely to report acceptance, refocusing on planning, and other-blame than females; however, face concern did not mediate gender differences in ERS. Our findings suggest that when Asians attempt to cope with adverse events, they may focus on unfulfilled roles and how to repair or improve role performance.

Assessing Neurodevelopment in Infant Rhesus Monkeys

Arman Chini

Sponsor: Erin Kinnally, Ph.D.
Psychology

Early neurodevelopment is a key organizing factor for emotion, cognition, and behavior. The electroencephalogram (EEG) is one of the most widely used in vivo tools in recording brain activity. EEG is sensitive to which brain regions are being activated at different points in time, in addition to reporting the magnitude of activation in each region. In this experiment, brain waves of four sleeping rhesus macaques monkeys were recorded using an EEG and the data was analyzed across developmental stages (Days 1, 14, 30, 40, and 115 of life). We plan to examine age related differences and correlations with aspects of emotion, cognition and behavior. Since older macaques possess neuronal structures that are more developed than their younger counterparts, it was hypothesized that older macaques would exhibit a greater magnitude of brain activity in cranial regions responsible for cognitive processing. We will also examine sex differences and correlations with aspects of emotion and behavior.

Do it for the Gram - The Relationship Between Young Women and Instagram

Shivani Chittaranjan

Sponsor: Patricia Serviss, Ph.D.
University Writing Program

Instagram has always been a popular social platform among college undergraduates and its popularity continues to increase especially among young women undergraduates which is intriguing since the use of Instagram amongst young women is often associated with body distortion and low self-esteem. 20 undergraduate women aged 17-22 were surveyed to understand what drives them to continue using this specific social networking site despite the detrimental effects that accompany it. The findings of the current study reveal that women tend to regret their time spent on Instagram with a probable cause that the effect Instagram has on them is negative in the long run as a result of constant comparison. Emphasis must be made that they compare not to compete or to be better than other women but to feel worthy or at par. It is hypothesized that they continue using Instagram regardless of its inimical impact for the instant gratification the virtual validation provides them with. Furthermore, the psychological effect Instagram has on women largely depends on the content viewed.

Scaffold-Directed Immunomodulation of Macrophages for Tissue Regeneration

Shahab Chizari

Sponsor: Jamal Lewis, Ph.D.
Biomedical Engineering

Every year in the United States, approximately 600,000 bone fractures fail to heal properly, leading to damaging consequences like bone loss and infection. The field of tissue engineering aims to promote wound healing by providing scaffolds to act as templates for cell growth. However, there is considerable potential to integrate immune-regulating molecules to further facilitate tissue regeneration. Macrophages are crucial in the inflammatory response as they can “shift” their phenotype based on chemical and physical interactions with their environment. The goal of this study was to engineer a biomaterial with specific physiochemical properties to control macrophage phenotype to accelerate wound healing. Hydroxyapatite scaffolds infused with PLGA microparticles were fabricated. The microparticles encapsulated either Dexamethasone (anti-inflammatory steroid), Lipopolysaccharide-A (an endotoxin), or both. Macrophage phenotypes were determined after in vitro seeding with the microparticle-scaffold system. Flow cytometry analysis revealed that scaffold type had a significant effect on macrophage activation and phenotype, and that the Dexamethasone-Lipopolysaccharide Scaffold was most efficacious at shifting macrophage phenotype. Future work will include continued optimization of the microparticle-scaffold system and in vivo studies. With further development, the microparticle-scaffold system has the potential to accelerate tissue regeneration through direct modulation of macrophages.

Number Discrimination in Infancy

Rebecca Cho

Sponsor: Lisa Oakes, Ph.D.
Psychology

Numerical discrimination is a detection procedure that captures infants’ individual differences in numerical abilities at a young age. These individual differences may allow us to further explore the relationship between infant numerical discrimination and development of later math skills. We are investigating numerical discrimination within infants by replicating a previously published study using a numerical change detection paradigm. In this procedure, infants view a numerically changing image stream in which pictures of 6 and 18 items alternate (e.g., 6 dots followed by 18 dots followed by 6 dots). They also view a non-changing image stream in which pictures with the same numerosity are repeatedly shown (e.g., 6 dots followed by 6 dots followed by 6 dots). We show infants these two types of streams side-by-side and record infants’ looking behavior to determine if infants prefer the changing stream over the non-changing stream. We predict that infants will be able to differentiate the numerosities in the changing stream, which represent a 1:3 ratio, and as a result that infants will look longer at the numerically changing stream compared to the numerically constant stream.

Unpacking the Anal Sac: Identifying Volatile-Producing Bacteria in Feline Anal Sacs and Their Roles in Scent Marking

Adrienne Cho

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

Over 30 years ago, a fermentation hypothesis was generated; it posits that bacteria in mammalian scent glands produce odorous volatiles responsible for scent production. Cats, in particular, are well-known for their scent marking behavior in communication. However, the role of the cat microbiome in this phenomena has not been explicitly studied. This project explores the connection between the microbiome of the domestic cat anal sac and cat scent-related behaviors. Preliminary 16S rRNA survey and culture of felid anal sac secretion highlighted three abundant bacterial species. Volatiles produced by these species were collected, analyzed, and identified. Thus far, data gathered from GC/MS analysis of the species has identified a number of volatile compounds found in both the whole anal sac and bacterial cultures. We will search the bacterial genomes for these relevant volatile production pathways; pinpointing the biochemical pathways responsible for specific bacterial volatiles in feline anal sacs could help identify the most important bacteria in scent production. This would not only contribute evidence to the fermentation hypothesis, but could also have a variety of applications in the petcare industry and in conservation efforts.

Chemochromic 2D Layered Oxides

Jae Choi

Sponsor: Kristie Koski, Ph.D.
Chemistry

Molybdenum trioxide (MoO_3), niobium pentoxide (Nb_2O_5) and vanadium pentoxide (V_2O_5) are two-dimensional layered oxides that are change color with intercalation. MoO_3 changes color from transparent to blue. Vanadium oxide changes color from yellow or dark orange to blue, and Nb_2O_5 changes color from brown to grey. These oxides are successfully synthesized via solvothermal methods to yield a variety of shapes such as rectangular, one-dimensional ribbons or rods with approximate lengths between 0.1 and 0.2 μm . Oxides can be manipulated in solution or on a substrate. Zero-valent intercalation is a new method to intercalate high densities of uncharged atomic species into a layered material. In this presentation, I will show how intercalation with zero-valent metals can be used to chemochromically control 2D layered oxides with visual inspection by microscope. Intercalation with metals such as Cu, Ru, Sn, Fe, Ni, and Co will be used to chemochromically manipulate V_2O_5 , MoO_3 , and Nb_2O_5 .

The Impact of Hepatocyte Growth Factor on Corneal Stromal Cell Differentiation

Tanvi Chokshi

Sponsor: Sara Thomasy, D.V.M., Ph.D.

VM: Surg/Rad Science

In corneal wound healing, the transformation of quiescent keratocytes to activated fibroblasts and myofibroblasts (KFM transformation) is needed for closure. However, prolonged or exaggerated exposure of myofibroblasts in the wounded area leads to corneal fibrosis, which results in severe vision loss. The KFM transformation is initiated by transforming growth factor-beta (TGF- β). Since hepatocyte growth factor (HGF) is known to inhibit TGF- β signaling, we hypothesized that HGF can reduce corneal fibrosis. We treated human corneal fibroblasts with TGF- β and HGF, and assessed the alteration in alpha-smooth muscle actin (α SMA), which is characteristically expressed in myofibroblasts. We showed that HGF suppressed the expression of α SMA mRNA and protein by quantitative real-time PCR, western blotting, and immunocytochemistry. Additionally, we showed that can HGF revert myofibroblasts to fibroblasts. As we continue to further test the effect of HGF on KFM transformation, we hope to better understand the impact of HGF can have on corneal fibrosis.

Numerical Solutions of Partial Differential Equations with Applications in Engineering

Blake Christerson

Sponsor: Mohamed Hafez, Ph.D.

Mechanical & Aerospace Engr

Partial differential equations (PDE's) play an essential role in many physical applications as they are able to describe phenomena in multiple dimensions. For example heat conduction, wave propagation, and equilibrium of fluid flow and structures must reside in multidimensional domains due to the nature of the applications. We will present numerical solutions for standard systems of PDE's of parabolic, hyperbolic, and elliptic types as well as an eigenvalue problem pertaining to buckling plates. The formulation the problems will be presented using simple-uniform grids and finite difference approximations as well as explicit and implicit time marching schemes. The accuracy and stability of the numerical calculations will be discussed and the results will be presented. Next, nonlinear PDE's will be studied and sample results will be displayed. All calculations will be done in Microsoft Excel with minimal use of visual basic macros, and the different behaviors of the solutions will be depicted from the numerical calculations.

Comparing the Acute Effects of Exercise and Dance on Mood

Rianna Chu

Sponsor: Craig Warden, Ph.D.

MED: General Pediatrics

There has been a growing literature on the physiological benefits of dance as an alternative to aerobics and strength training. In older adults, dancing has shown to be just as effective as traditional exercise activities. Like simple aerobics and strength training, dance has the ability to improve cardiovascular health, balance, VO_2 peak, strength, and endurance but in a low-impact and communal way. However, the mental health benefits of dance have not been well documented. The growing literature on the psychological benefits of exercise has demonstrated a reduction in symptoms of depression and anxiety and improvements in positive mood states. While we may suspect that dancing has similar mental health benefits as exercise, the possibility of observing greater mood improvements from dance becomes the motivation for this study. By comparing short-term changes in mood before and after dance and exercise classes at the UC Davis ARC, I hypothesize that dance will yield changes in mood. Participants will complete a pre- and post-class Profile of Mood States (POMS) survey to rate their current mood states. Secondary outcome measurements include comparing changes in mood states among different classes, ages, and genders will be measured using Multivariate Analysis Of Variance (MANOVA).

Respiratory Sinus Arrhythmia Predicts Young Children's Self-Regulation

Elisabeth Chun

Sponsor: Daniel Choe, Ph.D.

Human Ecology

Self regulation is the ability to modulate one's reactions and responses, and serves as an important indicator of young children's development. Respiratory sinus arrhythmia (RSA) measures variability in heart rate and respiration, serving as a physiological marker of behavioral and emotional self-regulation. In a preliminary sample of nine children (M age = 53 months; SD = 4.18, 5 girls), we measured children's RSA values during a sitting baseline and as they completed eight self-regulation tasks, including Day-Night, Happy-Sad, Bird-Dragon, Reverse Bird-Dragon, Tongue Task, Dinky Toys, Gift Wrap, and Gift Delay. We calculated the difference in RSA between each task and the baseline to represent changes in RSA during self-regulation tasks, which we then compared to children's performance. Preliminary analyses suggest that higher RSA values during Gift Wrap is associated with high self-regulation and larger differences between baseline and task RSA predict poorer self-regulation in Bird-Dragon. This ongoing research quantifies children's self-regulation behaviorally and physiologically to help us understand how children adapt to different environments and respond to challenges. By observing self-regulation early in children's lives, steps can be taken to improve children's behavioral and emotional responses to stress.

Social to Algorithmic Governance: Allusions of a New, Digital Iron Cage

Raquelmarie Clark

Sponsor: Martin Hilbert, Ph.D.
Communication

Address what current scholarship says about the increasingly important role algorithms play on implementation of policies on English Wikipedia, and in social interactions between human users and Wikipedia Bots. Methods: Research was conducted through literature review of thirteen peer-reviewed articles to compare effects of algorithms on institutional organization, focusing on the history of bots on Wikipedia. Results: Despite only a slight increase in bot activity on Wikipedia from a first analysis, May 2017 compared to December 2017 (+7%), site archives from April 2003 evidence increased scope of authority to include "Ban Enforcement". Policy enforcement by bots seems to have become common practice, leading to controversial reactions from human users (explored through the HagermanBot Case study). Bot governance on Wikipedia remains a cultural norm with no eventful updates to report. Resistance to change or willingness to adopt new institutional structure can vary depending on an organization's industry, structure design, level of influence from other organization types, the organization's culture, and ultimately how these variables converge. Bots on Social Media, e.g. Twitter, provide an area of interest for further analysis and investigation of claims of rapidly increasing usage for crucial purposes, such as shaping American election outcomes.

Organic Carbon Determination Using Fourier Transform Spectrometry: The Importance of Interpretation of Spectra and Statistical Modeling

Matthew Coats

Sponsor: Ann Dillner, Ph.D.
Air Quality Research Center

Atmospheric aerosol monitoring networks collect particulate matter (PM) across the United States to assess the impact of ambient PM on visibility and human health. Ambient samples, collected from a Fresno, CA Interagency Monitoring of PROtected Visual Environment (IMPROVE) network site in 2015 are analyzed using Fourier transform infrared spectrometry (FT-IR) to predict organic carbon (OC) concentrations with calibrations built from regression techniques. Building calibrations to predict OC from the FT-IR spectra are particularly sensitive to interference from ammonium nitrate infrared absorption. To address this, leverage and Cook's distance are used to determine anomalous samples which pertain to spectra that were also observed to contain high ammonium nitrate concentrations. Regression figures of merit, such as R^2 as well as normalized error and bias, are compared before and after removing samples identified using leverage and Cook's method suggesting that OC mostly predicted better for most calibration models after removing high NH_4NO_3 samples from the calibration problem. The samples that were removed had characteristics of high NH_4NO_3 absorbance peaks. Creating robust calibrations using field samples therefore benefit by addressing interferences known to absorb in the mid-infrared OC analytical regions.

Effects of Uniaxial Pressure on YbAgGe at Low Temperature

Evan Cobb

Sponsor: Rena Zieve, Ph.D.
Physics

YbAgGe is classified as a heavy fermion, a group of materials which often exhibit exotic low temperature phases and are not yet fully understood. This material grows in hexagonal crystal rods and due to its particular atomic structure, conflicts in nearest neighbor magnetic interactions allow for multiple possible magnetic spin states. These states have the same energy and are called degenerate. Crystal lattices with these degenerate states are said to be geometrically frustrated. Geometric frustration can be reduced by changing the distance between atoms by applying pressure in one direction, thus making some states more energetically favorable. Changes in geometric frustration can affect the electromagnetic properties of samples at low temperatures. We measure resistance and Hall Effect at several pressures as a probe of quantum phase transitions in YbAgGe. Temperature and magnetic field are also varied to further explore low temperature behavior. Results not final at time of abstract submission.

The Effect of Reproductive Hormone Interactions on pSTAT5 Protein Levels in Porcine Mammary Epithelial Cells

Julia Cohen

Sponsor: Russell Hovey, Ph.D.
Animal Science

Mammary glands produce the milk that mammals use to feed their offspring. Development of the mammary epithelium during female development depends on various reproductive hormones from the ovaries and pituitary that often work in combination. These signals are mediated by transcription factors including a protein called Signal Transducer and Activator of Transcription 5 (STAT5), which can be phosphorylated (pSTAT5) to activate genes responsible for cell growth and milk production. In a previous study our lab found that the combination of estrogen and prolactin stimulated maximal epithelial proliferation in the mammary glands of female pigs. I hypothesize that this hormone combination will also induce the greatest induction of pSTAT5. After sectioning mammary gland tissue from pigs treated with saline, estrogen, prolactin, or their combination, I will perform immunohistochemistry to localize nuclear pSTAT5. I will then analyze these samples microscopically to determine the percentage of epithelial cells positive for pSTAT5. Understanding how hormones affect cell growth could help us identify a cellular mechanism for the onset of human breast cancer.

Attempting to Isolating Key Bacterial Species in the Seagrass Microbiome, a Complete Genome of *Psychrosphaera haliotis*, and a Trial of the MinION Sequencer

Marcus Cohen

Sponsor: David Coil, Ph.D.
UC Davis Genome Center

With the rapid advance of sequencing technology, metagenomic analysis for describing microbial environments has supplanted traditional culture-based pipelines. However, given the complexity and expense of obtaining phylogenetic and genomic data from environmental samples, this project focused on a more traditional approach to isolate bacterial species important to California seagrass microbiomes as physical cultures. Using available metagenomic information as a guideline to target species that appeared ecologically important, numerous culture media were created to select for said species' growth. One species isolated as such, *Psychrosphaera haliotis*, was considered valuable for full genome sequencing given that no *Psychrosphaera* genome had been sequenced to date. As part of this effort, we attempted to utilize the new MinION by Oxford Nanopore, a portable DNA-sequencing technology. While *P. haliotis* itself was sent for SMRT sequencing with Pacific Biosciences, the resulting genome and overall process was compared with another sample sequenced on our MinION. A description of the *P. haliotis* genome should be of use to researchers studying this organism as well as the seagrass microbiome.

Investigating General Chemistry Students' Knowledge Retention and Success in Problem Solving

Rose Cohen-Sandler

Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Stoichiometry is one of the most challenging topics of general chemistry due to its reliance on problem solving skills and its inclusion of many different chemistry concepts. Using the Coding System for Investigating Subproblems and Network (COSINE) method, our study examines students' success with each subproblem, allowing the discovery of the exact place a student makes a mistake instead of focusing on the final answer. These subproblems were categorized based on chemistry concepts, such as limiting reactant and mole concept. This helped to identify the most challenging concepts that students face in a general chemistry course. This study also focused on students' knowledge retention between quarters. Students were tested both fall and winter quarters on stoichiometric topics to see if they could achieve the same level of success. Our preliminary results showed that in winter quarter, students had higher success rates than in the fall quarter, meaning that student understanding improved over time. Instructors should give their students more time to learn and process the material they teach. Among all the concepts studied, stoichiometric ratio was the most difficult topic for the students in the fall quarter, yet it had the highest success rate in the winter quarter.

Hold Your Horses, It's Just an Adaptation

Shelbie Condie

Sponsor: Matthew Stratton, Ph.D.
English

I am studying the relationship between Dorothy Johnson's fiction and their more famous film adaptations. Works such as "A Man Called Horse" (1950), "The Man Who Shot Liberty Valance" (1953), and "The Hanging Tree" (1957) were all made into movies starring Western screen icons like John Wayne and Gary Cooper. Reading these texts through the theories of adaptation, by scholars such as Susan Hayward, Thomas Leitch, and Brian McFarlane, investigate the significance of evaluating films based on their fidelity to fictional sources. What scenes are added or deleted? What elements of the Western genre does Johnson stick to? Finally, what are the stakes of judging one medium based on its relationship to another, entirely different one? From these findings, the cliché that a book is usually "better" than the movie version of a story is now questionable at best. Dorothy Johnson's stories stand out in a genre whose authorship is conventionally male, and my argument takes gendered aspects of adaptation as a key focus of my inquiry.

Testing the Utility of Nanobodies as Intracellular Probes for Protein Distribution in Neurons in Cultured Brain Slices

Karen Cornejo

Sponsor: Karen Zito, Ph.D.
Neuro Physio & Behavior

Nanobodies are biomolecules that can be expressed intracellularly while fused with fluorescent proteins, making them a powerful imaging tool that can be used to trace antigens in living cells. Recent studies highlight the biochemical and biophysical properties of nanobodies as key elements that contribute to their ability to serve as ideal intracellular biomarkers. My project involves transfecting organotypic hippocampal slices with nanobodies targeted against specific neuronal proteins to characterize their brightness and localization in pyramidal neurons. I am using biolistic transfections and 2-photon microscopy to investigate the subcellular localization of nanobodies against Homer, AMIGO, IRSP53 and SAPAP2. Out of these proteins, Homer, IRSP53 and SAPAP2 are concentrated in postsynaptic structures whereas AMIGO localizes on the soma. I expect that bright and well-localized nanobodies can provide excellent tools to investigate the roles of these proteins in the cellular processes that occur in neurons. Ultimately, the use and optimization of nanobodies as probes should enable novel applications that could be translated to therapeutic agents for neurological disorders.

The Relative Impacts of Host Morphology, Genetics, and Microhabitat on Variable Photosystem Performance of the Symbiotic Algae Zooxanthellae in Three Species of Sea Anemone in the Genus *Anthopleura*

Juliana Cornett

Sponsor: Richard Grosberg, Ph.D.
Evolution & Ecology

Three species of sea anemone in the genus *Anthopleura* commonly occur in the Pacific coast's rocky intertidal: the solitary anemones *A. sola* and *A. xanthogrammica*, and the clonal anemone, *A. elegantissima*. While *A. sola* and *A. xanthogrammica* are morphologically similar, *A. sola* and *A. elegantissima* have recently diverged and are nearly genetically identical. All host endosymbionts, either zooxanthellae (dinoflagellates) in the genus *Symbiodinium* or zoochlorellae (green algae), within their gastrodermal cells that provide carbon via photosynthesis. Host morphology, as well as environmental factors (temperature and light) that vary across the geographic range of these species, determine if an anemone hosts zooxanthellae or zoochlorellae. This project examines how varying environmental conditions across the intertidal zone (as opposed to across the geographic range of these species), combined with host morphology and genetic interactions between the host and symbiont, impact symbiont photosystem performance within a symbiont population. I used Pulse Amplitude Modulated (PAM) fluorometry to analyze the photosynthetic efficiency of symbionts in situ. I find that the photosynthetic efficiency of symbionts is most similar in *A. sola* and *A. xanthogrammica*, indicating that host morphology plays the largest role in shaping photosynthetic efficiency, while microhabitat and host genetic make-up play a smaller role.

Attack of the Great Recession: Myocardial Infarction Rates Due to Financial Stress

Gina Cortez

Sponsor: Patricia Roberson, Ph.D.
Human Ecology

The Great Recession (2008-2009) was the biggest global financial crisis since the Great Depression in the 1930s, effecting millions of Americans. Many Americans coped from the financial downturn in various ways, whether it was taking an additional job, claiming bankruptcy, or even foreclosing on their home. Many also experienced psychological effects from the emotional and psychological strain brought on by rapid changes in personal finances. Research has repeatedly found that having a lower socioeconomic status may influence the chances of having a heart attack. However, there has been limited research investigating heart attack rates during the Great Recession. Of the existing research, heart attack rates have been compared with the stock market during the recession. However, the average American does not participate in stocks. In another study, researchers observed heart attack occurrences in only one region of the United States during the Great Recession, finding unemployment rates to be the biggest influence. The present study will consider how financial stress levels may influence heart attack rates and likelihood of continued treatment using a wide sample population during the Great Recession.

Challenges and Solutions to Actigraphy in a Population Based Study

Evelyn Covarrubias

Sponsor: Leah Hibel, Ph.D.
Human Ecology

Actigraphy is a useful method of objectively recording sleep, and has been validated with the previous gold standard of measuring sleep, polysomnography. The California Babies Project is utilizing this method to study sleep in Mexican origin families in the greater Sacramento area. Mothers, fathers, and their children wear actigraphs - computerized devices worn on the wrist (parents) and ankle (infants and toddlers) - to record sleep and wake activity. Subjective data, including sleep and wake times, were collected via daily diaries using the phone application, Metricwire. Data were collected over a period of eight nights in the families' homes and then coded in the lab using Action4 software and validated scoring algorithms. The subjective and objective data were evaluated simultaneously in the coding process to accurately determine the quality and quantity of individuals' sleep periods. We aim to further describe the details of the coding process and address challenges and solutions in working with actigraphy.

Blinded and Unblinded Evaluation of Bulldog Spinal Cord Injuries Through the Use and Comparison of the Olby Scale and TCIS Scale for Gait Analysis

Emily Cowan

Sponsor: Aijun Wang, Ph.D.
MED: Surgery

Spina bifida is a devastating birth defect that can result in incontinence, impaired mobility, and paralysis depending on the severity of the associated spinal cord lesion. Humans and English Bulldogs naturally develop spina bifida, and the UC Davis Schools of Medicine and Veterinary medicine are collaborating to provide cutting edge veterinary care to affected dogs while gathering valuable preclinical data for human medicine. The goal of this project was to screen established canine locomotor scales to select the ideal scale for grading the recovery of treated animals. Two scoring systems, the Olby Scale and the Texas Spinal Cord Injury Scale (TSCIS) were used to assess the recovery of two treated English Bulldog puppies, and one aged matched untreated control animal. Two blinded reviewers and two unblinded reviewers graded the animals using both scales. The Olby Scale proved to be the superior rubric because it is more sensitive to slight ataxia. On average, blinded reviewers scored bulldogs 2 points higher than unblinded reviewers when using the Olby scale, but scored 0.22 points lower than unblinded scorers when using TSCIS.

These scores suggest the presence of unconscious bias from the unblinded reviewers, highlighting the importance of blinding to ensure accurate assessment.

Kristin Cox's Art

Kristin Cox

Sponsor: Gina Werfel, M.F.A.
Art

Kristin Cox is a junior at UC Davis studying Art Studio and Art History, planning to graduate in Spring 2019. She loves painting and drawing and has been practicing art for 5 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, and Thiebaud 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 natural 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. In addition to painting and drawing, she is aspiring to move past her comfort zone and dabble in sculpture and printmaking in the future. Kristin hopes to continue practicing art through college and after, and is considering applying to graduate schools in art studio disciplines such as painting or drawing after obtaining her undergraduate degree.

Diploid Evolution within Source-Sink Landscapes

Kyle Cox

Sponsor: Sebastian Schreiber, Ph.D.
Evolution & Ecology

Often, populations exist within landscapes comprising different quality patches. High-quality patches (sources) permit population growth, whereas low-quality patches (sinks) do not. Interestingly, past work has shown sinks may harbor the majority of a population, thus suggesting careful consideration of a habitat's role as a source or sink when practicing conservation and restoration. However, populations exhibit genetic diversity which must be considered for a fuller understanding of systems of this kind. We model a diploid population breeding within a source-sink landscape. One can appreciate the empirical analog of birds returning to their breeding grounds each year. We assume a single locus determines fertility within a patch, and patch selection follows traditional source-sink dynamics. We create a deterministic discrete-time model to track population size (ecology) and genotypic frequencies (evolution). This system reveals how novel non-viable alleles can invade an established population and persist via advantage within sinks. We note the importance of source-sink classification at distinct biological levels: allelic, genotypic, and population. We also explore which scenarios might lead to sources and sinks exchanging roles as polymorphisms shift through time.

The United Nations Security Council's Responsibility to Protect: Security or Trade?

Casey Crumrine

Sponsor: Lindsay Reid, Ph.D.
Political Science

Chapter VII of the Charter of the United Nations establishes that "the Security Council shall...decide what measures shall be taken...to maintain or restore international peace and security". Despite the obligations of the members states of the UNSC, it has been recognized through literature that "states participate in peace-keeping to serve their own interests". What 'interests' could be influencing the decisions of the UNSC to become involved, though, if not peace and security? I explore this question using a mixed-methods approach to study two cases of government violence, Burundi and Sudan, against civilian populations. I hypothesize that UNSC 'interest' – or disinterest – in cases is reflective of correlations between member states' economic connections to the aforementioned governments' economy. After standardizing quantitative data of exports and analyzing UNSC resolutions, I find that while my hypotheses are not supported by the quantitative and qualitative analysis, my findings reveal that the substance of resolutions may be significantly influenced by economic connections.

Enantioselective Synthesis of Novel 6-Membered Ring Products by C-H Insertions

Matthew Culberson

Sponsor: Jared Shaw, Ph.D.
Chemistry

Developing new synthetic methods is a key step to efficiently synthesizing natural products and drug targets. Both can be synthesized through intramolecular carbon-hydrogen (C-H) bond insertion, creating densely-functionalized heterocyclic cores enantioselectively. Previously, a thoroughly studied C-H insertion methodology was established to synthesize saturated, 5-membered ring heterocycles fused to benzene scaffolds called benzodihydrofuran (BDF) cores, found in natural products and drug candidates. There is now an opportunity to pioneer the study of C-H insertion reactions to form 6-membered ring products, expanding the scope of the current rhodium-catalyzed C-H insertion methodology. Successful preliminary results encompassed the creation of the 6-membered analogs: isochromans and tetrahydroisoquinolines (THIQs). Most substrates will start from 2-iodobenzyl alcohol. The nitrogen substrates will be created from a coupling reaction with benzaldehyde to form a ketone. Contrarily, the oxygen substrates are created by bromination followed by lithium-halogen exchange to form the ketone. The ketone is then transformed into the hydrazone for oxidation to the diazo in situ. Upon addition of the rhodium catalyst, a metal carbene will form to undergo intramolecular C-H insertion for products. Research is currently ongoing to expand the scope of isochromans and THIQs.

Viscosity of Cross-Linked Alginate Microcapsules (CLAMs) in Water as Related to Soluble Alginate in Solution

Julia Cunniffe

Sponsor: Tina Zicari, Ph.D.
Biological & Ag Engineering

Cross-linked Alginate Microcapsules (CLAMs) improve the stability and delivery of cargo by physical encapsulation. CLAMs are produced in the Jeoh laboratory by a patented spray-drying technology that allows alginate and calcium to cross-link at scaled volumes in limited steps. They may be used in the food industry to improve oil stability as well as in agriculture to deliver bioactive ingredients to soil. CLAMs are also used to introduce materials to cosmetics and control their release over time. As CLAMs may often be applied to these fields in aqueous suspensions, it is important to determine the suspension viscosity as a function of cross linking in the CLAMs. Lower extents of cross-linking may improve cargo release, but complicate operations such as mixing, pumping, and spraying. This study includes viscosity measurements of both alginates and CLAMs at different concentrations in aqueous solutions. The CLAMs were created at both high and low cross-linking extents by varying the calcium contents before formation. Here, viscosities of CLAMs in water at 2%, 5%, and 10% (w/v) were immediately measured by a Brookfield Viscometer and compared to the viscosity measurements of the powder suspended in water after 2 hours.

Compression Strength of Alkali-Activated Materials as Cement Alternatives

Patrick Cunningham

Sponsor: Sarah Miller, Ph.D.
Civil & Environmental Engr

Cement production accounts for roughly 8% of anthropogenic (human-caused) greenhouse gas (GHG) emissions. With a general consensus in the scientific community that GHG emissions should be reduced, alternatives to GHG intensive materials and processes are being explored. A promising alternative to traditional cements are alkali-activated materials—a combination of pozzolanic materials and an alkali-reactor. To better understand the potential of these alternatives and identify promising combinations of pozzolans and alkali-activators, mortar specimens with varying amounts of pozzolanic materials (natural pozzolan, fly ash, and slag) were prepared with different alkali-activators. Additionally, mortar specimens with varying cement proportions and mortar specimens with varying proportions of cement and pozzolanic materials, without an alkali-activator, were prepared. The specimens were cured at 100-percent humidity and tested for 7, 14, and 28-day compressive strength. In preliminary tests, the selected materials all reacted with the alkali-activators to form cementitious materials with varying speeds of activation and compression strengths. While still preliminary, this data will provide a more thorough understanding of the reaction speeds and compression strengths of the different alkali-activated material combinations and influence future research into the feasibility of these materials as concrete alternatives.

Gyrification Index Measurement in Children with Fragile X Premutation and Normal Alleles

Merna Danial

Sponsor: Susan Rivera, Ph.D.
Psychology

Fragile X-associated tremor/ataxia syndrome (FXTAS) is a late onset neurodegenerative disorder observed when an individual has a premutation (PM) in the fragile X mental retardation 1 (FMR1) gene. Premutations are characterized by 55-200 CGG repeats which is an unstable mutation that can expand and lead to Fragile X syndrome in later generations. Whereas, a normal FMR1 gene is characterized as having less than 45 CGG repeats. Gyrification index is a way to quantify the cortex buried in sulcal folds and is a tool that can be used to identify possible cortical complexity abnormalities that may be present. Large gyrification indices are indicative of extensive cortical folding. In this study, the local Gyrification Index (IGI) is measured using gathered MRI scans from a sample of children ages 7-12 years old. It is predicted that children with Fragile X premutation will have significantly different IGI's than children with normal alleles. Therefore if significant results are obtained from this study, they would provide a potential early biomarker that can be used to predict later onset of FXTAS.

Phosphorylation of S181 Converts Rbm24 From a Repressor to an Activator of p53 mRNA Translation

Danielle De Anda

Sponsor: Xinbin Chen, Ph.D.
VM: Surg/Rad Science

The global number of new cancer cases will increase to 22 million in the next two decades. The p53 transcription factor, which regulates the cell cycle and apoptosis, is commonly mutated in cancer. Rbm24 and Rbm38 are RNA-binding proteins that both regulate, and are regulated by, p53. Rbm24 and Rbm38 have sequence similarity, and both interact with p53 mRNA. Rbm38 is known to be a repressor of p53. However, when phosphorylated, Rbm38 becomes an activator of p53. Because the phosphorylation site in Rbm38 is conserved as S181 in Rbm24, I hypothesized that phosphorylation of S181 of Rbm24 activates p53 expression. Plasmids containing Rbm24 were used for site directed mutagenesis to create non-phosphorylatable S181A and phosphor-mimetic S181D versions. These mutants and a wild-type control were then used to transiently transfect cancerous cells, and expression of Rbm24 and p53 was measured using Western blot analysis. I found that wild-type Rbm24 repressed p53 expression. S181A, like wild type Rbm24, repressed p53 expression. However, unlike wild-type Rbm24, phosphor-mimetic S181D increased p53 expression. These results support my hypothesis that phosphorylation of S181 converts Rbm24 from a repressor to an activator of p53.

Chemoenzymatic Synthesis of Sialyl Lewis X, A Biologically Important Tetrasaccharide, and the Cloning and Characterization of Enzymes for Carbohydrate Synthesis

Natalie Deforest

Sponsor: Xi Chen, Ph.D.
Chemistry

Sialyl Lewis X (sLex) is a tetrasaccharide that plays important roles in cell-cell signaling, immune regulation, inflammation, and cancer metastasis. Because of the biological significance of sLex, it is important to develop effective synthetic methods to produce this compound with adequate purity in large scale to study its function in various biological process. Due to the presence of sialic acid and fucose in its structure, this molecule is a challenging target for traditional chemical synthesis. By incorporating enzymes into synthetic schemes, termed chemoenzymatic synthesis, the flexibility of traditional chemical synthesis can be augmented with more regio- and stereospecific enzymatic conversions to yield the desired synthesis target in a highly efficient manner. Described here is the one-pot multi-enzyme (OPME) synthesis of sLex tetrasaccharide Neu5Aca2-3Gal β 1-4(Fuca1-3)Glc β ProN₃ using the chemoenzymatic method, which avoids the use of high cost sugars-nucleotides and the purification process of the intermediates. Also described is the cloning and characterization of enzymes that can be used in the chemoenzymatic synthesis of biologically important carbohydrates.

Impact of Qualitative Research Experience on Pre-Health Undergraduate Students

Jenna Dekeater

Sponsor: Patrick Romano, M.D.
MED: Div Of Internal Med

Every year, thousands of pre-health students seek research experiences to bolster their applications to professional health schools and demonstrate their commitment to the field. Due to lack of exposure, qualitative research forms a tiny minority of these experiences in comparison to other forms of research. Recently, a qualitative study at the UC Davis School of Medicine, in conjunction with 41 pre-health students at the undergraduate campus, examined the role of student-run clinics in providing patient access to healthcare. The UC Davis School of Medicine operates seven student-run clinics and several affiliated clinics, each serving a different high-risk patient population. By engaging in qualitative research, students gained exposure to public health concepts, engaged in extended interviews with patients, and also learned interviewing and coding techniques. We designed a survey intended to gain insight into the students' experience of engaging in qualitative research, with hopes of learning how or if the process affected the students' perceptions of professional healthcare roles. Our findings could demonstrate the significance of such experiences in preparing pre-health students for future career goals.

Seize the Frame: Striving for Certainty Enhances Reframing Effects

Angelique Delarazan

Sponsor: Alison Ledgerwood, Ph.D.
Psychology

Considerable research has shown that negative and positive frames shape people's judgments and decisions. Yet people often encounter information that has been framed in different ways over time. A growing body of research suggests that certain frames, once encountered, tend to stick in the mind and limit how much people's attitudes change in response to reframing. The present research set out to identify individual differences that may influence how much people's attitudes change in response to reframing. In particular, across three studies, we examined whether individual differences in Need for Closure (NFC)—the tendency to prefer certainty over ambiguity—influence attitude change. Studies 1 and 2 revealed greater attitude change among individuals higher in NFC, $B = 5.12$, $SE = 1.50$, $p < .001$ and $B = 3.36$, $SE = 1.50$, $p < .05$. Study 3 is planned to manipulate NFC through imposing time pressure. Implications for how individuals high in NFC tend to “seize” on current frames rather than “freeze” on past frames are discussed.

Ecology and Phenotype of *Plantago lanceolata* Across a Latitudinal Gradient

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. Our study uses the protocol of PlantPopNet, an international project which aims to develop theory about the spatial dynamics of plant populations using data from *P. lanceolata* from populations around the world. At our site in Davis, CA, we will measure traits including flower characteristics, phenology, and physical dimensions of plants along transects. We will also record density within square meter plots. We will then compare fitness-related traits of *P. lanceolata* between three locations along a latitudinal gradient (Davis, CA, Oregon, and British Columbia) and between the past three years of survey data. We will use statistical tests to analyze the differences between these data for each region and each survey year. Past years' results suggest that differences exist between phenotypic traits in each region, and we predict there will be variation among survey years. The results of this study can be used to demonstrate geographical variation in *P. lanceolata*, and baseline data allows us to ask questions in the future about the factors influencing these traits, including climate, herbivory pressure, and disease.

One Health Learning in Global Disease Biology

Vanshika Desai

Sponsor: Daniel Melzer, Ph.D.
University Writing Program

The public health issues that our world faces today require an interdisciplinary approach to problem solving, one that not only addresses the health of humans, but also of animals and the environment. This form of integrative and collaborative problem solving is recognized globally by several influential programs and organizations such as the Center for Disease Control and Prevention and is termed "One Health." The UC Davis Global Disease Biology Program (GDB) aims to practice One Health learning. As it is a fairly new major, I analyze whether or not the components of GDB contribute to the overall goal of One Health learning. To understand more about the program's goals and values, websites such as the GDB major page and course curriculum were analysed. In order to determine if the goals and values were being met, students were interviewed and surveyed. Additionally, other components such as the Davis GDB Club and Daily Newsletter were observed. I have found that the goals and values of the GDB Program at UC Davis are indeed One Health focused. By providing a curriculum framed around One Health learning, the GDB Program proves its dedication to solving many of the world's most complex and difficult issues.

Characterization of *Setaria*-Specific Novel Compounds Produced by Cytochrome P450s

Puja Dhanota

Sponsor: Philipp Zerbe, Ph.D.
Plant Biology

Diterpenoids are a major class of plant secondary metabolites that mediate plant-environment interactions under abiotic and biotic stressors. We had previously characterized the initial steps in diterpene biosynthesis catalyzed by the diterpene synthase family in *Setaria italica* (Foxtail Millet) an ancient food crop and an emerging model for biofuel grasses. Pearson Correlation data from Phytozome (JGI, U.S. Dept of Energy) suggested that cytochrome P450 monooxygenases (P450s) – SiP450-1 and SiP450-2 are also involved in diterpene metabolism unique to *Setaria* and potentially involved in stress tolerance. Using an *E. coli* terpene production platform, we screened for the activities of SiP450-1 and SiP450-2 with diterpene substrates produced by *Setaria* diterpene synthases. We show that the *Setaria* diterpene synthase pair SiTPS9 and SiTPS8 produce abietadiene and sandaracopimaradiene which is later converted to novel hydroxylated compounds via SiP450-1. Ultimately, we aim to isolate novel compounds produced by SiP450-1, elucidate their structure using nuclear magnetic resonance (NMR), and determine their role in mitigating stresses such as drought or pathogen attack using plant-stress studies and anti-fungal assays.

Distinct Molecular Mechanisms of Lipotoxic Damage to Brain Hippocampus Microvasculature in Low-Density Lipoprotein Receptor Knock Out Male and Female Mice Models

Janeet Dhauna

Sponsor: Amparo Villablanca, M.D.
MED: Div Of Internal Med

Alzheimer's disease (AD) is the most common form of dementia, making up 80% of the cases. Altered neurogenesis of hippocampal neurons is an important early event in AD, causing the brain to be more susceptible to cerebrovascular injury. Hyperlipidemia causes cerebrovascular injury, which likely contributes to AD pathogenesis. Very little is known about the mechanisms of lipotoxic damage to brain microvasculature in males, and no studies have been done on females. Women have higher risk of AD than men. Using hyperlipidemic male and female low-density lipoprotein receptor knock out (LDLR KO) mice, we showed that hyperlipidemic stress and western diet causes up-regulated activating transcription factor 3 (ATF3)-dependent inflammatory, oxidative stress, vascular inflammation and apoptotic pathways specifically in hippocampus brain microvessels of males but interestingly not in females. Hence in order to study the molecular mechanism of lipid-induced cerebrovascular injury in female hippocampus microvessels, we did microarray analysis and showed that among 34,472 genes, 3369 genes were differentially expressed (DE) between the different diet and genotype groups. We categorized the top 20 DE genes from these groups and found that most were epigenetic genes.

Reconstructing Dietary Patterns at a Middle Period Site in Contra Costa County

Lucia Diaz

Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

This study focuses on reconstructing the ancient dietary practices of a hunting and gathering population in Contra Costa County. The site was occupied during the "Middle Period" or approximately 1800 to 1100 years ago by ancestors of the Ohlone. The site was excavated in the 1950s by archaeologists at UC Berkeley in anticipation of expanding urban development. Using skeletal collections curated at UC Berkeley, we examine stable isotope signatures of carbon and nitrogen in serial samples of permanent first and third molars, to reconstruct dietary patterns of a sample of males and females. Since, teeth grow sequentially in layers, this allows us to examine diet in approximately 1/2-year intervals from the age of 0 through 22 years. This includes the period of weaning and early childhood (age 5-9 years) which are often distinctive compared to adult diets. The isotopic data show that people had varying access to San Francisco Bay aquatic foods, such as shellfish and fish, which are distinctive in their carbon isotopes. While some individuals consumed greater amounts of bay foods, others had greater input from terrestrial environments. Furthermore, radiocarbon dates suggest that diets shifted to greater terrestrial food consumption over the centuries.

Using Fullerene Cocrystallization as a Purification Method

Isaac Diaz

Sponsor: Alan Balch, Ph.D.
Chemistry

Fullerenes are a class of hollow carbon cages generally comprised of multiple carbons bonded in pentagonal and hexagonal rings. Our lab focuses on the structural determination of fullerenes. It is difficult to determine the structure, as fullerenes are highly symmetrical and rotate in the solid state. To prevent the free rotation, we have introduced the use of a cocrystallization agent. I report my study on the cocrystallization of C₆₀ and C₇₀ with cobalt(II), copper(II), nickel(II), and zinc(II) ionically bonded to OEP (where OEP is the dianion octaethylporphyrin). Additionally, I have conducted experiments to determine if preferential crystallization occurs when I combine different ratios of C₆₀ and C₇₀ with the metal(OEP) compounds. I hope to implement this method as a means to purify crude material. Typically, it takes extensive rounds of HPLC to make these fullerene cages. If we could co-crystallize the compounds, analyze the structure, and separate the compounds using dissolution, we could vastly improve the efficiency of isolating C₆₀ and C₇₀ fullerenes. This would ultimately lead to the reduction of both time and cost in the purification process.

What Do Collectors Want? The Effect of Aesthetics Versus Functionality on Secondary Market Prices for Collectibles

Matthew Dimon

Sponsor: Giovanni Peri, Ph.D.
Economics

Technology has become ubiquitous across the modern world. Many commonplace objects now serve many functions due to their enhanced technological abilities. These additional features impact people's willingness to buy such products, but how much does it impact the price of these goods? And how can consumers, as investors in these goods, expect to make a return on these items given their enhanced functionality? My research focusses on this question by looking at the secondary-market prices of Nintendo's collectible figurine line: Amiibo. Amiibo are an interesting good in that they have both a clear function as collectibles (that is, they are physical models of Nintendo's most popular characters) and as useful pieces of technology in Nintendo's video games. Both of these functions would likely impact the price. My analysis looks at the impact of the release of new games on the resale value of these Amiibo, taking new games as a proxy for the additional functional capacities of the Amiibo when games are released. I find that while the aesthetic features of Amiibo have a significant impact on the price of an Amiibo in the current period, new game releases only significantly impact price after a lag of two quarters.

Evaluating the Role of Mer2 SUMOylation During Meiosis

Alexander Ditzel

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

Homologous Recombination (HR) is a high-fidelity DNA double-strand break (DSB) repair mechanism that plays essential roles in maintaining genomic integrity in somatic cells, and guiding chromosome segregation in meiotic cells. Meiosis is a specialized reductive cell division in which a diploid parent undergoes two rounds of division to create haploid cells, which differentiate into gametes. Mer2 is a protein known to be essential for the initiation of meiotic HR through programmed formation of DSBs and Mer2 mutants cells are unable to produce viable spores. Meiotic HR is strictly regulated through post-translational modification of the proteins involved. SUMO (Small Ubiquitin-like Modifier) is a post-translational modification that is attached to specific lysine side chains on target proteins to modify their stability and function. We found that Mer2 was highly SUMOylated at the time of meiotic DSBs formation and mapped the modified sites by mass spectrometry. To elucidate the role of Mer2 SUMOylation, we created a SUMO-no-more (SNM) mutant allele, defective for SUMO modification. Mer2-SNM was expressed in mutant cells, which were able to undergo meiosis. However, all spores were inviable and DSB formation was abolished. These data indicate an unanticipated role for SUMOylation in the initiation of meiotic HR.

Zeta Potential of Unilamellar Liposomes in Ionic Solutions

Diego Gabriel Docto

Sponsor: Tonya Kuhl, Ph.D.
Chemical Engineering

Liposomes, consisting of one or more phospholipid bilayers to form a spherical vesicle, are of importance to various fields including cellular biology, colloidal systems, food emulsions, and drug delivery applications. In this study, the maximum charge carried by lipid bilayer membranes was investigated by measuring the zeta potential of small unilamellar liposomes as a function of mole fraction of charged lipid species in the membrane. The liposome charge was measured in low salt conditions of 0.5 mM NaNO₃ as well as in high salt, physiological conditions - pH 7.4 phosphate buffer solution. The results revealed that in both low salt and physiological conditions, increasing anionic lipid concentration increased the liposome zeta potential but reached a saturation charge at surprisingly low mole fractions of the charged lipid (< 20 %). This behavior and moderation of membrane charge density is important for understanding cellular activity and apoptosis (recognition of cell death) in biological systems.

Effects of Early Vision Loss on Tactile Discrimination in *Monodelphis domestica*

Heather Dodson

Sponsor: Leah Krubitzer, Ph.D.
Psychology

The mammalian neocortex has a remarkable capacity to alter its functional organization and connectivity in response to sensory loss, particularly if this loss occurs very early in development. The marsupial, *Monodelphis domestica* (short-tailed opossum), is a good animal model for the study of cortical plasticity because its nervous system is highly immature at birth, allowing us to perform experimental manipulations to the sensory receptor arrays at a very early developmental stage, equivalent to embryonic stages in placental mammals. Previous studies from our laboratory have demonstrated profound alterations in cortical functional organization and connectivity for short-tailed opossums in which visual inputs were removed through bilaterally enucleation on postnatal day 4; however, the behavioral consequences of these changes were unknown. Bilaterally enucleated and sighted control opossums were trained to perform a two-alternative forced choice tactile-mediated task, involving the discrimination of sandpapers of different roughness. Bilateral enucleates significantly outperformed sighted controls, discriminating small differences in roughness with greater accuracy. This suggests that following the loss of vision early in development, structural and functional reorganization of the neocortex could allow for behavioral compensation through improved performance using spared sensory modalities, like the somatosensory system.

Raman Scattering Investigations of Intercalation Controlled Charge Density Waves in Bi_2Se_3

David Dominguez Aguilar

Sponsor: Kristie Koski, Ph.D.
Chemistry

Charge density waves (CDW) are of central focus in materials research for their exotic physical manifestation, unusual phonon properties, and potential ability to carry an electric charge. It is hypothesized that it is possible to systematically create and manipulate charge density waves at room temperature in Bi_2Se_3 , a two-dimensional (2D) layered material, by placing zero-valent transition metals in-between the layers of Bi_2Se_3 . A CDW in Bi_2Se_3 can be indirectly studied by spectroscopically observing “soft” phonon mode in the material. The phonons associated with distorted lattices become an acoustic “soft” phonon which interacts with photons at ultra-low frequencies. Through chemical intercalation techniques, copper and other transition metals were placed into the band gaps of Bi_2Se_3 and investigated using Raman spectroscopy. Bi_2Se_3 intercalated with ruthenium was found to exhibit soft phonon modes. Further investigation will utilize a homemade ultra-low frequency Raman system to observe the “soft” phonon modes. This investigation will provide fundamental information on CDWs in chalcogenides and how they can be controlled through the chemical intercalation of transition metals.

Investigating the Effects of Cancer Mutations on Doublecortin-like Kinase 1 (DCLK1) Self-Regulation via Auto-Phosphorylation

Ashlyn Downing

Sponsor: Kassandra Ori-McKenney, Ph.D.
Molecular & Cellular Bio

Mutations in the microtubule-associated protein, doublecortin-like kinase 1 (DCLK1), are strongly correlated with the development of a variety of different cancers. Previous work generated in the Ori-McKenney lab has demonstrated that DCLK1 regulates itself via auto-phosphorylation to modulate both its kinase activity and microtubule-binding affinity. Here, we sought to determine the mechanism of DCLK1 auto-regulation, and elucidate the effects of cancer mutations on the kinase activity, microtubule binding affinity, and auto-regulation of DCLK1. To approach this problem, we expressed and purified wild-type DCLK1 protein, as well as several cancer mutants of DCLK1. We used single-molecule fluorescence microscopy and solution biochemical assays to determine how each cancer mutant affects the microtubule binding affinity of DCLK1. In addition, we performed in vitro kinase assays to assess how each cancer mutant affects the auto-phosphorylation, and therefore auto-regulation, of DCLK1. Finally, we plan to analyze the localization pattern of wild-type DCLK1 during the progression of mitosis using retinal pigment epithelial cells (RPE1) and an anti-DCLK1 antibody. Overall, this study will provide valuable insight into how DCLK1 regulates its kinase and microtubule binding activities, and determine how cancer mutations alter this regulation.

Variation in the Colonization of Lettuce Roots by *Fusarium oxysporum* f. sp. *lactucae*

Lauren Downing

Sponsor: Thomas Gordon, Ph.D.
Plant Pathology

Fusarium wilt of lettuce, caused by *Fusarium oxysporum* f. sp. *lactucae* (FOL), is a source of economic loss for lettuce growers in California and Arizona. Development of FOL begins with infection of the plant root cortex, so plants that sustain fewer cortical infections are anticipated to have a lower risk of disease. In this study, recombinant inbred lines (RILs) of lettuce were measured for differences in the frequency of infection of roots by FOL to observe heritability of resistance to root infections, but results indicated no significant differences in this trait among RILs. To investigate whether host susceptibility affects the pattern of colonization by FOL, lettuce roots of resistant and susceptible types were inoculated with FOL and stained with lactophenol cotton blue at 24, 48, 72, and 96 hours post-inoculation. Work is underway to compare differences in the initiation of root infections by FOL in resistant and susceptible lettuce cultivars using confocal and light microscopy. This research on the differences in root infection process among cultivars will have broad applicability for improving genetic resistance against Fusarium wilt.

Behavioral and Physiological Indicators of Stress in Restrained Ewes

Shayna Doyle

Sponsor: Kristina Horback, Ph.D.
Animal Science

Livestock are subject to various procedures, including processing and transport, which could induce a negative state of fear or stress in the animal. Determining when animals are experiencing a negative state can be difficult, especially with a stoic prey species like sheep. The ability to assess when animals are in a stressed versus calm state can be beneficial for producers to prevent stress-induced illness, and ensure animal and human safety. Previous studies have reported strong associations between ewes with docile or calm temperaments and increased feed efficiency, growth rate, meat quality, wool growth, and overall health. To examine whether the response of sheep to physical restraint is consistent over time, and whether behavioral indicators of a negative state are associated with physical measurements, twenty-eight ewes were restrained in a squeeze chute for 10 minutes once a week for a 5-week period. Measurements include behavior while restrained in chute, speed of exit from chute, percentage of eye white exposed while restrained, respiration rate and heart rate while restrained. This study provides insight into sheep behavior and welfare, through the development of an objective measure of stress that is easy to use and applicable in a variety of settings.

Targeted and Suspect Analysis of Anthropogenic Chemicals in Conventional Versus Non-Conventional Soil Amendments Using High Resolution LC-ESI-qTOF-MS

Aimee Drew

Sponsor: Thomas Young, Ph.D.
Civil & Environmental Engr

Nutrient recycling through the use of soil amendments is an integral piece of soil health and fertility. Feedstocks such as compost and dairy manure are widely accepted agricultural fertilizers. Biosolids and sewage sludge from wastewater treatment plants however, have recently entered the spotlight as potential amendments. This study aims to identify the differences in anthropogenic chemicals found in sewage sludge-based amendments compared to those found in more widely accepted amendments. Seven samples were collected in Northern California for this study: (1) organic dairy manure, (2) non-organic dairy manure, (3) green-waste compost, (4) food waste compost, (5) Class A sewage sludge, (6) Class B sewage sludge, and (7) composted sewage sludge. A targeted analysis was conducted using ultra sonication and solid phase extraction coupled to High Resolution LC-ESI-qTOF-MS. Compounds of interest were limited to four classes, pharmaceuticals/antibiotics, personal care products, pesticides, and endocrine disruptors, and were quantified across all samples. In addition, samples underwent qualitative screening, comparing against a spectral library of representative pesticides, forensic toxicants and common water contaminants.

Composition of Soil Microbiomes in Tomato Fields Differ in Response to Conventional Versus Organic Management Practices

Evan Dumas

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

The impacts of conventional versus organic management practices on the dynamics of soil microbial communities in row crops are poorly understood despite the growing volume of research into plant microbiomes. Organic management uses compost amendments that add carbon, as well as essential plant nutrients, without the addition of synthetic pesticides; in contrast, conventional management utilizes mineral fertilizers, no-carbon inputs, and synthetic pesticides. We will analyze a time-series of microbial data collected every 20 days in tomato plots at the Russell Ranch Sustainable Agriculture Facility over a tomato growing season (March-October). Changes in microbial community composition will be determined from the relative abundance of 16S rRNA gene copies of bacteria and archaea. Fluctuations in the composition of communities will be compared to the timing of specific management practices such as inputs of fertilizer, compost, or pesticides; tillage; and irrigation water to reveal those microbial taxa that increase or decrease in response to these disturbances. Knowledge of how microbial communities respond to farming operations will help inform the development of practices to increase soil health as well as crop yields.

Increasing the Fitness of Surrogate *E. coli* by Serial Passage on a Host Crop

Tia Dunbar

Sponsor: Trevor Suslow, M.D., Ph.D.
Plant Sciences

Nonpathogenic bacteria are often used as surrogates to evaluate a diversity of objectives related to predicting pathogen survival, persistence, dispersal, and effectiveness of various process controls. Surrogates are important for open environment research and on-site studies at commercial facilities. A validated surrogate should be genetically stable and closely mimic the environmental fitness and response of the target pathogen to a preventive control. We are further assessing the survivability of nonpathogenic *E. coli* isolates (TVS 353, 354, and 355) on baby spinach. At this stage, until genomic sequences are available, differential genotyping is accomplished using Repetitive Extragenic Palindromic Sequence Polymerase Chain Reactions (REP-PCR), resulting in distinctive and stable band patterns over multiple doublings. Spinach will be mist-inoculated with log 6 CFU mL⁻¹ of a cocktail of the *E. coli* strains. Plants will be held at 20C and high RH for 72h, then shifted to low RH to induce desiccation stress over 72h. Surviving *E. coli* will be washed from leaves and concentrated using membrane filtration, then re-inoculated in three serial direct-transfers onto new spinach plants. At each cycle, purified *E. coli* colonies will be characterized by REP-PCR. Our aim seeks to determine if fitness can be improved for future field trials.

Formal and Informal Points of Access to Transition Resources in the Transgender and Gender Nonconforming Communities

Alida Duncan

Sponsor: Ryan Cartwright, Ph.D.
American Studies

There are very few representations of transgender individuals, let alone other gender nonconforming identities, in mainstream media. While concerning on its own, this lack of media representation is indicative of a much larger societal and institutional ignorance surrounding transgender and gender non-conforming (T/GNC) gender identities and their holistic wellbeing. This injustice continues to be perpetuated by healthcare providers who bar access to vital resources regarding transitioning to T/GNC communities based on inaccurate and violent assumptions. What kinds of information do transgender and gender non-conforming (T/GNC) young adults receive about transitioning-either medically or socially-and where are they getting this information? Using IRB approved interview data from T/GNC adults and health providers, this research will identify what kinds of medical information young adults have access to and how much information circulates. It also examines resources and networks that these communities build for and distribute among themselves in the absence of formal recognition of their identities. This research is sociological in nature as it is interview-based but recognizes the importance of utilizing feminist and gender studies based theoretical frameworks for analyzing social processes and institutions.

Ozone-Induced Inflammation in the Developing Rat Lung

Andrew Duong

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

More than half the American population is exposed to unhealthy levels of ozone, a highly reactive gas that damages the lungs if inhaled at unhealthy levels, especially early in life. This project's goal is to define the effects of early life ozone exposure on lung inflammation. Tests were done on 4 groups of rats (males(M) and females(F)) that were exposed to ozone (O) or filtered air (FA) in early postnatal period and assessed at 4 or 8 weeks (FA4, FA8, O4, O8). At necropsy, lungs were fixed with paraformaldehyde, embedded in paraffin and sectioned. Hematoxylin and Eosin stain were used to identify tissue inflammation. The distribution and abundance of "bronchus-associated lymphoid tissue" (BALT) were defined. BALT forms during inflammation or infection, thus high levels of BALT indicates damage to pulmonary tissue. The results indicate O4 yielded the highest levels of BALT > than O8, FA4, and FA8. Lung lavage fluid was obtained and prepared for lung cell differentials. Results indicate that neutrophil levels in O8F were > than O4M, O8M, and O4F. All ozone treatments produced significantly higher levels of neutrophils than filtered air treatments. We conclude that ozone exposure in early life stimulates lung inflammation.

Implementation of Positive Inclusivity in Design

Marielle Ednalino

Sponsor: James Housefield, Ph.D.
Design Program

Visual communicators are sources of information that have the potential to connect societies and communities. However, such communication does not necessarily reveal the true agenda behind their presentation. Amidst rising social tension on campus, visual messages increasingly have become vehicles for oppression, segregation, and discrimination. In response, my creative work and scholarly research seek to understand how such imagery could achieve opposite goals. My work creates temporary interactive spaces that encourage audiences to contemplate societal messages and promote new perspectives. The exhibition is constructed in two parts. First, vinyl wall imagery communicates social issues relevant to campus life. Second, graphic posters placed on top contradict the messages of the vinyl. The exhibit uses this juxtaposition to promote increased positive awareness and a recognition of how humans are incredibly "editable." My research emphasizes how the human brain combines information from visual experiences, synthesizes it, and draws on past experiences to provide a manipulated perspective of the world. By juxtaposing word and image we can re-orient individuals and encourage them to consider social situations in new ways. The gap between the human reception of an image and the actual reality of experience thus opens a space for conversation about society and individuals.

Proteasome Function is Altered in Long-Lived Ames Dwarf Mice

Emily Eijansantos

Sponsor: Aldrin Gomes, Ph.D.
Neuro Physio & Behavior

Ames dwarf mice exhibit prolonged longevity and delayed symptoms of aging compared to normal mice, and therefore have been of particular interest in studies of aging. These mice possess an autosomal recessive mutation that causes severe dwarfism and produces a long-lived phenotype that allows them to live an average of 50% longer than their normal siblings. In recent years, there has been an increase in research surrounding the ubiquitin-proteasome system (UPS) and its role in cardiovascular physiology and age-related cardiovascular decline. There is also evidence in another long-lived rodent, the naked mole rat, which suggests that its increased longevity may be linked to its increased proteasome expression. Furthermore, increases in immunoproteasome expression have been shown to correlate with increased life-span across species. I hypothesized that the heart lysates of Ames dwarf mice will have increased immunoproteasome expression and activity compared to wild-type mice, as well as higher levels of chaperones and UPS components. Although no difference in the 20S component of the proteasome was detected, the immunoproteasome subunits were significantly decreased in hearts from Ames dwarf mice relative to wild-type mice. We are currently measuring immunoproteasome activity in these animals.

Representation of Mental Illness Through Autobiographical Interactive Digital Media: Impacts on Viewers and Creators

Violet Elder

Sponsor: Glenda Drew, M.A.
Design Program

Design is a very personal practice, one in which designers approach each project informed by their own experiences, emotions, and interests. It is also a field that affords interpretation at many levels, holding options for different meanings for many distinct individuals. All of my design work is informed and influenced at some level by my own mental illness. Given the significant lack of cultural understanding of mental illness, design's potential to provide accurate and thorough representations holds social and cultural power. Digital interactive media, especially, has significant potential to communicate experiences. While making a number of autobiographical, interactive media pieces that convey some element of my experiences of mental illness, I will be researching how interactive media may positively impact other mentally ill individuals, as well as how the creation of said media might support my own development, serving therapeutically, in a manner akin to music therapy. Researching literary traditions of autobiographical work, existing autobiographical media, and critical media theory, I will design media pieces for a target audience of other mentally ill individuals. I will maintain devlogs that serve to communicate my processes and impressions, and I will playtest each piece with target audience members.

Investigating the Interactions Between Glucocorticoid and Thyroid Hormone Signaling in Amphibian Metamorphosis: Potential Impacts of Pharmaceuticals and Environmental Chemicals

Cody Ellis

Sponsor: John Furlow, Ph.D.
Neuro Physio & Behavior

Thyroid hormone (TH) is essential for developmental and homeostatic processes, including amphibian metamorphosis. Prior research suggested that other hormones, particularly glucocorticoids, potentiate TH action. Thus we are investigating how glucocorticoid receptor (GR) agonists or antagonists might affect TH activity during development. Metamorphosis in *Xenopus laevis* is an accessible developmental model for TH and glucocorticoid interactions. Usually, tadpoles naturally beginning metamorphosis are used to study TH action in the organism; however, to reduce time and cost, and provide a large number of uniformly developing tadpoles, induced metamorphosis in one-week old tadpoles will be used. We will quantify the effect of TH and glucocorticoids on metamorphic programs, alone and in combination, by morphometric analysis of tail and gill regression as well as brain region expansion will be used. To test the effects of these ligands on gene expression, we will use our transgenic *X. laevis* line that carries a luciferase reporter gene regulated by TH via *X. laevis* thibz TREs. If our hypothesis is correct, GR agonists will potentiate TH induced luciferase activity, while GR antagonists will inhibit TH induction of the reporter gene. Such findings would indicate that the two endocrine signaling systems are converging at a common gene expression pathway.

Exploring Student Interactions with Graduate and Undergraduate Teaching Assistants in Chemistry Laboratories

Daniel Erenstein

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 TA's and the ES's, 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 TA's or ES's and how the teaching styles may vary between the two lab instructors. Student inquiries and TA/ES 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. The results will also be used to assess the overall success of the Emerging Scholars program and suggest improvements to enhance the role of ES's in the labs.

Identifying Fusion Proteins in Epithelial Cells

Katherine Erickson

Sponsor: Soichiro Yamada, Ph.D.
Biomedical Engineering

Cell-cell fusion is a rare event in multi-cellular organisms, but plays a key role in events like zygote and muscle formation. While only specialized cells are thought to undergo cell-cell fusion, we have previously shown that normal epithelial cells can fuse, albeit only at self-contacts, and may express unidentified fusion protein(s). We are using the viral protein p14FAST, known to induce cell-cell fusion, as a "bait" protein to identify other fusion-related proteins. With p14FAST expression, large syncytia (up to 30 nuclei) were observed, suggesting that p14FAST is functional. Our hypothesis is that this p14FAST protein hijacks endogenous proteins to induce cell fusion, and these proteins may also aid membrane fusion at self-contacts. To identify these helper proteins, I constructed BioID2-tagged p14FAST, which biotinylates nearby proteins. We purified and identified these proteins with mass spectrometry. Top candidate proteins included EPS8, IQGAP, RICTOR, CLINT1, and FARP1. To determine whether these proteins are required for fusion, we will assess cells' fusion efficiency in their absence. With key fusion proteins identified, we will be in a better position to understand how cells fuse at the self-contact as well as in zygote and muscle formation.

Exploring the Anti-Cancer Effect of CMC2.24, A Novel Curcumin Derivative, in Combination with Gemcitabine in Pancreatic Cancer Cells

Yasmin Esparza

Sponsor: Gerardo Mackenzie, Ph.D.
Nutrition

Pancreatic cancer is a leading cause of cancer death. Gemcitabine, currently one of the standard drugs used to treat pancreatic cancer, has only shown minor improvement in patients' survival. Thus, new treatment approaches are urgently needed. Preliminary studies of our laboratory have shown that Chemically Modified Curcumin (CMC2.24) reduces the growth of pancreatic cancer cells in culture and in animal models of pancreatic cancer. Although CMC2.24 alone appears as a promising agent for pancreatic cancer, its efficacy may be improved if combined with gemcitabine. We hypothesized that CMC2.24 enhances gemcitabine's effect on reducing cell growth and will be a successful adjuvant therapy for pancreatic cancer. Pancreatic cancer cells, MiaPaCa-2 and Panc-1 cells, were treated with CMC2.24 and gemcitabine alone, or in combination, and cell growth assays were conducted at 48 and 72 hours after treatment. Preliminary data show that CMC2.24 and gemcitabine alone, decreased cell growth in a concentration-dependent manner; and, when combined, the drugs appear to have an additive growth inhibitory effect. In conclusion, CMC2.24 appears to be a strong combination partner with gemcitabine; enhancing the inhibition of pancreatic cancer growth. These results suggest that CMC2.24 may be useful as an adjuvant therapy for pancreatic cancer.

Machine Learning-Based Detection and Analysis of Calcium Sparks

Fernando Espinosa-Iniguez

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

The subcellular calcium spark is the unitary form of calcium release in numerous processes in physiological systems such as the heart and the brain. In cardiac myocytes, abnormal calcium release events are associated with pathologies such as arrhythmias and heart failure, and thus, are a critical and clinically relevant area of investigation. For many years, thresholding-based computer algorithms, such as the SparkMaster plugin for ImageJ, have served as the primary automated tool for detecting and quantitatively analyzing calcium sparks recorded using confocal laser-scanning microscopy. These algorithms, however, have been prone to various suboptimal detection limitations. In recent years, machine learning and neural network algorithms have greatly advanced computer vision-based approaches, and biological applications are only in the early stages. In this study, we present early work in the development of a novel computational method for detecting calcium sparks using a convolutional neural network on the open-source TensorFlow machine learning framework. Training the neural network on a SparkMaster-detected reference dataset of sparks from cardiac myocytes yielded detection rates that converged to SparkMaster's detection rates. Exceeding these detection rates is the ongoing goal of our investigation. Our work demonstrates early proof-of-concept for the efficacy of machine learning techniques in biological image processing.

Determination of Free Amino Group Concentration of Almond Milk During Simulated Digestion with Varying Gastric pH

Talia Estevez

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

Protein hydrolysis of food may vary by pH conditions in the stomach. The objective of this study was to determine if gastric pH influences free amino group concentration of almond milk during simulated digestion. Almond milk was soaked in water (140 g/L) overnight, blended and sieved. Almond milk was mixed with saliva (30s), gastric juice (1h), and intestinal juice (2h). During gastric digestion, a dynamic or static pH model was implemented. The dynamic model simulated distal (4.9-2.0) or proximal (6.4-4.1) regions of pig's stomach after ingestion of almonds, or pH profile of adult's digestion of cow's milk (6.5-4.7). For the static model, pH was adjusted to 2, 2.5, 3, 4, 5 or 6.5. Free amino concentration was determined using the O-phthalaldehyde (OPA) assay. Free amino content was significantly influenced by gastric pH ($p < 0.0001$). At the end of gastric phase, the three dynamic models had significantly different ($p < 0.0001$) free amino concentration. The pH of gastric phase had a significant impact over free amino content during intestinal phase. Samples that underwent in vitro gastric digestion at pH 6.5 and cow's milk pH profiles had the lowest free amino groups (133.1-237.4 $\mu\text{g/mL}$).

Demarginalizing the Migrant Experience through Narratives

Liliana Estrada Torres

Sponsor: Monica Torreiro-Casal, Ph.D.
Chicano Studies

The Mexican migrant labor force has a long, troubled history in the U.S. The U.S. has direct involvement in Mexican migrant exploitation through their policing along the border, history of discrimination, and abusive labor practices. The U.S agricultural business relies on the migrant labor force from Mexico, yet dominant discourse reflects contradicting approaches to address this population. Current politicians and mainstream media depict Mexican migrant workers as a drain on the economy. Anti-migration discourses claim that Mexican migrant workers take the jobs of native-born workers despite public opinion and evidence-based research to the contrary. These dialogues criminalize, dehumanize, and perpetuate negative stereotypes. In this research, I will analyze the experiences of Mexican migrant workers in California to deconstruct anti-immigration perceptions of them. Using a resilience perspective, this study will examine Mexican migrant worker narratives for their identified contributions, challenges, and support systems. The research will use survey data collected from an ongoing UC Davis study by Dr. Monica Torreiro-Casal and Dr. Linn Normand. In illuminating marginalized migrant workers' experience, my study aims to reveal contributions, perceptions, and narratives that help reclaim their humanity through the development of counter narratives.

Automated Machine Grading in Writing

Jihane Eter

Sponsor: Daniel Melzer, Ph.D.
University Writing Program

There has been much debate in the world of writing over the efficiency of grading students' work via machine scoring. While writing instructors ranging from elementary education to university level have had major input on this topic (with the majority unanimously agreeing that this method is unreliable), I decided to analyze the advantages and disadvantages of using machine scoring by conducting my own test through an online essay grading system and observing the feedback, as well as investigating previous studies. One can ultimately note that the main difference in criteria between machine grading and human grading is the fact that the latter can identify and process ideas, both ethically and logically. In contrast, virtual grading is limited to the recognition of general grammatical aspects such as sentence structure, format, correct source citing, spelling, etc. This study examines the difference between human and computer grading, and ultimately weighs the future of machine scoring as well as the consequences it may have on English departments and administrations across all disciplines.

Understanding the Cellular Origin of Volatile Organic Compounds (VOCs) to Enable Non-invasive Rapid Lung Infection Diagnostics

Alexandria Falcon

Sponsor: Cristina Davis, Ph.D.
Mechanical & Aerospace Engr

Volatile organic compounds (VOCs) are a rich diagnostic tool that allows for non-invasive identification of conditions in biological systems. They can be used for a variety of applications, including diagnostics. However, it remains unclear of how, where, or why specific VOCs are produced from complex living organisms. The purpose of my work is to examine the VOCs resulting from the proliferation of specific strains of bacteria found within the pulmonary tract of Atlantic Bottlenose Dolphins. This work is the first VOC profile of these bacteria generated in situ, and we test if they correlate with metabolites identified in External Breath Condensate (EBC) of cetaceans with clinically confirmed illness. Solid phase microextraction (SPME) technology was used to concentrate VOCs from the headspace above cultured samples of *Pseudomonas aeruginosa* and *Staphylococcus aureus*, and the VOCs were then analyzed using mass spectrometry. Certain compounds were produced by both bacterial strains, and some compounds did correlate with metabolites seen in clinical EBC samples. The correlation of these bacterial VOCs provides a groundbreaking link in understanding the possible sources of biomarkers that can be used for a variety of diagnostic applications.

Examining Ethnic, Gender, and SES Differences in the Social Validity of Cognitive Behavioral Therapy

Helen Fann

Sponsor: Nolan Zane, Ph.D.
Psychology

This study examined ethnic, gender, and SES differences in the social validity of nine essential components of cognitive behavioral therapy (CBT): Learning the relationship between thoughts, feelings, and behavior; identifying emotions; identifying harmful/helpful thoughts; challenging harmful thoughts; changing and replacing harmful thoughts with helpful ones; understanding healthy activities; generating healthy activities; realistic selection of healthy activities; and setting future goals. The sample included 527 undergraduates (74.4% Asian American, 25.6% White American) recruited from a university research pool. Asian Americans considered 6 of the 9 treatment emphases to be less socially valid than White Americans. Many of the ethnic differences in social validity involved treatment sessions focused on the cognitive activities of CBT and the realistic selection of healthy activities. These findings support previous research indicating that Asian Americans tend to focus more on somatic factors than the cognitive aspects of mental health problems and are more likely to believe that avoiding negative thoughts enhances mental health. Orienting initial sessions to behavioral activation activities may be a more credible and effective way to implement CBT with Asian clientele. No gender or SES differences were found. This study demonstrates the utility of social validation for developing and adapting more culturally informed interventions.

Fluoroquinolone Induced Tendinopathies in Engineered Human ACL Ligaments

Daniel Farivar

Sponsor: Keith Baar, Ph.D.
Neuro Physio & Behavior

Fluoroquinolones are a class of antibiotics used to treat urinary tract, upper respiratory, and intestinal infections that have been reported to have tendinopathic side effects. These tendinopathic effects are of interest and concern because, as of 2015, fluoroquinolones were the fourth most prescribed antibiotic in the United States with 32.5 million prescriptions per year with a rate of tendon rupture of 1.2 per 10,000 prescriptions (~4,000 per year). Still after about 35 years of research, a significant knowledge gap exists in how fluoroquinolones cause tendon rupture. Currently, I am investigating the effects of ofloxacin, a specific fluoroquinolone, on the tensile strength and collagen content of engineered tendons/ligaments made from human ACL cells to determine whether this model could be used to understand the underlying biology. Thus far, results indicate that ofloxacin decreases maximal tensile load (MTL) of engineered ligaments when compared with control groups and this effect is dose-dependent. These data suggest that engineered ligaments are an appropriate model for studying the effect of fluoroquinolones on connective tissue function and may provide important mechanistic clues as to how these drugs result in tendinopathy.

Differential Noise Level Effects on Predator and Prey Behavior at Crossing Structures

Parisa Farman

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

Habitat fragmentation is causing a decline in wildlife worldwide and is one of the largest conservation challenges currently being faced by ecologists and policymakers alike. Roads are a major contributor to habitat fragmentation; they form unsafe, often impassable barriers between habitat areas, preventing movement between groups and creating small, isolated populations. To combat fragmentation due to roads, wildlife crossing structures have been widely implemented across the U.S.; however, their use and efficacy are not clearly understood. The terrestrial species that underpasses are built for tend to be sensitive to noise, making it necessary to determine how traffic noise influences their behavior. Because animals can be differentially sensitive to noise, we elected to perform an observational study to determine whether traffic noise levels have a significant impact on behavior, and whether that impact varies between predator and prey species. We will be analyzing videos from eleven underpasses, each with two camera positions, quantifying the noise levels that correspond with different behaviors as quiet/none, moderate, or loud. We will then perform a chi-squared test to determine if increasing noise level is positively correlated with vigilant or flighty behavior, and if those correlations are different for predator versus prey species.

In Vivo Bioluminescence Imaging of Redox Biology in Cancer

Ian Farran

Sponsor: Marie anne Heffern, Ph.D.
Chemistry

Bioluminescence is the process by which a substrate is excited by a reaction with an enzyme and its subsequent relaxation to ground state through photon emission. The most commonly studied substrate/enzyme pair is luciferin/luciferase, as seen in fireflies. This process has been utilized towards developing bioluminescent probes for visualizing specific analytes in vivo. Tethering a cage to the compound not only prevents auto-oxidation but also improves specificity for the analyte. The caged substrate reacts with the analyte to release the bioactive substrate for reaction with luciferase. This type of imaging is applied to many different cell types including, but not limited to, cancer cells. Bioluminescent imaging can be used for monitoring and visualizing gene expression, movement and growth of implanted cells, or tracking micronutrients within cells. To this end, we look to specifically cage a luciferase substrate, coelenterazine, which will react with an analyte of choice that will allow luciferase to then oxidize coelenterazine for bioluminescent emission. Specifically, we aim to develop multiple cage coelenterazine's that will preferentially react with hydrogen peroxide or metal ions thus releasing bioactive coelenterazine for reaction with luciferase. This work will allow visualization of micronutrient movement that has otherwise been elusive.

Episodic Memory for Emotion Words Learned in Primary Versus Secondary Language

Caitlyn Rose Fastenau

Sponsor: Beth Ober, Ph.D.
Human Ecology

Several studies have shown a processing advantage for positive (versus negative) emotion-laden words for both native and non-native speakers, with a larger effect in native speakers (e.g., Kazanas & Altarriba, 2015). Our current study works to identify if native English speakers (E1) recall more positive valence words after repeated delays compared to non-native English speakers (E2). Memory was tested by asking participants to orally recall a list of positive and negative words after several delayed periods: immediate, short, long, extra-long, and a two-week extended email delay. Subjects were given a series of distractor tasks in between delayed recalls. After the delayed recall tests, participants were given a yes/no recognition test. Through preliminary analysis, we have seen a significant interaction of Group (E1 vs. E2) by Valence (positive vs. negative). Both E1 and E2 performed equally well on the positive words, but the E2 group had decreased recall of negative words. These findings increase our understanding of the emotional context of verbal memory in bilingualism and suggest further investigations of the relationship between language fluency, learning, and memory of emotional features of verbal material.

Generating Mushroom Substrates from Pre-Digested Wine Waste

Amanda Favilla

Sponsor: Christian Nansen, Ph.D.
Entomology/Nematology

The production of agricultural food waste (AFW) is a global issue. California alone produces 3.5 billion tons of organic food processing waste annually. While many view AFW as a problem, it can also be considered an opportunity. As natural decomposers, mushrooms offer an alternative possibility for the diversion of organic wastes, with additional benefits in generating value-added materials (i.e. edible mushrooms and compost). To facilitate mushroom growth, insects may be used to pre-digest AFW, making nutrients more readily available. Using insects to breaking-down AFW has gained interest as both a research discipline and business opportunity. The research question addressed in this study is: what impact does insect pre-digestion have on the quality and quantity of the resulting mushrooms? Red and white wine waste were subjected to three mealworm densities (high, low, and without) for five weeks. After insect-based pre-digestion, the wine waste was inoculated with oyster mushroom mycelium and incubated for four weeks. Mushroom quantity and quality were analyzed and compared across treatment groups. We expect that level of insect-based pre-digestion positively correlates with mushroom yield and quality. They have wide relevance to the growing interest in sustainability of agricultural food systems.

Introduction of *KCNB1* Human Missense Mutations Associated with Infantile Epilepsy Using Gene Editing in Zebrafish

Eva Ferino

Sponsor: Megan Dennis, Ph.D.
MED: Biochem & Molecular Med

KCNB1 is a gene that encodes for a voltage-gated potassium channel. Protein-altering de novo mutations in human *KCNB1* have been implicated in the pathophysiology of epileptic encephalopathies. Although the outcome of loss-of-function variants is straightforward, the functional impact of missense mutations is less clear. We premise that zebrafish carrying orthologous human missense mutations identified in patients will allow us to dissect mechanisms of pathogenicity. We used CRISPR/Cas9 gene editing paired with a DNA oligo donor template encoding for a one-base pair nucleotide change (A to G) orthologous to human amino-acid substitution Y380C. Thus far, we have optimized generation of mosaic mutants through the design, in vitro transcription, and injection into single-celled embryos of guide RNAs targeting exon 3 of *KCNB1*. We have also performed Illumina sequencing of 5 day-old zebrafish embryos to confirm efficiency. Experiments are now ongoing to introduce the single-site nucleotide substitution. Further work includes determining if the missense mutation generated in zebrafish lead to the same epileptic phenotypes observed in humans. If successful, the results of this research will facilitate improved diagnoses and understanding of disease etiology for researchers, clinicians, and patients.

Child Body Mass Index and Diet Behaviors Associated with Parent Restrictive Feeding Practices

Shanthal Ferreyra

Sponsor: Lenna Ontai, Ph.D.
Human Ecology

The prevalence of childhood obesity has been increasing over the last thirty years. The home environment is a major concern because parent feeding practices, such as restriction, can have a vital impact on a child's development to self-regulate their food intake and influence food preference. Restriction is defined as restricting a child's access to junk food and restricting the total amount of food consumed. Birch and colleagues found that higher child weight status was associated with greater parent use of restrictive feeding practices. The purpose of this study is to expand these results by assessing the association between parent restrictive feeding and child dietary energy density in relation to changes in BMI percentiles with data from the UC Davis Healthy Kids project (N = 60 parent-child dyads). BMI was calculated using the child's measured height and weight. Eating behaviors were captured in dietary logs that recorded energy density and restrictive feeding was observed from a videotaped mealtime. We hypothesize that child BMI will be associated with higher consumption of energy dense foods and parental use of restrictive feeding behaviors.

Observed Mother-Child Interactions: Associations Between Preschoolers' Social Behaviors, Temperament, and Their Mothers' Cognitive Functioning

Hana Fisher

Sponsor: Daniel Choe, Ph.D.
Human Ecology

The way in which children react and interact with the world, or their temperament, impacts their social behaviors, particularly with their mothers during early childhood. However, few studies examine the relationship between mothers' cognitive functioning and young children's temperament-related behavior. This ongoing study examines associations between maternal self-regulatory and intellectual functioning, and preschool-age children's temperament and observed social behavior. A sample of 9 mother-child pairs (M=38 years, SD=1.3, 9 female; M=4.5 years, SD=4.428, 4 female, respectively) were video-recorded for two interaction tasks, Free-Play and Clean-Up, and later coded at individual and dyadic levels using the Parent-Child-Interaction-System. Mothers were administered an intelligence test to assess intellectual ability, computerized tasks to measure self-regulation, and parent-reports to measure child temperament. Preliminary findings suggest that maternal self-regulation is associated with several aspects of children's observed social behavior and temperament, with different associations seen across different tasks. Maternal intelligence, while showing correlations with child behavior, seems to be unrelated to temperament. Further explorations will clarify the direct effects of mothers' intelligence and self-regulation on children's behavior. These findings are important because children's positive social behaviors are crucial for their healthy development and positive future outcomes.

The Latinx Homeless Situation in the Orange and Los Angeles County

Tony Flores

Sponsor: Monica Torreiro-Casal, Ph.D.
Chicano Studies

In the United States, the Latinx community is considered to be one of the largest ethnic minority groups; however, there is little information regarding the homeless situation in Latinos/as. Over the past few years, the homeless population in Los Angeles and Orange County have dramatically increased. The purpose of this study is to identify the factors that contribute individuals to become homeless in both of these counties. In addition, this research will also investigate the components that lead Latinx members to continue being homeless. This study will address different ecological factors such as mental health issues, chemical dependency, socio-economic status, and lack of social support. Data collection will be gathered by interviews conducted with counselors and staff members from homeless shelters in order to get a profound perspective on the causes that lead to this life change. Conclusions from this study will not only help the scholarly community understand the Latinx homeless situation, but it will also identify their needs.

Individual Differences and the Use of Verb Bias During Sentence Processing

Adira Fogel

Sponsor: Debra Long, Ph.D.
Psychology

Verb bias, the frequency of a verb appearing in a given structure, may facilitate sentence processing acting as a cue to the syntactic structure. Simple direct object (DO) structures are generally read faster than complex sentential complement (SC) structures, but past studies have found that sentences are read faster when the verb bias (DO or SC) is consistent with the structure. In the current study, participants completed a self-paced reading task where they read temporarily ambiguous sentences that contained a DO or SC verb within a DO structure (e.g. "The goalie confessed the defeat with real heartbreak") or an SC structure (e.g. "The goalie confessed the defeat was really heartbreaking"). Language experience and working memory capacity (WMC) were measured with standardized individual difference measures (i.e. the Nelson Denny, operation span, and reading span tasks). This research investigates how individual differences, verb bias and sentence structure affect sentence processing speed. Preliminary analyses suggest that higher WMC and language experience lead to faster reading times, and that sentences are read faster when the verb bias is consistent with the structure.

Number Discrimination in Infancy

Taylor Fong

Sponsor: Lisa Oakes, Ph.D.
Psychology

Numerical discrimination is a detection procedure that captures infants' individual differences in numerical abilities at a young age. These individual differences may allow us to further explore the relationship between infant numerical discrimination and development of later math skills. We are investigating numerical discrimination within infants by replicating a previously published study using a numerical change detection paradigm. In this procedure, infants view a numerically changing image stream in which pictures of 6 and 18 items alternate (e.g., 6 dots followed by 18 dots followed by 6 dots). They also view a non-changing image stream in which pictures with the same numerosity are repeatedly shown (e.g., 6 dots followed by 6 dots followed by 6 dots). We show infants these two types of streams side-by-side and record infants' looking behavior to determine if infants prefer the changing stream over the non-changing stream. We predict that infants will be able to differentiate the numerosities in the changing stream, which represent a 1:3 ratio, and as a result that infants will look longer at the numerically changing stream compared to the numerically constant stream.

The Ground State Degeneracy of Quantum Spin Rings

Kerstin Fontus

Sponsor: Bruno Nachtergaele, Ph.D.
Mathematics

We consider quantum spin rings, which are quantum systems with a Hilbert space $V(N)$, defined as the tensor product of N finite-dimensional complex Hilbert spaces. Each tensor factor is labeled by $j = 1, 2, \dots, N \bmod N$. The time evolution and energy spectrum of the system are defined by the Hamiltonian, given as a Hermitian operator H_N acting on $V(N)$. We are interested in the situation where each tensor factor in the Hilbert space is a copy of C^n , for some $n \geq 2$, and H_N is a sum of terms, each of which acts on a pair of nearest neighbor tensor factors as a fixed operator h . The goal of the project is to study the ground states, or the lowest energy states, of the system. These are given as the unit vectors in the eigenspace belonging to the smallest eigenvalue of H_N . In particular, we are interested in the dimension of this eigenspace, which is commonly referred to as the ground state degeneracy.

The Expression of Genetically Variant Peptides in Pigmented and Non Pigmented Hair and its Implications for a Novel Technique of Human Identification

Rachel Franklin

Sponsor: Robert Rice, Ph.D.
Environmental Toxicology

Current methods of human identification rely heavily on the presence of DNA evidence to obtain genetic information. In situations when DNA is absent or degraded, it is important to have an alternative means of constructing genetic profiles. This study expands upon a current project utilizing single amino acid polymorphisms (SAPs) in hair shaft proteins for human identification with comparable discriminatory power to that of DNA. This study involves a comparison of the expression levels of genetically variant peptides (GVPs) found in pigmented and non-pigmented hair from a single individual. To investigate this, hair samples from four unrelated European Americans were analyzed using Tandem Liquid Chromatography Mass Spectrometry. Preliminary results suggest significant differences in the expression of two proteins containing SAPs of interest. Further research will include a full GVP analysis that will guide a strategy for human identification in individuals with both pigmented and non-pigmented hair, a reflection of aging.

Juveniles Reduce Affiliation Between Socially Monogamous Titi Monkey Pairs (*Callicebus cupreus*)

Tristan Franzetti

Sponsor: Karen Bales, Ph.D.
Psychology

Titi monkeys are socially monogamous and form pair bonds with their partners. These pair bonds vary in strength and dynamic, similar to human relationships. Male titi monkeys exhibit high levels of paternal care. Some accounts have noted that titi monkeys will choose their pair mate over their child, and will even abandon their infant to maintain their pair bond. This two-part study examined the effects of juveniles on pair bonding. The first part investigated if titi monkey pairs with children exhibit affiliative behaviors less frequently than lone pairs without young offspring. The second part examined the impacts juveniles had on the pair relationship. Preliminary data suggests that among pairs with infants (<4 months), the parent carrying the child approaches the other more frequently, and the parent not carrying leaves more frequently, indicating that the infant is interfering with the affiliation directly. Among pairs with older juveniles (>4 months), I expect the combined affiliation each adult exhibits with their pair mate and their offspring to be the same as the affiliation levels lone pair mates exhibit to each other. This would show that the total affiliation adults exhibit does not change, but is shared between two individuals.

Impact of Qualitative Eesearch Experience on Pre-Health Undergraduate Students

Tanner Frediani

Sponsor: Patrick Romano, M.D.
MED: Div Of Internal Med

Every year, thousands of pre-health students seek research experiences to bolster their applications to professional health schools and demonstrate their commitment to the field. Due to lack of exposure, qualitative research forms a tiny minority of these experiences in comparison to other forms of research. Recently, a qualitative study at the UC Davis School of Medicine, in conjunction with 41 pre-health students at the undergraduate campus, examined the role of student-run clinics in providing patient access to healthcare. The UC Davis School of Medicine operates seven student-run clinics and several affiliated clinics, each serving a different high-risk patient population. By engaging in qualitative research, students gained exposure to public health concepts, engaged in extended interviews with patients, and also learned interviewing and coding techniques. We designed a survey intended to gain insight into the students' experience of engaging in qualitative research, with hopes of learning how or if the process affected the students' perceptions of professional healthcare roles. Our findings could demonstrate the significance of such experiences in preparing pre-health students for future career goals.

Ecology and Phenotype of *Plantago lanceolata* Across a Latitudinal Gradient

Madeline Frey

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. Our study uses the protocol of PlantPopNet, an international project which aims to develop theory about the spatial dynamics of plant populations using data from *P. lanceolata* from populations around the world. At our site in Davis, CA, we will measure traits including flower characteristics, phenology, and physical dimensions of plants along transects. We will also record density within square meter plots. We will then compare fitness-related traits of *P. lanceolata* between three locations along a latitudinal gradient (Davis, CA, Oregon, and British Columbia) and between the past three years of survey data. We will use statistical tests to analyze the differences between these data for each region and each survey year. Past years' results suggest that differences exist between phenotypic traits in each region, and we predict there will be variation among survey years. The results of this study can be used to demonstrate geographical variation in *P. lanceolata*, and baseline data allows us to ask questions in the future about the factors influencing these traits, including climate, herbivory pressure, and disease.

The Mental Health of Undocumented UC Davis Students

Kimberly Galindo

Sponsor: Malaquias Montoya, Ph.D.
Chicano Studies

My research project will conclude the mental health of undocumented students, I will be doing a survey of 100 undocumented students at UC Davis and 100 of regular US citizens, from there I will pick 25 of both groups and do a one on one interview on how they mental health. The political climate that we live in today does affect undocumented students so I want to understand how much more does it affect them. This research project will include written transcripts, surveys and personal stories. This project will be done through the murals programs so I have two quarters of information for my research. I will pick the questions for the surveys and do the interviews face to face. This research project is important to not just me because I'm a undocumented student at UC Davis but to fully understand what is going on in the minds of these young people the news, the president and everyone is talking about. This research project will understand the affects how their work, studies, families, dreams effects them during these times.

Optimizing RAD54 Crystallization Conditions

Rudolph Gallegos

Sponsor: Wolf Heyer, Ph.D.
Microbiology & Molec Genetics

Homologous recombination (HR) promotes high fidelity DNA repair. The HR pathway involves many proteins including RAD54, a double-stranded DNA-dependent ATPase and translocase. Recent work in the Heyer laboratory has focused on the hypothesis that RAD54 inhibitors could increase cancer cell sensitivity to anticancer treatments that produce interstrand crosslinks, a type of DNA damage normally repaired by HR. Crystallization of RAD54 bound to DNA will allow us to better understand how the protein interacts with its substrate and may enable rational inhibitor design. Literature and previous experimental studies suggest the minimal length of dsDNA for ATPase activity is 15 base pairs flanking a single strand flap of 45 nucleotides. To optimize crystallization conditions, I am determining the minimum size of DNA substrate necessary for RAD54 complex formation. To accomplish this, I used Sf9 (*Spodoptera frugiperda*) cells to produce hRAD54 expressed from a baculovirus vector. RAD54 expression is confirmed using immunoblotting. A gel-mobility shift assay, using various lengths of DNA substrate, is performed to detect complex formation. Thus far, I have shown that 10 base pair flanking the single strand flap is not enough to support RAD54 complex formation.

Different Cultural Writing Styles of Organization vs the American Style Organization: How Culture Affects the ESL Student in America

Ratnapala Gamage

Sponsor: Daniel Melzer, Ph.D.
University Writing Program

My research topic is about American style essay organization. The American style of organization includes a clear introduction, a clear body supporting a thesis, and then concluding by showing that the evidence verifies the thesis statement. Many ESL students come from different cultures and different writing traditions and as a result many struggle to follow the American style of organization. My main question is, how can American organization help ESL students to write a better essay? I am interested in this topic because the American reader will understand my essay better if it's in the style they are familiar with. I learned a writing style organization from Sri Lanka and I am having to learn this American style organization for the American reader. Furthermore, I am also interested in looking into this topic because I want to give solutions and alternatives to my ESL peers. I interviewed two ESL students and one ESL professor at UC Davis about their experiences. In addition, I looked at library databases and writing center websites for secondary research.

Measuring Air Pollutant Levels for Rhesus Macaques Exposed to Ambient Wildfire Smoke

Sandya Ganesh

Sponsor: Lisa Miller, Ph.D.
VM: Anat Physio & Cell Biology

Early life exposure to wildfire smoke can have long-term detrimental effects to both immunity and airway physiology. Additionally, wildfire smoke (WFS) is capable of long range transport and can significantly increase ambient particulate matter (PM_{2.5}) and ground-level ozone (O₃) in distant counties. In the summer of 2008, infant rhesus macaques (age 3±1 months) were exposed to PM_{2.5} and O₃ derived from a series of wildfires in Trinity/Humboldt Counties, located approximately 200 mi. from the California National Primate Research Center. Pollutant levels were recorded by the California Air Resources Board monitoring site #57,577 around 2 mi away from the colony. In this study we aimed to quantify the ambient exposure experienced by each monkey during different developmental periods of their lives. We calculated cumulative PM_{2.5} and O₃, maximum PM_{2.5} exposure, and days over the NAASQ dictated safety indexes for PM_{2.5} and O₃. We found that infants born in 2008 were exposed to significantly higher levels of PM_{2.5} than those born in 2009. To better understand the impacts of WFS on long-term health, we will use these data to correlate developmental WFS exposure with immune parameters and pulmonary function measurements.

Transportation Preferences of Patients Discharged Home from the University of California Davis Emergency Department

Siddhi Ganesh

Sponsor: John Richards, M.D.
MED: Emergency Medicine

Many patients presenting to the University of California, Davis (UC Davis) Emergency Department (ED) arrive by ambulance or relatives. This leaves the ED responsible for coordinating their transport home after being discharged. This study surveyed 500 discharged patients via an anonymous questionnaire and reports the transportation preferences of patients discharged home, their awareness of the new forms of transport, and potential cost savings to the ED for patients that receive assistance with their travels. Preliminary analysis shows that 26.42% of patients arrived by ambulance while 44.88% were transported by someone else. However, only 2.49% planned to use ambulance transport while 58.09% were relying on assistance by someone else to go home. Of those surveyed, 85.22% were aware of application based ride-sharing services such as Uber/Lyft, and 52.2% had used these services. Additionally, 50.21% felt that their medical insurance should arrange and pay for their transportation home, while 30.98% felt that the Emergency Department should arrange and pay for their transport home. The data from this project could provide a basis for the institution of an application based ride-sharing service that facilitates safe and expeditious discharge of patients returning home from the UC Davis ED.

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.

Navigating the "Hidden Curriculum": College Student Academic Engagement Strategies with Authority Figures

Madison Garcia

Sponsor: Caitlin Patler, Ph.D.

Sociology

Sociological research on postsecondary education finds that colleges privilege undergraduate students who manifest cultural and social capital typically expressed among high socioeconomic status students. Student engagement with professors is just one of many situations rewarding elite capital in college, as it is heavily tied to positive academic outcomes including increasing students' access to institutional resources, fostering educational experiences, and heightening post-graduate mobility. Building on this research, I examine how race, gender, and socioeconomic status intersect to impact low-income minority student engagement with professors and TAs in office hours and meetings outside of lecture. Gathering data from eighteen original in-depth interviews, I measure student experiences and patterns of engagement with TAs and professors across various demographic backgrounds. I will apply inductive and deductive methods to code and analyze student engagement styles and their outcomes. As more underrepresented, minority students attend college, this research in this field of higher education is critical. To that end, my findings have the potential to inform efforts to bridge the gap between low and high-income pre-college student experiences, which could help close the disparity in academic outcomes.

Challenges and Solutions to Actigraphy in a Population Based Study

Anabelle Garza

Sponsor: Leah Hibel, Ph.D.

Human Ecology

Actigraphy is a useful method of objectively recording sleep, and has been validated with the previous gold standard of measuring sleep, polysomnography. The California Babies Project is utilizing this method to study sleep in Mexican origin families in the greater Sacramento area. Mothers, fathers, and their children wear actigraphs - computerized devices worn on the wrist (parents) and ankle (infants and toddlers) - to record sleep and wake activity. Subjective data, including sleep and wake times, were collected via daily diaries using the phone application, Metricwire. Data were collected over a period of eight nights in the families' homes and then coded in the lab using Action4 software and validated scoring algorithms. The subjective and objective data were evaluated simultaneously in the coding process to accurately determine the quality and quantity of individuals' sleep periods. We aim to further describe the details of the coding process and address challenges and solutions in working with actigraphy.

The Influence of Engineered Silver Nanoparticles on Stromal Cells of the Cornea

Brooke Gates

Sponsor: Sara Thomasy, D.V.M., Ph.D.

VM: Surg/Rad Science

Demand for engineered nanoparticles (ENPs) has increased dramatically in recent years, resulting in more ENPs in the environment. However, the impact of ENPs on the eye, particularly the cornea, is understudied. This study was conducted to assess the impact of ENPs on corneal stromal cell viability and KFM transformation or the differentiation of quiescent keratocytes to activated fibroblasts and myofibroblasts in wounded cornea. Three silver (Ag) NPs were tested: 20nm Ag, and 1 and 10% silver silica (AgSiO₂), at concentrations 0.05-250µg/mL. Rabbit corneal fibroblasts were tested for cell viability using a MTT (tetrazolium) assay. Quantitative PCR and western blot were performed to detect mRNA and protein expression in the absence or presence of 10ng/ml TGF-β1; 25µg/mL 1 or 10% AgSiO₂, and 50µg/mL 20nm Ag. Cell viability was significantly decreased at 250µg/mL for 1 and 10% AgSiO₂ (P < .0001). This concentration did not significantly impact cell viability for 20nm Ag. The α-smooth muscle actin (α myofibroblast marker) mRNA expression was significantly reduced with 1% AgSiO₂ (P = 0.034) and 20nm Ag (P = 0.014). Protein expression was not significantly altered for these two ENPs. In conclusion, silver ENPs can impact KFM transformation.

Efficiency of Groundwater Use in Agriculture

Tadewos Getachew

Sponsor: Frank Loge, Ph.D.
Civil & Environmental Engr

Water shortage has been a serious impediment to the agricultural sector due to the drought conditions in California since 2011. As a result, groundwater has become a major alternative and accounts for 50% of the current agricultural water use. The Sustainable Groundwater Management Act (SGMA) was passed to conserve and govern the use of groundwater in California. However, the amount of groundwater used in the private sector is not quantified. This research focuses on finding a methodology to calculate the volume of groundwater extracted by agricultural wells in the Angiola Water District, by using the data of the energy consumed to pump the water from agricultural wells. The accuracy of the methodology is then validated using the actual groundwater flow data collected from the district. This methodology can be used in estimating a general census of groundwater withdrawals in California by using energy consumption data available at electrical companies. Analysis of the groundwater withdrawals will help the California legislature ensure the sustainability and conservation of groundwater use.

A Mathematical Model of a Pig Ventricular Myocyte

Bardia Ghayoumi

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

Over the last few decades, computational modeling and simulations have been widely used to reveal fundamental mechanisms underlying phenomena in arrhythmias, such as discordant alternans, tachycardia, and fibrillation. Especially, multiscale models are useful to understand how single channel modifications affect cellular and tissue scale phenomena. A pig is one of the best animal models to investigate cardiac phenomena because of its similarity to human heart; however, few mathematical models have been developed. We have built a physiologically detailed mathematical model of a pig ventricular myocyte based on experimental data measured with the physiological action potential (AP)-clamp Sequential Dissection method. The base model is a rabbit ventricular myocyte model developed by Mahajan et al. We removed currents which do not exist in the pig myocyte, as well as varied model parameters to fit amplitudes and kinetics of the currents and APs. We made sets of parameters for the normal and heart failure myocytes in the border and remote zone of the infarct. With these parameters, our models can recapitulate experimental observations of these myocytes. This computational model provides a basis to explore AP and calcium dynamics in the pig cardiac myocyte and also at tissue level under various pathophysiological conditions.

Changes in Maternal Macronutrient Choice During Gestation and Lactation

Charity Gikura

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

Meeting adequate nutritional requirements is important for health and is especially critical during pregnancy. In addition to increased caloric demand, there are changes in specific macronutrient (carbohydrate, protein, fat) requirements during pregnancy and lactation, however it is unknown to what extent protein intake is increased for optimal nutrition during these periods. The aim of this study was to investigate changes in protein intake during gestation, lactation and weaning. We hypothesized that female mice would increase the percentage of calories from protein during gestation and lactation and return to baseline after weaning. To test this hypothesis, we utilized a two-diet choice paradigm. Mice were provided with equal quantities of isocaloric diets containing either 18% of kcal or 4% of kcal from protein, with a corresponding change in carbohydrate content and holding fat constant. For a week prior to breeding, we established the baseline protein intake by measuring feed weights of each diet. Following mating we regularly measured feed intake during gestation, lactation and weaning. Our preliminary data support the hypothesis that pregnant females increase the percentage calories consumed from protein. A better understanding of maternal nutrition requirements, can help shape dietary recommendations to optimize the health of the offspring.

Assessment of Neuroinflammation in a Neonatal Model of Enteric Bacterial Infection

Shane Gillis

Sponsor: Melanie Gareau, Ph.D.
VM: Anat Physio & Cell Biology

Neonatal dysbiosis alters development of the microbiota-gut-brain axis (MGB). Alterations in the gut during early development following bacterial infections can have long term effects on cognitive functioning in adults, such as memory, learning, anxiety, and depression. Neuroinflammation may be a major contributor to the effects of a bacterial infection during early development of the MGB axis. We hypothesize neuroinflammation arising from bacterial infection during neonatal development leads to cognitive defects in adulthood. Neonatal mice were infected with enteropathogenic *E. coli* (EPEC) inducing intestinal dysbiosis. Adult mice were perfused with paraformaldehyde and brains collected and embedded in OCT. Frozen tissues were sectioned using a cryostat, and then subjected to immunohistochemistry (Iba1 [microglia] and GFAP [astrocytes]). Tissues were imaged using confocal microscopy and analyzed (IMARIS). Antibodies for Iba1 and GFAP successfully stained coronal brain sections. Analysis of the staining patterns by IMARIS are currently in progress. We anticipate finding increased neuroinflammatory markers indicative of a response to alterations in gut microbiota. By investigating mechanisms involved with cognitive deficits that may arise from dysbiosis in neonatal development of the MGB axis, our goal is to find ways to restore the alterations in the MGB axis in adulthood.

How Traffic Noise Affects Parental Care in Tree Swallows

Michelle Gin

Sponsor: Gail Patricelli, Ph.D.
Evolution & Ecology

Noise generated by human activity has increased in pervasiveness and intensity in recent decades. Previous work has shown that such noise adversely affects terrestrial and marine organisms at individual and population levels. In this experimental field study, we will look at how anthropogenic noise (specifically traffic noise) affects parental care in tree swallows (*Tachycineta bicolor*). Traffic noise is especially concerning because it is a linear noise source and thus has the potential to affect a large area of both natural and developed habitat. To expose tree swallows to traffic noise, we used speakers that played previously recorded traffic noise. We also filmed their nest boxes to measure adult tree swallows' nestling feeding rates. We hypothesize that traffic noise will negatively affect tree swallows' parental care. We predict that adults exposed to traffic noise will have lower nestling feeding rates and will spend a lower percentage of time in nest boxes than those in the control group. If we find that noise negatively affects parental care in tree swallows, conservation concerns become relevant because of potentially far reaching effects: reduced parental care may result in decreased nestling survival, which could lead to declines in tree swallow populations.

Building a Sweeter Tomato

Lauren Glevanik

Sponsor: Neelima Sinha, Ph.D.
Plant Biology

Tomatoes are a \$2 billion industry in the United States with California producing 94% of processing tomatoes and one third of fresh market tomatoes. Traditional commercial breeding has focused on making tomatoes uniform, hardy, and sturdy for mechanical planting, harvesting, and transport. But what about taste? Heirloom tomato varieties are considered sweeter and more flavorful than commercial lines. Sugar concentration (BRIX) in fruit is thought to be determined by photosynthesis in leaves. Our models show that photosynthetic rate, leaf complexity, and BRIX are correlated. Tomatoes with more complex leaves like M82 canning tomatoes (*Solanum lycopersicum* cv. M82) have less sweet fruit (lower BRIX) while heirlooms with less complex leaves are sweeter (higher BRIX; unpublished data). Heirloom tomatoes with a rounder leaf shape are characterized as potato leaf. The C-locus was identified as the gene regulating the potato leaf morph (Busch et al., 2011). We hypothesized that if the C-locus gene in M82 was silenced using CRISPR, then the resulting plant would exhibit a simplified leaf shape and have higher fruit BRIX, creating a sweeter tomato. I will present leaf shape and fruit sugar data on M82 individuals with mutations at the C-locus gene.

Next Steps in Designing a Helmet-Mounted Device to Provide Training Information to Cyclists: Adding Distance and Speed Information.

Lauren Gloekler

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

Cyclists increasingly use technology to map their route and monitor various performance metrics. Many such technologies are handlebar-, forearm-, or wrist-mounted, which requires the cyclists to take their eyes off the road to monitor their performance. Such devices cause distraction and potential danger. To address this problem, we are developing a helmet-mounted device that displays performance data in real-time on an unobtrusive screen in the cyclist's peripheral vision. Previous students designed and prototyped a device to quantify the cyclist's heart rate, and selected global positioning system (GPS) and barometer components to quantify rider location. The goal of this project is to expand the previous work by testing the GPS accuracy, writing custom software that collects GPS data and processes that data to quantify distance traveled and velocity, and then displays this information on a helmet-mounted screen. GPS accuracy was tested and determined to be 4.78 meters. Software is currently being developed and tested for use with an Arduino microcontroller to calculate distance traveled and speed over set time intervals. Total distance traveled and average and maximum speed will also be determined. The final device will provide a safer method for cyclists to monitor their training intensity.

The Effects of Neonatal Dysbiosis on Adult Neurogenesis and Cognition

Lily Goldfield

Sponsor: Melanie Gareau, Ph.D.
VM: Anat Physio & Cell Biology

The gut microbiota is important in maintaining overall health. Proper colonization of the gut is crucial in the neonatal stage; infections and inflammation during neonatal life have the potential to impair the establishment of the microbiota. Preliminary studies from our lab have shown that disruption of the microbiota-gut-brain (MGB) axis during neonatal life can cause cognitive deficits in adulthood. Neurogenesis is the formation of neurons by the proliferation and differentiation of neural stem cells. Nucleotide binding oligomerization domain (Nod) receptors bind bacterial peptidoglycan and are expressed on intestinal epithelial cells and neurons, making them a possible pathway for maintaining the MGB axis. We hypothesize that neurogenesis will be impaired in mice either following neonatal dysbiosis or from the lack of Nod1/Nod2 receptors. Brains from adult WT and NodDKO mice were perfused, embedded, and cut; and stained for markers of neurogenesis (Ki67, DCX, and cFos). Antibodies for Ki67, DCX, and cFos showed clear staining when compared to no primary controls, indicating that all antibodies are satisfactory, analysis using IMARIS is in process. This study will yield important information on the role of neurogenesis in maintaining cognitive deficits in mice with a dysfunction of the MGB axis.

Hydrologic Impact of Combined Winter Cover Cropping and Conservation Tillage for Sustainable Farming Practices in California

Anna Gomes

Sponsor: Jeffrey Mitchell, Ph.D.
Plant Sciences

The future of food production will require the use of farm practices which simultaneously improve soil health, reduce greenhouse gas emissions, and utilize water efficiently. Winter cover crops and reduced tillage are two practices that may meet this requirement, but uncertainties remain around their impacts on soil water content (SWC), pre-season irrigation demands, and managerial logistics. While the soil and climatic benefits of these practices are generally understood, our research aims to target the knowledge gaps around water use. Weekly neutron probe readings were taken on a long-term research field site at the University of California West Side Extension Center in the San Joaquin Valley. This data was converted to SWC using a linear regression to reveal the cumulative hydrologic impact of combined reduced tillage and winter cover cropping. Our results from the 2016 - 2017 winter season illustrate that in the top 35 inches of the soil profile, conservation tillage practices left fields 0.7 inches wetter than standard tillage and winter cover cropping left fields 0.7 inches drier than fallowed fields. Farms with comparable climatic conditions and cash crop rotations throughout California can expect to experience similar hydrologic impacts from these farm management decisions.

Observing Latinx Student Satisfaction: Mapping the Experiences at the Hispanic Serving Institution (HSI) and Non-Hispanic Serving Institution (Non-HSI).

Oriel Gomez

Sponsor: Marcela Cuellar, Ph.D.
Education

Latinx/Hispanic students are increasingly enrolling in post-secondary institutions, making them one of the fastest growing ethnic groups to pursue higher education. Latinx/Hispanic students typically enroll in Hispanic Serving Institutions (HSIs; post-secondary institutions that enroll a minimum of 25% student body identifying as Hispanic) or non-Hispanic Serving Institutions (Non-HSIs; post-secondary institutions with less than 25% of Hispanic students). Student experiences at these distinctly designated colleges and universities yield different levels of satisfaction overall based on various factors. With varying results of student satisfaction at HSIs and Non-HSIs, I examine the differences in student satisfaction at these institutions and the determinants that help explain these differences. Using nationally recognized longitudinal data, I evaluate the progress of students at various HSIs and Non-HSIs at the beginning of their first year and at the end of their senior year, further reflecting on their experiences coming in and out of college. The responses help suggest the varying degree of satisfaction that contribute to the Latinx/Hispanic student's perception of their college experience.

Students' Motivation Towards Seeking Feedback and/or Help

Michael Gonzalez

Sponsor: Carolyn Thomas, Ph.D.
Undergraduate Education

This research project looks at whether Freshmen & Sophomore students seek feedback and/or help, and what motivates them to do so. The driving force behind this research is the lack of conversation among students & instructors on campus about tutoring. The goal is to understand what motivates students to seek out feedback on their writing assignments, and where are they going & not going. The way in which this research was approached is by surveying students specifically in English writing courses. The survey asks several different types of questions about where students do seek help; where they are likely to seek help; at which part in the writing process do students seek help; and questions about their experiences related to seeking feedback on writing assignments. Additionally, included in the survey are a Writing Apprehension & Communication Apprehension questionnaire to see if students with high apprehension in writing are seeking help, and whether students with high communication apprehension are not seeking help. The methods being used are a mix-methods approach analyzing quantitative & qualitative data. Students' responses are analyzed in aggregate, along with their short answer responses to answer the questions that have been proposed. This research project is ongoing.

Bipartite Mutualistic Networks: Hierarchy, Evolution, and Critical Transitions

Grayson Gordon

Sponsor: Raissa D'Souza, Ph.D.
Mechanical & Aerospace Engr

There is a wide breadth of existing research on the study of "mutualism" in ecological networks. From this research, we know and understand the basic characteristics that make a network mutualistic. For example, it is the tendency of these networks to have actors that are either generalists (interact with many other actors) or specialists (interact with few other actors). Another hallmark of mutualism is for sub-communities of dense or similarly patterned interactions to be present in the overall network. However, very little research has been done on these types of networks outside of nature. Can we observe these same properties in human networks? And if so, what are the implications of these properties? The goal of our research is simple: to discover whether or not complex human networks mirror aspects of well-documented and well-studied ecological networks. If they do, we can theoretically apply lessons learned about the robustness and resilience of mutualistic interactions in nature to our own human interactions. We can seek to preserve the stability of certain networks (trade, scientific collaboration, etc) or we can seek to destabilize certain networks (international terror).

The Behavior of Californian Farmers in Cover Crop Adoption

Kennedy Gould

Sponsor: Mark Lubell, Ph.D.
Environmental Science & Policy

Conservation agriculture is growing in importance for mitigation and adaptation strategies for climate change. This research is interested in cover cropping, which can improve soil health, water retention, and pest management. Comparatively, California's intensive and diverse agricultural systems, cover crops improve soil health and weed suppression, but research is still being conducted on their use for water retention. Despite the benefits, adoption of cover crops is often determined by farmers' perceptions of the costs and benefits. This study integrates survey data with in-person interviews of California farmers to understand the motivations and barriers in farmers' decisions to adopt cover cropping practices. Evaluating factors include crop type, information sources, land tenure, and perceived costs and benefits to find what influences farmers to adopt. Preliminary findings suggest that farmers are more likely to adopt cover crops if they get information from multiple sources and if they own the land. It is also likely that certain sources of information will be more associated with cover crop adoption than others. These findings will contribute to a growing field of study that analyzes what motivates farmers' land management decisions. Understanding farmer decision-making can be useful to influence the perception of conservation agriculture.

Examining the Psychosocial Factors Linked to Diabetes Diagnosis and Management

Grace Grant

Sponsor: Patricia Roberson, Ph.D.
Human Ecology

Diabetes prevalence is a threat to the health of our society, approximately 23.5 million adults in the US are diabetic. This is by no means a static number as the prevalence of this chronic disease is estimated to increase 55% by 2035. The WHO has estimated an increase from 4.7% in 1980 to 8.5% in 2014 of global diabetes prevalence among adults over 18 years of age. In a study focused on determining factors of poor glycemic control in diabetes patients, lower levels of education is linked to poorer diabetes management. Once diabetes is developed, there also appears to be a bidirectional influence between diabetes and depression and a bidirectional association between depression and social support. Social support can be determined based on the amount (e.g., number of relationships) and quality of social support (e.g., relationship strain) an individual receives. Understanding the psychosocial influences on diabetes diagnosis and management is crucial because of the impact bidirectional effects have on diabetes. This study will examine how psychosocial factors of education level, social support, and depression are linked to diabetes.

The Impact of Telomere Length on Cardiac Progenitor Cell Fate

Joanne Alexandr Grayda

Sponsor: Nirmala Hariharan, Ph.D.
MED: Pharmacology

The regenerative potential of cardiac progenitor cells (CPCs) decreases with age. Telomere shortening is a hallmark of aging, which contributes to stem cell exhaustion. Understanding the impact of telomere length on cell fate of CPCs is essential to enhancing their regenerative potential. We hypothesize that: 1) telomere length determines cellular fate of CPCs, and 2) CPCs switch from quiescence to differentiation and senescence when telomeres are short. We isolated CPCs from mouse strains with different telomere lengths to study how short telomeres affect CPC biology. Mus musculus castaneus (CAST) is a naturally occurring mouse strain with short telomeres compared to common lab strains, FVB and C57 mice. Molecular expression of quiescence markers (p21, p57) decreased in CAST CPCs coincident with up regulation of senescence and commitment markers, indicating that CAST CPCs switch from reversible quiescence to "irreversible" forms of cell cycle arrest, senescence and commitment. Transfection with modified mRNA encoding wild type telomerase reverse transcriptase (TERT-WT mmRNA) elongated telomeres, restored quiescence, and attenuated senescence and lineage commitment in CAST CPCs. Data suggests telomere length regulates cell fate, showing evidence for quiescence and proliferation in CPCs with longer telomeres but senescence, lineage commitment when telomeres are short.

Transient Treatment with Psychoplastogens is Sufficient to Cause Long-Lasting Changes in Neuronal Structure

Alexandra Greb

Sponsor: David Olson, Ph.D.
Chemistry

Many neuropsychiatric diseases are characterized by deficits in neuroplasticity, and therefore, agents capable of promoting neuroplasticity have enormous therapeutic potential. Neurotrophic factors such as brain derived neurotrophic factor (BDNF) are a class of biomolecules that are produced naturally in the brain capable of promoting neuroplasticity. However, BDNF cannot be used therapeutically as it does not pass the blood brain barrier. Fortunately, we have discovered a class of compounds that are brain penetrant and are capable of inducing plasticity effects similar to BDNF. We refer to these medicinal compounds as psychoplastogens due to their ability to induce changes in structural plasticity. However, their mechanism of action is currently unknown. The goal of my research is to investigate the mechanism of psychoplastogens like LSD and ketamine. To evaluate the effects of psychoplastogens on plasticity, cortical rat neurons were treated, fixed, and stained so that we could visualize changes in dendritic morphology using microscopy. We found that transient treatment for one hour with psychoplastogens was sufficient to cause increases in neuronal outgrowth. Ultimately, we hope to identify better-tolerated compounds capable of promoting plasticity and to elucidate the basic biology responsible for their mechanisms of action.

Differential Noise Level Effects on Predator and Prey Behavior at Crossing Structures

Mia Guarnieri

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

Habitat fragmentation is causing a decline in wildlife worldwide and is one of the largest conservation challenges currently being faced by ecologists and policymakers alike. Roads are a major contributor to habitat fragmentation; they form unsafe, often impassable barriers between habitat areas, preventing movement between groups and creating small, isolated populations. To combat fragmentation due to roads, wildlife crossing structures have been widely implemented across the U.S.; however, their use and efficacy are not clearly understood. The terrestrial species that underpasses are built for tend to be sensitive to noise, making it necessary to determine how traffic noise influences their behavior. Because animals can be differentially sensitive to noise, we elected to perform an observational study to determine whether traffic noise levels have a significant impact on behavior, and whether that impact varies between predator and prey species. We will be analyzing videos from eleven underpasses, each with two camera positions, quantifying the noise levels that correspond with different behaviors as quiet/none, moderate, or loud. We will then perform a chi-squared test to determine if increasing noise level is positively correlated with vigilant or flighty behavior, and if those correlations are different for predator versus prey species.

Milk Fat Globule Membrane and its Implications in Infant Neurodevelopment

Jordan Gueniot

Sponsor: Bo Lonnerdal, Ph.D.
Nutrition

Supplementation of infant formula with Milk Fat Globule Membrane (MFGM) may improve infant neurodevelopment, thus narrowing the gap between formula-fed and breastfed infants. A previous randomized control trial of MFGM exhibited increased scores on behavioral tests in infants provided the MFGM enriched formula, thus the aim for this project was to explore the mechanisms behind this improvement. MFGM is a membrane surrounding milk fat globules in the milk of humans and other mammals. It is comprised of lipids, proteins, and other bioactive components which are important in gut and brain health. To test the hypothesis that MFGM may aid in neurodevelopment, we supplemented restricted-growth rat pups with MFGM and its components. We performed behavioral tests including T-maze to test brain function, and found an increase in brain function in the rats supplemented with MFGM. We are in the process of performing a stereological analysis of the brain tissues in order to determine the neuronal population of the CA2 and CA3 subregions of the hippocampus of each rat. Based on the behavioral test findings, we expect to see an increase in neurons in the group supplemented with MFGM, which will help to validate increased neurodevelopment in these animals.

Knights Landing One Health Center Community Garden

Ana Guerrero

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

In the agricultural unincorporated community of Knights Landing in Yolo County a group of farmworker femmes gathered and the “Grupo de mujeres” surfaced. They discussed the struggles of their community and advocated for their needs and recruited Juanita Ontiveros farmworker rights activist and Natalia Deeb Sossa UC Davis faculty for Chinax studies. These struggles were intertwined with environmental exposures to pesticides due to the surrounding agricultural matrix. Together they created a community based research and action program that incorporated community members as part of the UC Davis research team. The Knights landing garden project is an extension of the Knights Landing One Health Clinic, which is a student run 501 (c3) non-profit catered towards bringing free and culturally relevant healthcare services to the Knights Landing area, specifically to women, children and farmworkers. The hopes are that this garden can be a community ran tool against food insecurity and to strengthen community ties. Methods are participatory mapping, surveying, methods, focus groups and “minga” work days where people come together to envision and work on the space. The garden will have a “minga” team which will work closely with the “promotoras de salud” based on the Paul Freire model.

Simulation of Steel Moment Frame Response Under Earthquake Excitation

Daisy Guitron

Sponsor: Chia-ming Uang, Ph.D.
UCSD: Structural Engineering

Steel moment frames composing of wide-flange beams and columns are widely used in high seismic regions like California to resist earthquakes. Although structural designers routinely design moment frames based on elastic analysis tools, implicit in the building codes is the assumption that these structures are expected to yield and deform inelastically for energy dissipation in order to achieve an economical design. To understand how the moment frames will actually perform in a strong earthquake, nonlinear dynamic analysis is needed. In this research, the computer software PISA 3D (Platform of Inelastic Structural Analysis for 3D Systems) will be used. Three building frames representing low (4-story), medium (8-story), and tall (16-story) buildings will be analyzed. To consider the random nature of earthquake ground motions, ten ground motions recorded from historical earthquakes will be considered as the input motion. One research objective is to evaluate if the formation of soft-story will occur. The second objective is to evaluate the relationship between story drift ratio and top end rotation of the first-story columns.

Increasing Western Blotting Sensitivity with polyHRP

Anita Gunaseelan

Sponsor: Aldrin Gomes, Ph.D.
Neuro Physio & Behavior

Increasing the sensitivity of indirect immunoassays is a well-researched area. The cross-linking of enzymes to antibodies to create immunoconjugates can be used to indirectly detect antigens in the analysis of immunoassays. Horseradish peroxidase (HRP) has shown increased sensitivity for the detection of antigens and has been employed for more than 20 years in both Western blots and Enzyme-Linked Immunosorbent Assays (ELISAs). Poly-HRP antibody-conjugates have been utilized recently to provide an enhanced signal in ELISA techniques, by chemically manipulating the antibody conjugate to attach several HRP enzymes. The use of commercially available Poly-HRPs to amplify signals in Western blot techniques has not been investigated. Four commercially available Poly-HRPs were investigated by Western blotting and all four resulted in higher antigen detection sensitivities compared to conventionally utilized secondary antibodies which contain only one HRP enzyme. These results suggest that Poly-HRP secondary antibodies are likely to become a commonly used reagent for Western blots.

Formulation of Curcumin in Solid Lipid Nanoparticles Enhances the Efficacy of Curcumin in Hodgkin's Lymphoma

Jacob Guorgui

Sponsor: Gerardo Mackenzie, Ph.D.
Nutrition

Naturally occurring dietary compounds hold merit for cancer prevention and treatment. Among them, curcumin appears especially promising because of its non-toxic and effective anti-cancer properties. Curcumin has been shown to inhibit Hodgkin's lymphoma (HL) cell growth in vitro, but its poor in vivo bioavailability and unacceptable pharmacokinetics highlight the need for novel in vivo delivery systems. Thus, we explored whether encapsulation of curcumin in solid lipid nanoparticles (SLN-curcumin) and d- α -Tocopheryl polyethylene glycol 1000 succinate (TPGS)-stabilized curcumin nanoparticles (TPGS-curcumin) could enhance its efficacy in vivo. Using a HL heterotopic xenograft model, our laboratory showed that SLN-curcumin, and to a lesser extent TPGS-curcumin, enhanced the tumor growth inhibitory effect in comparison to curcumin alone. Compared to vehicle-treated controls, SLN-curcumin and TPGS-curcumin inhibited tumor growth by 50.3% ($p < 0.02$) and 43.0% ($p < 0.04$), respectively, while curcumin alone reduced tumor growth by 35.0% ($p < 0.05$). Using HL xenograft total tumor extracts, we explored molecular targets that have been implicated in HL. In particular, we focused on molecular pathways that are known to be involved in cell proliferation and the inhibition of apoptosis to reveal a more complete mechanistic rationale.

A Deep Learning Approach to Sustainable Waste Management

Pranav Gupta

Sponsor: Ilias Tagkopoulos, Ph.D.
Engr Computer Science

According to the Environmental Protection Agency's (EPA) report, USA generated 254.1 million tons of trash in 2013. Compared to 1960 when USA generated only 88.1 million tons, the municipal solid waste generation has increased by a staggering 188.4%. Despite our best efforts to recycle and compost, we are lagging behind as we were only able to achieve a 34.3% recycling rate in 2013. Here, we propose to address the problem at the source by building an inexpensive smart trash can that takes trash images, processes them and then automatically segregates it into Compost, Recyclable & Landfill bins. We do this by implementing Convolutional Neural Networks (CNNs) and Computer Vision algorithms on a Raspberry Pi 3 to correctly identify the images of trash. Our dataset includes the 2527 labelled TrashNet images coupled with an increasing set of images acquired by our smart trash can. Preliminary results show a performance of 60% in trash classification, with further refinement under way. This project paves the way for intelligent, inexpensive and sustainable waste management across a wide spectrum of commercial and residential facilities.

Factors That Contribute to Coping for Children of Mexican Origin

Celeste Guzman

Sponsor: Kali Trzesniewski, Ph.D.
Human Ecology

First and second generation immigrant children, with Mexican parents, face unique challenges as they manage attachments to Mexican and American culture, and as their parents transition to America. To understand what might help Mexican-origin children overcome challenges, here we investigate which parental factors and cultural values affect children's coping skills over time. We tested whether children's ($N = 674$) Familism (how important they think their family is), Mexican/Mexican-American pride (how much pride they have in, and how connected they feel to Mexican and Mexican/American culture), Parental Involvement in Education (how much they reported that their mother and father helped them with schoolwork), and Parental Monitoring (how much they reported that their mother and father were aware of their activities inside and outside of school), were associated with children's coping. All measures were assessed every two years over a 6-year period, starting when the children were 10 years old. All within and across time correlations between these factors and coping were positive and statistically significant. Familism and mothers' monitoring were the most consistent predictors of positive coping. Overall, the findings suggest the importance of family values, and family support, to immigrant children's coping skills.

Multicultural Education and the Use of Super-Ordinate Identity as a Threat Reducing Agent to Reduce Bias

Gaby Guzman

Sponsor: Jeffrey Sherman, Ph.D.
Psychology

Multicultural education has been a method that has been introduced to reduce stereotypes and prejudice, although it works better with nonwhite Americans than white Americans. One reason that multicultural education may be less effective for white Americans is that white Americans may feel less belonging to their white identity when exposed to multicultural viewpoints. The current study examines whether making white Americans feel less threatened by thinking about a super-ordinate identity (i.e., all Americans) can enhance the effectiveness of multicultural education in this population. White UCD undergraduates will either be exposed to analogies of America as a “melting pot” or control analogies before learning about multicultural education. Then participants will be exposed to an indirect measure of their association between “whiteness” and “America” as well as measures of racial bias more generally. It is predicted that when participants receive multicultural education along with introducing the threat reducing agent (melting pot notion), they will have less bias than people who receive the multicultural education without the threat reducing agent. It is predicted that reductions in white-American associations will mediate the change in general bias.

Characterization of Stress-Inducible Diterpene Synthases in *Panicum virgatum*

David Hagelthorn

Sponsor: Philipp Zerbe, Ph.D.
Plant Biology

Switchgrass (*Panicum virgatum*) is a dedicated biofuel crop valued for its high energy yield and environmental stress resilience. Diverse networks of diterpenoid small molecule metabolites have been shown to be critical stress defenses in the related monocot crops rice and maize. To investigate the yet unknown diterpenoid defense system of switchgrass, we mined the switchgrass genome and identified 29 diterpene synthase gene candidates. Here we present the biochemical characterization of 12 diterpene synthases by co-expression in an engineered *E. coli* system and analysis of the resulting enzyme products via gas-chromatography mass spectrometry (GC-MS) and nuclear magnetic resonance (NMR) analysis. The characterized enzymes showed both known and previously unrecognized functions in primary and secondary diterpenoid metabolism. Transcript and metabolite profiling of switchgrass leaves and roots demonstrated that gene expression of several of these specialized enzymes was induced by abiotic stress. Together, these findings expand our knowledge of diverse diterpenoid networks in monocot crops and provide resources for improving plant defense for sustainable bioenergy production.

Protein RNA Silencing Suppressors of a Parasitic Pathogen and Their Effect on Infection Severity

Natalie Hamada

Sponsor: Richard Micheltmore, Ph.D.
Plant Sciences

The downy mildews are parasitic plant pathogens that infect crops and cause significant damage by reducing yields. *Bremia lactucae* is a downy mildew species that infects lettuce, covering it with spores and weakening its immune system so that it is vulnerable to a plethora of other diseases. Suppression of the host's immune response is achieved by *B. lactucae* through the secretion of effector proteins. RXLR3 is an effector thought to suppress the ability of the host to perform RNA silencing, an important component of the plant immune system. My goal is (1) to demonstrate RXLR3 silencing suppression in lettuce using the GUS reporter system, and (2) to evaluate a leaf disc assay to quantify the effect of RXLR3 overexpression on *B. lactucae* growth. The leaf disc assay involved using transgenic lettuce expressing RXLR3 and non-transgenic lettuce for comparison. The leaf discs were incubated on agar medium after being treated with a suspension of *B. lactucae* spores. Parameters of the assay were adjusted until the controls displayed even sporulation, which was quantified using computer analysis of photographs. Determining if effector expression promotes *B. lactucae* growth is important because it provides insights on the mechanism by which the pathogen succeeds.

Ambush in the Dark: A Study in Reception of Homer's *Iliad* in Virgil's *Aeneid*

Lauren Hampson

Sponsor: Timothy Brelinski, Ph.D.
Classics

This study aims to examine the intertextuality between the tenth book of Homer's *Iliad* and the ninth book of Vergil's *Aeneid*. I will look at how Vergil adapted the *Iliad*'s infamous night raid to his own uses, especially how Vergil recasts the encounter between Odysseus, Diomedes, and Dolon in the night raid of Nisus and Euryalus, both survivors of the Trojan war and soldiers of Aeneas. I will also examine how Vergil emphasizes the pathos in this scene through the inclusion of the lamentation of Euryalus' mother, a moving end to this episode. What does this tell us about how Vergil thought about the unmourned and practically unnoticed death of Dolon and, to an extent, of Rhesus? Further, I will explore what the characterization of Nisus and Euryalus tells us about Vergil's understanding of heroes and warriors worthy of renown. These questions and others furnish the base upon which the discussion about these two works will be built.

Transcriptional Regulation Driving Bistable Switch Behavior in Xylem Cell Differentiation

Diane Han

Sponsor: Siobhan Brady, Ph.D.
Plant Biology

Plant secondary cell walls (SCWs) provide mechanical support and make up the majority of the plant's biomass. The xylem cells contain SCWs and are responsible for the transport of nutrients and water from the root to shoot. In past studies, it has been hypothesized transcriptional factors (TFs) VND7, MYB83, and MYB46 interact as master regulators of xylem differentiation. My work uses real-time quantitative polymerase chain reaction (RT-qPCR) to determine quantitatively the fold-change of these TFs in response to induction/over-expression in the *Arabidopsis thaliana* root. Fold-changes in TF expression are compared to the number of cells with formation of a SCW to determine the relationship between TF expression and xylem differentiation. We then performed single-cell sequencing on VND7, MYB83, and MYB46 over-expression lines to further quantify and identify xylem cell types in *Arabidopsis* roots at the transcriptional level. The results gained from this were used to confirm increased xylem cell differentiation in the over-expression lines.

Thermal Properties of 2D Materials Measured by Probe Beam Fluctuation Due to Thermal Lensing

Kyle Hanks

Sponsor: Kristie Koski, Ph.D.
Chemistry

The physical properties of everyday "macro" materials are well understood. However, when the material becomes very thin (only a few nanometers thick) reactions to external influences can be less predictable. In our experiment we will investigate how heating a thin material will change its shape and how it conducts and dissipates heat. The thermal properties of <10nm thick material can be measured by fluctuations in a probe beam reflecting off a heated surface. Using frequency controlled pulses of a 632nm laser to heat a multi-layer two-dimensional (2D) material such as Si_2Te_3 , the surface shape will change and a lensing effect will be induced. Another collimated 632nm probe beam reflecting off that surface will be detected by a CMOS digital camera. By measuring changes in the probe beam, such as energy fluctuations, focus distortions and position changes, the properties of this 2D nanomaterial, particularly thermal conduction and expansion, can be calculated.

Suicide by Cop: A Sociological Study of Comparative Cases

Matthew Hanna

Sponsor: Christina Smith, Ph.D.
Sociology

Police brutality towards unarmed black men in the United States has been the center of much contemporary discussion on police violence. However, one area of police violence that has been greatly understudied is when armed civilians desire a violent response from police. This study examines the phenomenon of suicide by cop (SbC) where civilians purposefully provoke the police in order to end their lives. This study not only compares SbC cases to failed SbC attempts but also other suicidal events for which police were present at the scene but did not contribute to the suicide. The research sample is 136 suicidal events from January through March 2015 from the database Police and Civilian Outcomes of Threatening Events (PACOTE). Descriptive statistical analysis finds that in 60 percent of SbC events, police are specifically responding to a call for a suicidal person compared to only 25 percent of police present suicide events. Content analysis of notes and text messages points to the uniquely American cultural understanding of police as legal instruments producing death. The varying police organizational responses to suicidal events have important social implications on police perceptions towards SbC and what constitutes appropriate training and official response to suicidal situations.

DysUtopia: A Screenplay

Andrew Hanson

Sponsor: Kristopher Fallon, Ph.D.
Cinema & Digital Media

When surrounded by constant streams of digital entertainment, "fake news," and other mediated glimpses into the world, how can one discover what is objectively true? By writing a feature-length screenplay in the standard industry format, we seek to creatively explore these concepts. Ultimately, the aim of our project is twofold. For ourselves, we hope to learn about the process of writing a feature-length screenplay. For readers, we hope to encourage critical thought about the nature of truth, the role of cinema, as well as other pressing present-day global issues, and equally as important, experience something that is both entertaining and engaging. The screenplay is set in a slightly-futuristic dystopian world, where the corruption of government and corporate figures plagues everyday life from the most menial matters to sweeping global issues. Written in the style of a mockumentary, and using different forms of comedy such as sketch humor, dry humor, and dark humor, the screenplay attempts to show the absurdity of bureaucratic behavior and the development of a kyriarchy through illogical policies and the consumption and acceptance of a toxic world by the general public.

The Materialization of Free Will in Milton's *Paradise Lost*

Cristina Harber

Sponsor: Tobias Menely, Ph.D.
English

Most of the conversation concerning free will in John Milton's *Paradise Lost* tackles it as a metaphysical and theological problem; however, I am interested in how it is materialized within the poem through Eve. Specifically, I am interested in the way Eve represents herself in the narrative as a person capable of critical and provisional thinking. Possessing these two qualities, I argue, is a tangible signal of free will. For example, Eve's dream in Book 5, while at least partly influenced by Satan, also contains traces of her planetary discussion with Adam the day before—leading me to think that part of the dream is her own unconscious design. Thus, the dream scene is not one of total manipulation and objectification of Eve, but a moment where she exercises her potential for cognitive provisionality. To complete this project, I will be looking at moments in *Paradise Lost* where the narrative could have taken multiple trajectories, other primary texts regarding predestination, such as Luther and Erasmus: Free Will and Salvation and Milton's On Christian Doctrine, as well as sources that deal with fictionality's rhetorical purpose, such as Catherine Gallagher's article "The Rise of Fictionality".

Blinded and Unblinded Evaluation of Bulldog Spinal Cord Injuries Through the Use and Comparison of the Olby Scale and TCIS Scale for Gait Analysis

Morgan Hardie

Sponsor: Aijun Wang, Ph.D.
MED: Surgery

Spina bifida is a devastating birth defect that can result in incontinence, impaired mobility, and paralysis depending on the severity of the associated spinal cord lesion. Humans and English Bulldogs naturally develop spina bifida, and the UC Davis Schools of Medicine and Veterinary Medicine are collaborating to provide cutting edge veterinary care to affected dogs while gathering valuable preclinical data for human medicine. The goal of this project was to screen established canine locomotor scales to select the ideal scale for grading the recovery of treated animals. Two scoring systems, the Olby Scale and the Texas Spinal Cord Injury Scale (TSCIS) were used to assess the recovery of two treated English Bulldog puppies, and one aged matched untreated control animal. Two blinded reviewers and two unblinded reviewers graded the animals using both scales. The Olby Scale proved to be the superior rubric because it is more sensitive to slight ataxia. On average, blinded reviewers scored bulldogs 2 points higher than unblinded reviewers when using the Olby scale, but scored 0.22 points lower than unblinded scorers when using TSCIS. These scores suggest the presence of unconscious bias from the unblinded reviewers, highlighting the importance of blinding to ensure accurate assessment.

Virgin Beta Cells Persist when Pancreatic Islet Architecture is Perturbed

Rebecca Harris

Sponsor: Mark Huisin, Ph.D.
Neuro Physio & Behavior

Beta cells are essential to maintaining healthy blood sugar levels through the secretion of insulin. Loss or exhaustion of beta cells leads to diabetes, and thus a source from which to regenerate them is vital to finding a cure. Our lab has discovered virgin beta cells, a novel population of immature beta cells, that occur in a specialized neogenic niche at the interface between alpha and beta cells within mouse pancreatic islets. It is not known if virgin beta cells will persist in this specific location when the islet architecture is perturbed. To address this question, we investigated the effect of perturbed islet architecture in a mouse with a deletion of the glucagon receptor gene (gcgrKO), which leads to islets with an unusually high number of alpha cells at the periphery. We utilized immunohistochemistry and confocal microscopy to image gcgrKO mouse islets, and then analyzed them with a tool we have developed that quantifies cell type and location within the islet. Our preliminary findings suggest that these virgin beta cells persist and occupy the same neogenic niche found in islets with normal architecture. These results further our understanding of the micro-environment necessary to support virgin beta cells.

Investigating General Chemistry Students' Knowledge Retention and Success in Problem Solving

Mario Hartanto

Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Stoichiometry is one of the most challenging topics of general chemistry due to its reliance on problem solving skills and its inclusion of many different chemistry concepts. Using the Coding System for Investigating Subproblems and Network (COSINE) method, our study examines students' success with each subproblem, allowing the discovery of the exact place a student makes a mistake instead of focusing on the final answer. These subproblems were categorized based on chemistry concepts, such as limiting reactant and mole concept. This helped to identify the most challenging concepts that students face in a general chemistry course. This study also focused on students' knowledge retention between quarters. Students were tested both fall and winter quarters on stoichiometric topics to see if they could achieve the same level of success. Our preliminary results showed that in winter quarter, students had higher success rates than in the fall quarter, meaning that student understanding improved over time. Instructors should give their students more time to learn and process the material they teach. Among all the concepts studied, stoichiometric ratio was the most difficult topic for the students in the fall quarter, yet it had the highest success rate in the winter quarter.

Episodic Memory for Emotion Words Learned in Primary versus Secondary Language

Elisabeth Hartman

Sponsor: Beth Ober, Ph.D.
Human Ecology

Several studies have shown a processing advantage for positive (versus negative) emotion-laden words for both native and non-native speakers, with a larger effect in native speakers (e.g., Kazanas & Altarriba, 2015). Our current study works to identify if native English speakers (E1) recall more positive valence words after repeated delays compared to non-native English speakers (E2). Memory was tested by asking participants to orally recall a list of positive and negative words after several delayed periods: immediate, short, long, extra-long, and a two-week extended email delay. Subjects were given a series of distractor tasks in between delayed recalls. After the delayed recall tests, participants were given a yes/no recognition test. Through preliminary analysis, we have seen a significant interaction of Group (E1 vs. E2) by Valence (positive vs. negative). Both E1 and E2 performed equally well on the positive words, but the E2 group had decreased recall of negative words. These findings increase our understanding of the emotional context of verbal memory in bilingualism and suggest further investigations of the relationship between language fluency, learning, and memory of emotional features of verbal material.

Quantification of *Fragaria x ananassa* DNA with TaqMan Probe

Megan Haugland

Sponsor: Thomas Gordon, Ph.D.
Plant Pathology

Research into plant pathogen ecology requires identification of niches where pathogens increase in abundance. This information can be exploited to reduce disease incidence by limiting pathogen access to critical niches. However, quantification of pathogen abundance by culture-dependent methods is often slow and labor intensive. Quantitative real-time PCR (qPCR), specifically the TaqMan probe method, has been proposed as a high-throughput alternative. This method quantifies pathogen DNA by the hybridization of a short, fluorescent probe to pathogen DNA between the forward and reverse primers. The TaqMan method has greater specificity than other methods and can be used in multiplex assays to simultaneously quantify multiple loci. Differences in DNA extraction efficiency and the presence of PCR inhibitors can confound results based on quantification of DNA at a single locus. These variables can be controlled by expressing results as a ratio of pathogen:host DNA, which can be simultaneously quantified in TaqMan assays. The purpose of this study was to develop a TaqMan probe for strawberry (*Fragaria x ananassa*), which can be damaged by a number of plant pathogens. This probe for *F. x ananassa* can serve as the host DNA control for assays designed to quantify the abundance of plant pathogens.

A Grave Form of Art: A Comparative Discussion of Bronze Age Cycladic Figurines and Egyptian Shabti Statuettes

Wyatt Haywood

Sponsor: Alexandra Sofroniew, M.D., Ph.D.
Art

Is there a common culture of funerary art in the Early Bronze Age (2500BCE to 1800BCE) Mediterranean? Two varieties of figurines from this period, the Shabti from Egypt and the Folded-Arm Figures found across the Cycladic Islands, are plentiful in museum collections around the world. However, the Cycladic figurines have been enigmatic to archeologists for centuries, while the Shabti are unambiguous by nature. This paper uses a comparison of these two types of figurines to trace a possible lineage between them, and in the process helps extend the limited context of both types. Besides reinforcing the theory of Early Bronze Age trading routes throughout the Mediterranean, similarities in the form, style, and material of these two types of figurines suggest a shared function between the artworks within the funerary context of the cultures. They are commonly identified as grave goods, created to function in the afterlife, or funerary art that was created to memorialize the deceased. Instead, I will argue that these figurines serve a purpose beyond that of funerary artwork. I will assert that they had a domestic use, where they were thought to be mystical and used in ritual, which then continued into the afterlife.

The Impact of Acculturation and Enculturation on the Mental Health of Ethnic Minorities

Shuhua He

Sponsor: Nolan Zane, Ph.D.
Psychology

The United States is home to various racial and ethnic groups, and this heterogeneity is expected to increase in the future. Acculturation to mainstream culture and enculturation to one's heritage culture become increasingly relevant as both have implications for mental health. This study assessed the relationships between acculturation, enculturation, and mental health. Participants included 60 ethnic minority college students ranging in age from 18 to 42. Enculturation to one's heritage culture was negatively associated with both depression and anxiety, but not related to perceived stress. Acculturation was also negatively correlated with depression, but was not significantly related to anxiety or perceived stress. When acculturation and enculturation were included in the same regression model, only enculturation to one's heritage culture emerged as a significant predictor of anxiety. Neither acculturation nor enculturation emerged as a significant predictor of depression when both were accounted for in the same model. Findings suggest that enculturation to one's heritage culture may act as a protective factor with respect to mental health, specifically anxiety. Based on these results, health care professionals and practitioners should consider incorporating ways to maintain or preserve one's heritage culture as a protective factor against emotional distress and stress among ethnic minority populations.

Mitochondrial Toxicity of NRTI Therapy in HIV

Behnaz Hekmat

Sponsor: Gino Cortopassi, Ph.D.
VM: Molecular Bio Sciences

It is well documented that both the HIV infection and certain drugs used in AIDS treatment have various toxicity effects in patients. These effects are correlated with duration of treatment as well as the specific regimen used. Nucleoside reverse transcriptase inhibitors (NRTIs) make up a large portion of treatment plans, however NRTIs are known for mitochondrial toxicity. So far there have been limited studies directly evaluating mitochondrial function in NRTI-treated patients. We hypothesize that prolonged treatment with NRTIs will reduce mitochondrial copy number and gene expression in clinical settings, thus producing some of the associated comorbidities observed in patients. We evaluated the mitochondrial copy number (mtDNA: nDNA ratio) in healthy controls [HIV-individuals], HIV+ individuals and HIV+ individuals treated with NRTI for 12 months. Initial findings suggest that in patients with a large increase in their mtDNA ratio after 12 months of treatment there is a toxicity effect leading to the mitochondrial proliferation. We are currently evaluating the extent of mitochondrial DNA damage and mitochondrial gene expression.

First Report of a New Crown Rot Disease of Tomato in California, Caused by Pathogens in the *Fusarium solani* Species Complex

Erin Helpio

Sponsor: Cassandra Swett, Ph.D.
Plant Pathology

California produces 90% of the countries processing tomatoes, with \$1,031,995 in cash receipts for the state. In 2017, *Fusarium solani* species complex isolates (FSSC) were recovered from tomatoes in the Central Valley of California that had crown rot symptoms. There is no record of any species in the FSSC causing crown rot in California, suggesting that this may be a new crown rot disease in the state. To test this hypothesis, Koch's postulates was conducted using seven crown rot-associated FSSC isolates from each of four species groups, together with negative wound and biological controls. Each treatment was applied in triplicate by placing spores and hyphae in a 1mm epidermal wound at the base of the stem of 5-week-old tomato plants (cv. H8504). Treatment had a significant effect on lesion size 8 weeks after inoculation ($P < 0.001$). Isolates within two FSSC species groups caused significantly greater crown rot lesions (55-65 mm on average) compared to both wound and biological controls (3-7mm). These results suggest that at least two species in the FSSC are new crown rot pathogens of tomato in California. This information can be used to develop diagnostic tools and identify resistant cultivars for control.

Parental Redirection and the Creation of Joint Attention

Anna Herbolzheimer

Sponsor: Lisa Oakes, Ph.D.
Psychology

Mother-infant dynamics are important factors in the development of joint attention, where two partners coordinate their attention towards a common object or goal. Parental sensitivity is particularly critical. Sensitive parents give prompt and appropriate responses to children's behavior (Miller & Gros-Louis, 2013; Tomasello & Farrar, 1986), whereas redirective parents initiate new activities unrelated to the infant's ongoing focus (Miller & Gros-Louis, 2013; Tomasello & Farrar, 1986). In this study, we observed mother-infant dyads as they played with toys and read books, while wearing head-mounted eye trackers. This allows us to record both motor and looking behaviors by mother and infant during these play sessions. We will evaluate whether dyads with more redirective behaviors (i.e., mother grabbing infants' hands or taking objects away from infants) have less instances of joint attention (i.e., both looking at the puzzle) than dyads in which the mothers are less redirective. Our aim is to discover ways that mothers can encourage the development of joint attention.

Effects of Roadway Emissions on the Lung

Anacelly Hernandez

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

Living near busy roads is associated with lung diseases (infections, asthma, and chronic bronchitis) as well as reductions in overall lung function. These health effects are more prominent when the exposure occurs early in life. The central focus of this study is to understand how highway emissions affect the respiratory system of juvenile rats as they mature, and to determine if long early-life exposure increases airway inflammation later in life. Juvenile (four week) rats were constantly exposed to real-time tunnel concentrated vehicular emissions from a major northern California freeway (TRAP). Lung tissue was collected from adult animals after 3 and 6 months of continuous exposure. Control groups included unexposed adult rats, and rats that were exposed to filtered air (FA) during development. At collection, lung tissue was fixed and embedded in paraffin. Histologic stains were used to reveal inflammation, mucous cell abundance and/or scarring. Lungs were also imaged using the CytoViva Hyperspectral Imaging system to determine where traffic-pollution particles deposit. In the FA control group, inflammatory cells were found in large airways. In TRAP exposed group, inflammatory cells were spread throughout the tissue and were more abundant in smaller airways.

The Racialized Collective Memory and Media Framing of New Orleans Natural Disasters

Hannah Higgins

Sponsor: Drew Halfmann, Ph.D.
Sociology

Following several natural disasters in New Orleans, various racial groups have formed differing collective memories. Formed when an entire community holds a similar recollection of a shared experience, collective memories can be broken down into three key principles: they are selective according to one's identity, they align hierarchically to produce a dominant memory, and they have consequences on future group behaviors and disaster responses. These memories expand the rift between races and perpetuate social inequality through the promotion of stereotypes. This research argues that media plays a significant role in shaping the collective memories of Hurricane Betsy and Hurricane Katrina through the spread of stereotypic rumors about Black New Orleanians. These media representations become engrained in the collective memory of white audiences, which aids in legitimating racist disaster responses that leave Black communities severely vulnerable and disadvantaged. Media analysis highlights the complex dynamics through which collective memory manifests and without crucial changes, future disaster responses will be highly predictable mechanisms that reinforce racial inequality.

Genome Wide Association Study Identifies a Locus 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 aberrant lashes grow from openings of the Meibomian glands along the eyelids. These lashes can cause irritation and corneal ulcers, which can lead to corneal scarring and vision loss. Because of its bilateral nature and prevalence in a breed with known Mendelian disorders, this condition is hypothesized to be inherited as a Mendelian trait. To test this hypothesis, a genome wide association study (GWAS) was performed utilizing the Equine Affymetrix 670K array (MNEc670k) on fourteen cases and thirty-eight controls that were phenotyped for distichiasis. A chi-squared test for a basic allelic association identified a locus on ECA5 and on ECA13 as significantly associated ($p_{\text{corrected}} = 6.4 \times 10^{-2}$ and 7.9×10^{-4} , respectively), however genomic inflation was high ($\lambda = 1.48$). To correct for this, a single locus mixed linear model (EMMAX) analysis was performed. Under a recessive model, the locus on ECA13 was further supported ($p_{\text{corrected}} < 4.8 \times 10^{-2}$). Haplotype analysis identified a 360 Kb run of homozygosity on ECA13 in thirteen of the fourteen cases and supports a recessive mode of inheritance. This locus contains two annotated genes, which will be further investigated to identify candidate causal variants.

Ultra-High Pressurized Cellulosic Biomass Pretreatment for Production of Ethanol-Based Biofuels

Alex Hitomi

Sponsor: Tina Zicari, Ph.D.
Biological & Ag Engineering

Cellulosic biofuel offers potential as a reliable and cost-efficient alternative capable of lowering society's dependence on fossil fuels, however the conventional dilute acid pretreatment process used for upstream biomass break down is currently unfeasible due to costs associated with the pretreatment process. This work evaluates the use of an ultra-high pressurized pretreatment that relies on both the superacidification and freezing point depression of aqueous solutions under intense pressurization rather than thermochemical breakdown of biomass. Compared to conventional dilute acid pretreatments that require costly heating and downstream conditioning methods, the proposed pressurized pretreatment process circumvents the need for conditioning steps like pH adjustment and buffer transfer, harsh chemical catalysts like sulfuric acid and external heating. Using a clamp-cell pressure reactor capable of reaching pressures of 2 GPa with piezooptical ruby fluorescence measurement methods, pressurization has been used to induce solubilization and facilitate general physicochemical breakdown of the biomass structure in a manner similar to conventional dilute acid pretreatments.

Temperature Driven Phase Transitions in *Euplectella Aspergillum* Silica Sea Sponges

Wai Lone Ho

Sponsor: Kristie Koski, Ph.D.
Chemistry

Marine sea sponges have the remarkable ability to use silicon from the environment to form silica as a form of defense and structural support. The building blocks of the silica sponge *Euplectella Aspergillum* are micro and nano-scale SiO_2 particles in a hierarchical cylindrical structure surrounding proteins. Raman spectroscopy of the sponges indicates that they lack a higher-ordered silica ring structure, commonly found in other naturally occurring silicas. Additionally, characterization of the silica sponge by X-ray diffraction (XRD) and Raman spectroscopy shows that a phase transition from amorphous silica to cristobalite occurs with heating. Further controlled experiments conducted using Differential Scanning Calorimetry (DSC) more accurately measured the phase transition temperature to be a range between 970°C to 1010°C, significantly lower than normally observed phase transition temperature between 1400°C to 1700°C. These findings suggest that the lack of a higher-ordered silicate ring structure may result in a more kinetically favorable transition from amorphous silica to cristobalite.

Relatedness and Chemical Signaling in Primitively Eusocial Female Orchid Bees

Kirsten Hodgson

Sponsor: Santiago Ramirez, Ph.D.
Evolution & Ecology

Eusocial insects display a large amount of behavioral variation, with some species living in simple social groups of two or three individuals and other species living in social groups consisting of thousands of cooperating individuals. In contrast to advanced eusocial species, primitively eusocial species are not typically distinguished by obvious morphological differences between castes. Rather, communication between individuals is primarily conducted through chemical signaling by way of cuticular hydrocarbons (CHCs), lipids on the surface of all insects. Individuals often have distinct CHC profiles that advertise reproductive status or signal relatedness. Although the use of CHCs in insect communication is widely documented, less is known about how this function has evolved in primitively eusocial insects. To that end, we examine the relationship between relatedness and CHCs among individuals in social groups of the primitively eusocial orchid bee *Euglossa dilemma*, to test the hypothesis that relatedness explains variation in CHCs. We sampled 20 *E. dilemma* nests, collecting CHC and genotype data for all individuals, and assessed correlations between these data sets. The results of this analysis will further our understanding of how *E. dilemma*, and potentially other primitively eusocial species, use CHCs for social communication.

The Comparative Effects of Nano Copper on Two Different Populations of the Bay Mussel, *Mytilus galloprovincialis*

Anne Holt

Sponsor: Gary Cherr, Ph.D.
Environmental Toxicology

The objective of this study was to investigate copper oxide nanoparticle uptake, accumulation and effects in two populations of the bay mussel, *Mytilus galloprovincialis*. Most studies on nanoparticle toxicity in mussels have focused on mussels obtained from shellfish companies or aquaculture, with controlled upbringing and consistent life exposures before experimental exposures. In this study, mussels were harvested from two local sites that have been exposed to varying conditions in their lifetime. Mussels were exposed to 250 µg/l nano-CuO as well as to 250 µg/l nano-CuO in combination with algae for four days to investigate the effects of feeding in nanomaterial uptake. Copper was found to accumulate in the digestive gland of both mussel populations but was present in larger amounts in the digestive gland of mussels from Porto Bodega, a more polluted site. Little accumulation was found in the gills of the mussels, and the activity of the hemocytes and their concentration did not significantly differ among the treatments or between each population after exposure. Nano copper oxide in this study did not significantly affect immune system health or copper accumulation, but feeding did seem to play a role in copper uptake to the digestive gland.

Temporary Contracts in Madrid: Immigration and Youth Labor Force

Tara Homara

Sponsor: Janine Wilson, Ph.D.
Economics

Spain, like many other Western European countries, struggles with high unemployment rates, and has turned to using temporary contracts to attack this problem. Initially, in the 1980's, Spain allowed more employers to use temporary contracts as a way to manage its extreme unemployment rate; however, Spain still faces high levels of unemployment today. My research, focused on Madrid, explores what factors are causing Spain to continue the use of temporary contracts, if the unemployment rate continues to exist at such high levels. Are immigrants the reason for so many temporary contracts? Are youth workers the ones using temporary contracts? Using regression analysis and data from INEbase, I want to know why Madrid continues to use high levels of temporary contracts, if it's unintended consequence is more unemployment. Through data on immigration rates, the labor force, and structural changes in the labor market, I examine the effects these variables have on the use of temporary contracts in Madrid.

Direct Visualization of Fungal Invasion in Plants Through Microscopy and Staining

Aleshia Hopper

Sponsor: Daniel Kliebenstein, Ph.D.
Plant Sciences

Botrytis cinerea (*Botrytis*), commonly known as gray mold, devastates many fruit and vegetable crops. To wreak its havoc, *Botrytis* must first enter the plant. To prevent this entry, most plants have developed lines of defense: tough cell walls and a waxy, repellant coating. Unfortunately, plants require natural pores, stomata, to exchange gases and water with the environment, making them susceptible to intruders. This leads to the question: how does *Botrytis* enter the plant? Does it burrow straight through cell walls or sneak in via stomata? Do different isolates of *Botrytis* enter plants using different strategies? To answer these questions, we must locate *Botrytis*'s preferred site of entry. There are multiple methods to observe the behavior of pathogens in plants. Many of these techniques are indirect and make inferences about pathogen invaders based on the plant's immune response. Optical microscopy and staining will allow us to directly visualize the entry behavior of *Botrytis*. The experimental procedure has many optimizable steps, including inoculation of *Arabidopsis* leaves with different isolates of *Botrytis*, decolorization of infected leaves, application of a staining solution, and visualization through microscopy. We will present the optimized procedure and show how *Botrytis*'s hyphal structures enter infected *Arabidopsis* leaves.

Design of a Multiplex SNP Assay for the Detection of Five Different Arboviruses Transmitted by Aedes Mosquitoes

Parker Houston

Sponsor: Gregory Lanzaro, Ph.D.

VM: Pathology, Micro, & Immun

The Aedes mosquito is an invasive species in California. They are able to transmit various arboviruses, such as Zika and West Nile, which makes them a threat to human health. Early detection of arboviruses in mosquito allows vector control districts to take necessary measures. We are currently developing a multiplex diagnostic assay to detect the presence of Chikungunya, Dengue (serotypes I-IV), West Nile, Yellow Fever, and Zika within an infected Aedes mosquito. Aligning complementary cDNA sequences of these arboviruses allowed us to design specific primers that can amplify parts of the viral genome and identify distinct single nucleotide polymorphisms (SNPs) within these amplified regions. The advantage of our method over other methods is that we can identify the presence of multiple viruses within one reaction. Additionally, our assay can be extended with other markers that provide us with more information about the genotype of the Aedes mosquito, such as insecticide resistance or drought tolerance. We are currently testing the specificity and efficiency of the assay, but this assay shows potential to be an effective surveillance tool for early virus detection in Aedes mosquitoes.

Influence of Dietary Intervention on Adult Human Gut Microbial Composition

Hannah Houts

Sponsor: Angela Zivkovic, Ph.D.

Nutrition

The community of microbes inhabiting an individual's gut is influenced by their environmental conditions, but also contributes to a unique internal environment. The purpose of this study was to determine how an individual's typical, or baseline, gut microbiome changes in response to pronounced dietary changes. Additionally, the efficacy of a two week washout period to eliminate a treatment order effect was examined. The study had a double crossover design, where 20 participants ate their typical diet and then consumed for four days either a high-fiber mediterranean diet or a fast food diet, followed by a two week washout period of their typical diet, and then consumed four days of the alternate experimental diet. Fecal samples were collected at the end of each diet, from which bacterial DNA was isolated, the 16s rRNA gene was amplified, and was sequenced with Next-Generation Sequencing (NGS). Microbial community compositions and similarities were mapped using the DADA2 pipeline. Analyses have shown variability in microbiome response to dietary changes among individuals.

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 151 articles and will have completed work on 307 by the end of my research; 26 of these articles have been critically analyzed for their relevance. 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.

Quantifying Ubiquitin Inclusions in an Inducible Mouse Model of Fragile X-Associated Tremor/Ataxia Syndrome (FXTAS)

Caroline Hsieh

Sponsor: Robert Berman, Ph.D.

MED: Neurological Surgery

Fragile X-associated tremor/ataxia syndrome (FXTAS) is a progressive, late-onset neurodegenerative disorder that stems from a CGG trinucleotide repeat expansion in the 5' UTR of the FMR1 gene. FXTAS is characterized by increased levels of FMR1 mRNA, decreased levels of FMRP, and the production of toxic peptide FMRpolyG through repeat-associated non-AUG translation. FMRpolyG is thought to play a contributing role in the pathology of FXTAS. The hallmark histopathology in FXTAS is the presence of intranuclear ubiquitin-containing inclusions in neurons and astrocytes. We use a doxycycline-inducible mouse model of FXTAS, in which we can selectively express a CGG(n) trinucleotide repeat expansion in neurons at different time points during development, to investigate both disease progression as well as the correlative relationship between increasing inclusion size and the severity of symptoms associated with FXTAS. We utilize immunohistochemical and stereological techniques to quantify inclusions that arise in the hippocampal region of animals that are 8 weeks and 20 weeks on a doxycycline treatment. Results from this study will provide a greater understanding of disease progression, likelihood of disease reversibility and intervention with a potential drug therapy, and the contributions of CGG repeat expansions in neuronal FXTAS pathogenesis.

Comparison of Cyanotoxin Concentrations in the San Francisco Estuary Between Dry and Wet Years

Jessica Hsiung

Sponsor: Tomofumi Kurobe, Ph.D.

VM: Anat Physio & Cell Biology

Harmful algal blooms (HABs) in the San Francisco Estuary (SFE) are becoming more frequent due to severe drought in California, the most recent one of which occurred between 2011 and 2017. Toxins produced by cyanobacteria (cyanotoxins) deteriorate water quality and threaten public safety and aquatic health. As California's dry climate pattern tends toward more frequent and intense drought situations, *Microcystis aeruginosa* and other toxin-producing cyanobacteria that favor warmer water temperature are likely to flourish in the SFE and increase risk of cyanotoxin contamination and exposure. In this study, concentrations and occurrence of cyanotoxins were monitored in the SFE from 2014 to 2017. Each year, monthly field sampling was performed during cyanobacteria bloom periods at ten stations in the SFE by the California Department of Water Resources. Ambient water and algal samples were collected for analysis of three cyanotoxin concentrations (anatoxin-a, microcystins, and saxitoxin) by enzymatic assays and for quantifying biovolume of *M. aeruginosa* by image analysis (FlowCam). The monitoring data and trends in cyanotoxin concentrations between wet and dry years will be discussed. The results will assist in efforts to assess water quality and monitor HAB occurrence patterns in the SFE during drought and off-drought years.

Healthy UC Davis: A Campus Wide Initiative to Promote Campus Health and Well-Being

Tanya Hsiung

Sponsor: Jacqueline Bergman, Ph.D.

Nutrition

One third of the American population is obese. Creating a healthy campus is a promising approach to address the obesity epidemic by fostering healthy habits among young adults. This potential prompted the Partnership for a Healthier America to create the Healthier Campus Initiative (HCI). Healthy UC Davis is one of many versions of the HCI being implemented throughout the United States. Healthy UC Davis aims to provide UC Davis community members with support, opportunity, information, and tools to engage in healthy behaviors. There are three branches: Nutrition and Food, Physical Activity, and Emotional Health and Well-being. As initial 2017-2018 funds are depleted, Healthy UC Davis stakeholders hope to create a self-sustaining program that continues to promote campus health. As part of the Healthy UC Davis sustainability plan, Healthy UC Davis will serve as a platform for collaboration among pre-existing UC Davis programs that hold the same values and goals. In addition to providing an account of methods used in the development and implementation of Healthy UC Davis, this study will identify barriers and facilitators to sustaining healthy campus programming as reported by Healthy UC Davis stakeholders.

Translational Neuroscience in Reverse: Adapting EEG Analysis Techniques from Bedside to Bench

Emily Hsu

Sponsor: Gene Gurkoff, Ph.D.

MED: Neurological Surgery

Temporal lobe epilepsy (TLE) is defined by spontaneous recurring seizures emanating from within the temporal lobe. Patients with TLE frequently report cognitive deficits. Anti-epileptic drugs (AED) are prescribed to limit the occurrence of seizures, however, over 40% of patients with TLE do not respond to treatment. Also, many of those who demonstrate significant seizure reduction with AED experience side effects that worsen their cognitive deficits. Therefore, there is a need to develop innovative treatment strategies to reduce seizures and improve cognitive function in patients with TLE. Theta frequency oscillations (6-10 Hz) are observed in the electroencephalogram (EEG) and play a critical role in learning an environment. In the novel object task, rats will preferentially explore a novel as compared to a familiar object. Based on clinical studies, we propose to analyze specific epochs of behavior in the novel object task, during object familiarization and testing, including (1) as rats approach, (2) interact with, and (3) leave an object as well as (4) when it navigates the environment. We hypothesize that altered oscillations during object interaction will predict poor learning in epileptic as compared to control rats. Moreover, we hypothesize that stimulation will improve oscillations and therefore learning.

Differences in Beliefs About Women's Gender Roles, Between Sexual Orientation and Gender

Alice Hsu

Sponsor: Paul Hastings, Ph.D.

Psychology

Historically, women have been oppressed and expected to ascribe to subordinate roles. Patriarchal dynamics between men and women have predominately been examined within heterosexual populations. Whether people whom identify as non-heterosexual (i.e., lesbian, gay, bisexual, or queer(LGBQ)) ascribe to similar patriarchal beliefs about women's gender roles requires further examination. This study examined group differences between gender and sexual orientation to the belief that women should be subordinate. We hypothesized women would report less belief in subordination than men and that LGBQ participants would report less of the belief compared to heterosexual participants. Questionnaires were administered to participants (N=200) between the ages of 18-29 years old (M=23.58, SD=2.65). A 2(female/male) X 2(straight/LGBQ) two-way ANOVA was conducted to test our hypotheses. Results showed a main effect for gender; women (M=6.95, SD=3.07) ascribed less to subordinate beliefs than men (M=8.71, SD=4.95), $F(2,200)=10.02$, $p<0.01$. We also observed a main effect for sexual orientation. Straight (M=9.10, SD=4.61) participants ascribed to more subordinate beliefs than LGBQ individuals (M=6.57, SD=3.29), $F(2,200)=14.22$, $p<0.001$. The interaction between gender and sexual orientation was not significant ($p>0.05$). These findings show that despite progressive gender movements, adherence to patriarchal gender roles by men and straight individuals remain pervasive.

Relationships Between Head and Body Shapes in Scorpaeniform Fishes

Lin-Ya Hu

Sponsor: Peter Wainwright, Ph.D.
Evolution & Ecology

Scorpaeniformes is a morphologically diverse order of ray-finned fishes, encompassing lionfishes, rockfishes, sea robins, among many other species. Scorpaeniform fishes live in a wide range of habitats, but mostly on or near the bottom of the ocean. Previous research in other clades has showed that head and body shapes are significantly correlated, but that this relationship can differ across species. One implication is that body shape can constrain head morphology and may impact the ability of fishes to interact with their environments. Studying the morphology of diverse species in Scorpaeniformes, we hypothesized that head and body shapes of fishes are closely related and that extreme deepening or shallowing of body depth will constrain head depth, lower jaw length, and mouth width across this order. Morphometric data from the National Museum of Natural History were used to evaluate the strength of relationships between body depth and head and jaw dimensions. This study will help us understand patterns of morphological diversification in scorpaeniform fishes and may also provide further insight into the influence of ecological factors, like habitat, on the evolution of body and head shapes.

Cardiac Aging Associated with Nucleolar Stress and Perturbed Ribosome Biogenesis

Trang Hua

Sponsor: Nirmala Hariharan, Ph.D.
MED: Pharmacology

The nucleolus is an important organelle for ribosome biogenesis and acts as a stress sensor. Previous research shows that impaired ribosome biogenesis is characteristic of the aged heart. We hypothesize that nucleolar stress is accompanied by increased ribosome biogenesis and accumulation of free ribosomal proteins such as RPL11 that upregulate p53 and contribute to cardiac aging and age-associated affliction. To test our hypothesis, we used two types of mouse models: chronological aging and biological aging. We compared young and old C57 mice in the chronological aging model and 3 different mouse strains -FVB, C57, and CAST in the biological aging model. CAST mice exhibited significantly increased E/A ratio within 2 months after birth indicating diastolic dysfunction. Expression of senescence markers p53 and p16 were increased, coincident with shortening of telomeres in 2 month old CAST mice, indicating acquisition of early cardiac aging. Increased pre-rRNA levels were observed in old C57 and CAST mice that exhibited age-associated cardiac hypertrophy, suggesting an increase in ribosome biogenesis in chronological and biological models of aging. Protein expression of RPL11 and p53 were also increased in CAST mice, suggesting accumulation of free RPL11 that causes an increase in p53 level. These data support our hypothesis.

Functional Analysis of the Microtubule-Associated Protein MAP65-9 in the Mustard Plant *Arabidopsis*

Calvin Huang

Sponsor: Bo Liu, Ph.D.
Plant Biology

Microtubule-associated proteins, MAPs, play critical roles in microtubule organization for physiological events like mitosis and cytokinesis. The MAP65 family consists of 9 proteins in *Arabidopsis thaliana*. Recent studies indicated that MAP65-3 and MAP65-4 function in microtubule organization in the phragmoplast, allowing cell plate assembly in between two sets of microtubules. Additionally, MAP65-4 is detected at the cortical cell division site throughout mitosis, but its loss does not affect division plane orientation. Due to the homology between MAP65-4 and MAP65-9, we hypothesized MAP65-9 and MAP65-4 function redundantly in regulating cell division plane. Both map65-4 and map65-9 homozygous mutants did not exhibit defects in growth and development. The two mutants were crossed to generate map65-4 map65-9 double mutants. Phenotypes in cell division and growth will be analyzed. Meanwhile, we have transformed the map65-9 mutant with a MAP65-9-GFP (green fluorescent protein) construct to determine the intracellular localization of MAP65-9 by fluorescent microscopy. Information from MAP65-9 localization and phenotypic analysis of the double mutant will allow us to determine its function in cell division and its relationship with MAP65-4.

MTAP Regulates Malignancy and is Novel Prognostic Factor for Kidney Cancer

Carissa Huang

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

Patients with renal cell carcinoma (RCC) have unusually poor prognosis; therefore, it is urgent to discover potential molecules for predicting malignant changes that will lead to RCC. We have identified S-methyl-5'-thioadenosine phosphorylase (MTAP) and its substrate methylthioadenosine (MTA) as a possible biomarker. In patients with RCC, we found low MTAP expression accompanied with high MTA level. Datasets for RCC (n=538) from The Cancer Genome Atlas showed that patients with low MTAP levels have significantly shorter overall survival compared to the high MTAP group. Immunohistochemistry staining of normal kidney tissues confirmed an increase of MTAP protein expression compared to RCC tissues, and MTAP expression is inversely proportional to tumor grade. Accumulation of MTA was observed in high-grade tumors showing high malignant potential. MTAP-knockout RCC cells displayed an elongated, spindle-like morphology with extended pseudopodial branches. Genetic manipulation of MTAP studies demonstrated that MTAP expression inhibits epithelial-mesenchymal transition, invasion and migration of RCC cells. Loss of MTAP resulted in an activation of IGF1R signaling in RCC cells. Taken together, our findings indicate a major contribution of MTAP loss to kidney cancer cell malignancy and a viable biomarker for tumor detections.

Episodic Memory for Emotion Words Learned in Primary versus Secondary Language

Sophia Huang

Sponsor: Beth Ober, Ph.D.
Human Ecology

Several studies have shown a processing advantage for positive (versus negative) emotion-laden words for both native and non-native speakers, with a larger effect in native speakers (e.g., Kazanas & Altarriba, 2015). Our current study works to identify if native English speakers (E1) recall more positive valence words after repeated delays compared to non-native English speakers (E2). Memory was tested by asking participants to orally recall a list of positive and negative words after several delayed periods: immediate, short, long, extra-long, and a two-week extended email delay. Subjects were given a series of distractor tasks in between delayed recalls. After the delayed recall tests, participants were given a yes/no recognition test. Through preliminary analysis, we have seen a significant interaction of Group (E1 vs. E2) by Valence (positive vs. negative). Both E1 and E2 performed equally well on the positive words, but the E2 group had decreased recall of negative words. These findings increase our understanding of the emotional context of verbal memory in bilingualism and suggest further investigations of the relationship between language fluency, learning, and memory of emotional features of verbal material.

Light as an Environmental Stimulus Regulating Retinal FGF15 Gene Expression

Carl Huang

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

Environmental influences on metabolism have been an ongoing focus for research regarding weight gain and weight loss. Namely, disruptions of the light:dark cycle via inappropriate light exposure have been implicated in metabolic syndromes. FGF15, the rodent ortholog of human FGF19, is a peptide signaling molecule secreted from the gut and acts in the liver to promote weight loss when given pharmacologically. Recent evidence suggests that FGF15 may be produced in the retina as well. Therefore, we hypothesized that retinal FGF15 may be a light-regulated signal influencing systemic metabolism. To test this, retinas will be harvested from 4 rats during the light cycle (the rodents' inactive phase), and from 4 rats during the dark cycle (active phase). mRNA will be isolated and converted to cDNA for qPCR to analyze gene expression of retinal FGF15 during both light and dark cycles. Our preliminary data suggests that retinal FGF15 is in fact differentially regulated by light and upregulated during the dark cycle. These findings support our hypothesis and may have implications for our understanding and treatment of metabolic health. A better understanding of how the environment influences metabolism could aid in human behavioral and therapeutic treatments to impede the worldwide obesity epidemic.

Profanity in Early Modern Drama

Mariana Huben

Sponsor: Seeta Chaganti, Ph.D.
English

What exactly makes a bad word so bad? Where do these words come from, how do they achieve their infamy in the English language, and how do writers use them in literature? Early modern drama presents a unique way to explore profanity, as people experienced a shifting economy, the creation of new social classes, changing religious values, improvements in hygiene, and sociocultural moralization processes. William Shakespeare's *Measure for Measure* and Ben Jonson's *Bartholomew Fair* both focus on morality and hypocrisy. Both plays use profanity to emphasize that problems in society – immoral sexual relations, prostitution, venereal disease – are not necessarily caused by the words we use to describe those topics. While the words themselves may cause offense, the true offenders in society are those who pretend to be morally superior when they are truly hypocrites. Looking at how early modern playwrights use profanity helps a modern reader understand the historical depth of bad words – many of which we still use today – and how alongside morality, hypocrisy, insults, religion, and class stratification, we can more deeply appreciate their value in our culture.

Can Single Amino Acid Substitutions in Inner Kinetochore Protein CENP-C Induce Haploids?

Amy Huddleson

Sponsor: Anne Britt, Ph.D.
Plant Biology

Haploids are of great value to plant breeding, shortening the duration and minimizing the labor required to produce true-breeding lines, which classically require 7-8 generations of back-crossing. By doubling haploids, true-breeding lines can be obtained in one generation. It has previously been demonstrated that manipulation of the *CENH3* gene, which codes for a centromere-specific histone protein, resulted in haploid induction. During cell division, the centromere serves as an attachment point for the kinetochore proteins which serve as an attachment point for spindle fibers, which then pull apart the chromosomes. Both the centromere and the kinetochore are essential for proper chromosome segregation during cell division. Modification of the centromere causes missegregation of chromosomes which is why it results in haploids. Since kinetochores are equally essential for chromosomal segregation, reasonable to speculate that modification of the kinetochore may also lead to missegregation of chromosomes, resulting in haploids. Our question is: can manipulation of inner kinetochore protein CENP-C by single amino acid substitutions in conserved residues also result in haploid induction?

Relationships Between Head Morphology and Body Depth in Labrid Fishes

Nikita Hudson

Sponsor: Peter Wainwright, Ph.D.
Evolution & Ecology

Dwelling in habitats from coral reefs to the sandy sea floor, the aesthetically captivating Labridae are widely regarded as one of the most speciose and morphologically diverse groups of marine fishes. The vast morphological diversity found in labrids is related to their ability to diversify across extensive ranges of environmental and ecological niches. It is possible, however, that this may also constrain the relationship between body depth and head morphology as seen in other adaptive radiations. Here, we examine the dynamics of the relationship between body depth and head depth, lower jaw length, and mouth width diversity in labrids. This study uses the largest data set of its type, with data collected from the National Museum of Natural History, and includes measurements of nearly 600 specimens within Labridae, across over 200 species. To quantify the strength of the relationship between head morphology and body shape we used a phylogenetic framework and linear morphometric data to estimate and compare head shape diversity in shallow and deep bodied fishes. We hypothesize a strong connection between these two regions. This research sheds light on the interaction between body and head shape evolution and provides novel insight into an incredibly diverse radiation of fishes.

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. *Hydra* is a small aquatic species capable of whole body regeneration due to its large proportion of stem cells. In other regenerative animals such as Planarians and *Nematostella vectensis*, regeneration genes are upregulated in response to all injuries, even injuries that do not require regeneration. When regeneration is not required, regeneration genes are subsequently down-regulated. By contrast, my preliminary data suggest that in *Hydra*, molecular response to wounding is immediately specialized depending on the nature of injury (i.e. wounds that require full regeneration vs. nonregenerative wounds). Based on these findings I hypothesize that wound response in *Hydra* is rapidly specialized to injury type. To test my hypothesis, I will examine expression of regeneration-specific genes during different types of wound healing in *Hydra*: 1) nonregenerative injury (incision) and 2) two types of regenerative injuries (head and foot regeneration following bisection). The gene expression levels will be evaluated by extracting total RNA, creating cDNA, and measuring expression of the genes through quantitative PCR (qPCR). This will provide insight into why regenerative ability varies among species and regenerative capacity declines with age.

Comparative Analysis of Body Elongation as a Major Trend in Demersal Fishes

Justin Huynh

Sponsor: Peter Wainwright, Ph.D.
Evolution & Ecology

Demersal fishes are a unique group to study because they share ecological qualities of both pelagic and benthic dwellers, and could exhibit morphological trends associated with either habitat. They may be found traversing the open water column or just above the seafloor, two habitats that contain different degrees of structural complexity. While body elongation has been shown to be the dominant axis of variation in reef fishes, it is unclear whether the ecological drivers for body elongation diversity are unique to reef habitats, or if this trend persists across a broader range of benthopelagic environments. We test whether elongation is the dominant form of shape diversity across demersal teleost fishes. We collected morphometric data from the National Museum of Natural History and used linear measurements of depth and length to quantify body elongation. We evaluated our data within a phylogenetic framework for teleosts to estimate the dominance of elongation across fish shape diversity. Fishbase and various literatures were used to validate the demersal habitats of our study species. We predicted that body depths relative to standard length show the greatest trend in diversity across demersal fishes, providing evidence that the importance of elongation is not limited to reef environments.

Water Quality Issue in the San Francisco Estuary

Khiet Huynh

Sponsor: Tomofumi Kurobe, Ph.D.
VM: Anat Physio & Cell Biology

Abundance of pelagic fish species in the San Francisco Estuary (SFE) such as Delta Smelt, Threadfin Shad, Longfin Smelt, and Striped Bass has been declining since 2000s. We hypothesize that water quality, toxins or pollutants in water play a critical role in the decline. In this study, water samples collected from ten sampling stations throughout the SFE in summer and fall 2017 were used for fish embryo toxicity testing using Medaka (*Oryzias latipes*) as a model. In September, Medaka embryos, incubated in water samples from central Delta (D4, D12, D19, D22, and D28A), displayed significant mortality and impaired motility. Also, many embryos experienced bacterial growth outside of egg membrane which eventually lead to mortality. The cause of the adverse effects is still unknown, however toxins from cyanobacteria could be associated with the mortality event because of high correlation with cyanobacteria abundance (*Microcystis* spp). We will discuss possible cause of the adverse effects.

Relationships Between Head and Body Shapes in Scorpaeniform Fishes

Yunjin Hwang

Sponsor: Peter Wainwright, Ph.D.
Evolution & Ecology

Scorpaeniformes is a morphologically diverse order of ray-finned fishes, encompassing lionfishes, rockfishes, sea robins, among many other species. Scorpaeniform fishes live in a wide range of habitats, but mostly on or near the bottom of the ocean. Previous research in other clades has showed that head and body shapes are significantly correlated, but that this relationship can differ across species. One implication is that body shape can constrain head morphology and may impact the ability of fishes to interact with their environments. Studying the morphology of diverse species in Scorpaeniformes, we hypothesized that head and body shapes of fishes are closely related and that extreme deepening or shallowing of body depth will constrain head depth, lower jaw length, and mouth width across this order. Morphometric data from the National Museum of Natural History were used to evaluate the strength of relationships between body depth and head and jaw dimensions. This study will help us understand patterns of morphological diversification in scorpaeniform fishes and may also provide further insight into the influence of ecological factors, like habitat, on the evolution of body and head shapes.

Multi-Player Augmented Reality Game: Developing a Collision Avoidance System in a Simulated Environment

Hyeyeon Hwang

Sponsor: Nelson Max, Ph.D.
Engr Computer Science

Although augmented reality (AR) games have been rapidly developing, hardware-software integration systems for AR quadcopter games are still underdeveloped. The game system we propose consists of a game player, a quadcopter drone with a video camera, two computers, a touch controller, a virtual reality headset, and wireless communication links. The challenge is that having users control the quadcopter may lead to collisions between two quadcopters or between quadcopters and physical barriers. We use the Gazebo robot simulator, the open-source Robot Operating System framework, and Micro Air Vehicle Link (MAVLink), a message protocol for information exchange, to create a semi-autonomous quadcopter collision avoidance system in a simulated environment. Unless a quadcopter is close to colliding, the touch controller input will be sent directly to the quadcopter via MAVLink. Upon receiving the controller input, the computer will automatically repel the simulated quadcopter from the obstacle it would have collided with. When the quadcopter is outside the threshold distance of a collision, the control of the quadcopter will return to the user with the touch controller. Developing this semi-autonomous control system will allow for safe gaming environments and minimize damage induced by quadcopter collisions.

Effects of Heat Stress on Development of Bovine Ovarian Preantral Follicles

Kendall Hyde

Sponsor: Anna Denicol, D.V.M., Ph.D.
Animal Science

Heat stress (HS) has negative effects on fertility of cattle. Deleterious effects are well documented in ovarian antral follicles, but data regarding how HS affects development of preantral, early ovarian follicles is limiting. In this study, we are using in vitro culture to explore the effects of HS on survival and development of preantral follicles. HS treatment involves exposing follicles to 41°C for eight hours, then 38.5°C for sixteen hours for fourteen days. The control group is incubated at a constant 38.5°C for fourteen days. Culture conditions are 5% CO₂ in humidified atmosphere. Individual follicle growth and viability are assessed after seven and fourteen days of culture. Expression of genes related to heat shock (HSP70), apoptosis (BAX), oxidative stress response (SOD), and ATP production by individual follicles will also be evaluated. We expect HS will decrease follicle growth, viability, and ATP production, and that follicles undergoing fourteen days of HS treatment will have higher expression of HSP70, BAX, and SOD, than the control. These data are important to better understand how early ovarian follicles are affected by elevated temperatures and will help us devise ways to prevent and treat HS-related subfertility in cows.

Role of Hop1 SUMOylation in Meiotic Recombination

Stegi Ilanthiraian

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

Meiosis produces haploid gametes through a series of events that require the pairing, synapsis, and recombination of homologous chromosomes. Meiotic protein Hop1, a component of the synaptonemal complex (SC), regulates homologous chromosome interactions in meiosis. Regulation of Hop1 localization, stability and interactions still remains unclear. Our lab has shown that Hop1 is post-translationally modified by small ubiquitin-like modifier (SUMO) protein at no less than 15 different lysine residues. To better study the role of Hop1 SUMOylation in meiosis, we mutated all 15 SUMOylation sites in Hop1. We initially observed a reduction in spore viability (25%) and a decrease in recombination rates. Our data also indicate that modification by SUMO becomes essential when recombination is compromised. This suggests that SUMOylation of Hop1 is important for ensuring proper levels of recombination occur between homologous chromosomes during meiosis. We also constructed mutants of Hop1 with individual sites mutated to determine which sites among the 15 mutated sites are responsible for the observed phenotypes. Preliminary data suggest that certain SUMOylation sites might be more involved in regulating Hop1 behavior than others. Future experiments will further analyze how SUMOylation modulates the many functions of Hop1.

Evaluation of Safety and Immunogenicity of HIV Vaccines in Infant Macaques

Ramya Immareddy

Sponsor: Koen Van Rompay, M.D., Ph.D.
Primate Center

HIV-infected women can transmit the virus to their infant in utero, during delivery, or through breastfeeding. Although HIV drugs have become more available and their use can drastically reduce the risk of mother-to-child transmission (MTCT) of HIV, in resource-poor areas of the world, women often don't have consistent access to these drugs or are not able to take the drugs regularly enough, especially after delivery during prolonged breastfeeding. It is estimated that every day, worldwide approximately 400 infants still become HIV-infected, most of them through breastfeeding. Accordingly, HIV transmission through breastfeeding has become the dominant route of MTCT and the risk increases with the duration of breastfeeding. Ideally, a vaccine can be found that, when given to a breastfeeding infant shortly after delivery, can induce immune responses that reduce the chances of becoming HIV-infected. Infant rhesus macaques have previously been found to be a useful animal model of pediatric HIV infection. In the current study, we immunized infant macaques with different HIV vaccine constructs. Our results indicate that the vaccines were safe, and induced antibody responses against the virus. Further data analysis is in progress. These studies can guide the further development of these vaccines in human clinical trials.

Using Herbarium Specimens to Examine the Effects of Climate Change on the Phenology of a Native California Wildflower

Lahari Indraganti

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

Climate change is causing phenological shifts in many organisms, potentially leading to changes in species interactions and community composition. Understanding how past changes in climate have affected phenology is critical for predicting how change will affect organisms' ability to adapt to future novel abiotic conditions. I am investigating the effects of climate change on phenology of the native California wildflower, *Streptanthus tortuosus*, using herbarium specimens and local historical weather data to elucidate whether flowering trends correlate with changes in environmental variables such as temperature and precipitation across populations for the past 30-60 years. I will also compare historical phenology with recent observations from the same localities, assessing differences in phenological trends across latitudinal and elevational gradients. I hypothesize that phenology will advance across all populations as a function of time with higher elevation populations advancing disproportionately due to intensified effects of warming on mountains. I aim to examine the effects of climate change on phenology and potential consequences such as reduced fitness through drought stress or phenological mismatches between the plant and its pollinators. This study will help us better understand and predict plants' ability to adapt and persist as they face new and increasingly variable environmental conditions.

Absence of Breast Cancer Associated Factor BRCA2 Impacts Ovarian Follicle Development in Mice

Willa Ingelson-Filpula

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

Homologous recombination is an error-free DNA repair required for both germ and somatic cells to maintain genomic integrity. BRCA2 is a major player in regulating recombination repair, mediating the assembly of RAD51 onto breaks, thus catalyzing the pairing and exchange of DNA strands for successful repair. This study aims to further our understanding of BRCA2 function during meiotic recombination, specifically during reproductive development - analyzing the production of ovarian follicles. We employed a Brca2 conditional knockout mouse model, a line carrying a conditional flox'd allele of Brca2 gene with a mouse line expressing Cre recombinase under a meiosis-specific promoter (Spo11-Cre). This mouse model led us to inactivate Brca2 exclusively in cells undergoing meiosis. To understand the role of BRCA2 at distinct stages of reproductive development, histological sections of ovaries from postnatal day 1 and 4 of Brca2 flox'd and age matched controls were analyzed. Brca2 mutants showed a significant decrease in follicle number compared to controls at both postnatal day 1 and 4. This data suggests a key role for BRCA2 during follicle development. However, to further understand the loss of ovarian follicles in Brca2 mutants, we are currently investigating follicle counts and meiotic stages in embryonic ovaries.

The Latinx Homeless Situation in the Orange and Los Angeles County

Endy Ixcoy

Sponsor: Monica Torreiro-Casal, Ph.D.
Chicano Studies

In the United States, the Latinx community is considered to be the largest ethnic minority group; however, there is little information regarding the homeless situation in Latinos/as. Over the past few years, the homeless population in Los Angeles and Orange County has dramatically increased. The purpose of this study is to identify the factors that contribute individuals to become homeless in both of these counties. In addition, this research will also investigate the components that lead Latinx members to continue being homeless. This study will address different ecological factors such as mental health issues, chemical dependency, socio-economic status, and lack of social support. Data collection will be gathered by interviews conducted with counselors and staff members from homeless shelters in order to get a profound perspective on the causes that lead to this life change. Conclusions from this study will not only help the scholarly community understand the Latinx homeless situation, but it will also identify their needs.

Visualizing Real-Time Changes in Force-Dependent Protein Localization

Kyle Jacobs

Sponsor: Soichiro Yamada, Ph.D.
Biomedical Engineering

Cancer cells constantly experience mechanical forces due to overcrowding and migration via metastasis. These mechanical forces have been shown to alter proteins' subcellular localization and/or activate downstream signaling pathways. However, it remains unclear how force affects the progression and outcome of disease. Because cells in vitro do not experience the same force-bearing conditions as they do in vivo, visualizing mechanosensitive protein responses has proven difficult. To observe real-time changes in protein localization due to mechanical forces, we developed a motorized cell stretch device that is compatible with a confocal fluorescence microscope. We initially tested the device by stretching cells that express GFP-tagged zyxin, a cell-adhesion protein that has been shown to be sensitive to mechanical forces. As expected, after the cells were stretched, zyxin appeared to be recruited to actin stress fibers. Using in situ proximal biotinylation (BioID), we have identified force-dependent binding candidates of zyxin. We plan to use the motorized cell-stretch device to explore the candidate proteins' localization to determine the succession of force-induced protein recruitment and interaction.

Validation of Enhancer Elements within Human-Specific Segmental Duplications

Dhriti Jagannathan

Sponsor: Megan Dennis, Ph.D.
MED: Biochem & Molecular Med

Human-specific segmental duplications (HSDs) are DNA regions that share high sequence homology to each other (>98%) arising uniquely within the human lineage. Several genes are located within these regions. While considerable research has addressed the functions of the duplicated genes, enhancers have largely been ignored. Enhancers are regulatory sequences of DNA that activate transcription of genes when specific proteins, transcription factors, are bound. We hypothesize that duplicated enhancers will have activity, which may be differential to the ancestral enhancers, when paralogs (derived duplicated DNA within species) are compared. Previously, we analyzed published ChIP-seq datasets of lymphoblast cell lines in humans to identify histone marks that are associated with active enhancer activity across HSD regions. Using these datasets, putative enhancers within duplicate paralogs were discovered. We used Gateway cloning to validate these identified regions by generating luciferase reporter constructs. Experiments are ongoing to transfect plasmids into human HeLa cell lines. Functional enhancer constructs will show increased luciferase activity. To test our hypothesis, we will compare enhancer strength between putative enhancers from different paralogs testing for differential activity. Validation of these enhancers and their target genes can be used to further study the impact of duplications in gene regulation.

Comparing Anterior Cruciate Ligament Injury Risk of Youth Athletes with the Landing Error Scoring System

Arman Jahangiri

Sponsor: Gretchen Casazza, Ph.D.
Ucdmc Aps Appointments

Risk of knee injury—specifically a tear to the anterior cruciate ligament (ACL)—is an inherent part of playing competitive sports that include jumping, cutting and deceleration. It is important to investigate how biomechanical factors that increase an athlete's risk of ACL injury differ between gender, age, anatomical factors, strength of supporting muscles, and sport. The Landing Error Scoring System (LESS) is a reliable and valid clinical assessment of jump-landing biomechanics and knee injury risk. The aim of this study is to compare ACL injury risk factors in 103 gymnastic, volleyball, soccer, basketball, football, and rugby athletes at the competitive club and high school levels, ranging in age from 7-18 using LESS. The athletes were videotaped performing a drop jump landing task off a 45cm stool onto a Kistler force plate. A LESS score was calculated for each athlete by examining trunk, hip and ankle flexion angles, knee valgus, stance width and landing force at both the initial and ending landing positions. The LESS may have screening potential for ACL injury risk in youth athletes, specifically for determining sports specific injury risk factors to target in preventative training programs to mitigate future injuries for athletes.

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

Noor Jamaludin

Sponsor: Suad Joseph, Ph.D.
Anthropology

The term "Sunni" was used by the West in reference to Muslims. Our lab examined 283 articles published from 1900 to 1909, and I critically analyzed 8 relevant articles where the term "Sunni" was used by New York Times correspondents. We discovered that the term "Sunni" was used almost exclusively in volatile binary opposition to Shite Muslims. I argue that this depiction of volatility between Sunni Muslims and Shite Muslims was used to craft a narrative of Islam as being inherently troubled and used to justify colonial rule. This misrepresentation has embedded into American society the idea that Islam is a form of organized religion which is inherently problematical. I suggest that such news media misrepresentation supported the West to build a narrative of Islam that persists today. This research is part of an analytical genealogical project of the New York Times over 150 years conducted in Dr. Suad Joseph's lab of Anthropology.

Metamemory Development: How Well Children Integrate Helpful Hints into Their Decision-Making

Khushboo Jani

Sponsor: Simona Ghetti, Ph.D.
Psychology

Metamemory, or the ability to monitor the accuracy of one's memory, develops throughout middle childhood and can be used to guide children's future decisions and actions. Importantly, children are often not alone when they make their decisions and may receive helpful recommendations from people around them. In the current study, we investigated the role of metamemory (i.e., the extent to which people are more confident in their responses when they are accurate compared to when they are not) in children's ability to use external information from their environment. In this experiment, 7- and 9-year-old children (N=40) completed a recognition memory test with confidence judgments. Critically, reliable hints (70% valid, 30% invalid) were provided on the majority of trials. We predicted that young children's metamemory would be lower than that of older children. Furthermore, we predicted that younger children would over-rely on hints based on previous research consistent with the literature showing that young children are highly susceptible to suggestions from others. The present study provides new insight into the development of metamemory in children as they learn to gauge the integrity of external information and incorporate it into their decision making.

Centrifugation Induced Release of ATP from Red Blood Cells

Anjana Jayaraman

Sponsor: William Ristenpart, Ph.D.
Chemical Engineering

Centrifugation is the primary preparation step for isolating red blood cells (RBCs) from whole blood, including for use in studies focused on transduction of adenosine triphosphate (ATP), an important vasodilatory signaling molecule. Despite the wide use of centrifugation, little work has focused on how the centrifugation itself affects release of ATP from RBCs prior to subsequent experimentation. Here we report that both the centrifugation speed and duration have a pronounced impact on the concentration of ATP present in the packed RBCs following centrifugation. Multiple subsequent centrifugations yield extracellular ATP concentrations comparable to the amount released during the initial centrifugation, suggesting this effect is cumulative. Pairwise measurements of hemoglobin and ATP suggest the presence of ATP is primarily due to an increase in centrifugation-induced hemolysis. These results indicate that common centrifugation parameters, within the ranges explored here, can release ATP in quantities comparable to the low end of the range of values measured in typical ATP transduction experiments, potentially complicating experimental interpretation of those results.

Differences in Grammatical Errors Made by Spanish- and Cantonese-Speaking Dual Language Learners

Grace Jeong

Sponsor: Yuuko Tonkovich, Ph.D.
Education

Dual language learners (DLLs) make consistent and systematic grammatical errors as they learn the societal language, English. This study examines the difference in grammatical errors made between Spanish- and Cantonese- speaking DLLs. It also studies the type of grammatical errors (i.e. lexical, syntactical, referential, and code-switching) that DLLs routinely make. This sample consists of a total of 146 children who were enrolled in six kindergartens (79 Cantonese- and 67 Spanish-speaking DLLs). Data was collected during Fall 2006. Children were asked to create their own narratives in English to tell the story of a wordless picture book, *Frog Where Are You?*. The children's narratives were evaluated on the types of grammatical error that were made. Inter-rater reliability was used to establish the internal validity of the study. Results indicate that the majority of the errors were syntactical, followed by lexical, and then referential. Few code-switching errors were evident, all of which were made by Spanish-speaking DLLs. Implications of this study will inform educators about which specific areas of grammar teachers should focus on with DLLs.

Using Machine Learning Techniques to Predict Merger Activity

Tiffany Jiang

Sponsor: Giovanni Peri, Ph.D.
Economics

Historically, attempts to empirically estimate effects of merger activity have had little success and yielded low R-squared statistics. By taking advantage of the large amount of data available in public records, I use SEC 10-k filings to estimate the effects of words on predicting merger activity. I use words as predictor variables to fit a regression and then use machine learning in two ways. First, natural language processing is used to identify words in the text documents. Second, I fit a sparse model using the combined regularization techniques "ridge" and "lasso" regularization known as "elastic net". By using machine learning techniques, I am able to measure the impact of "hard to observe" variables to verify previous theories, such as merger activity being driven by technological change. Trying how to systematically analyze the patterns of merging companies could assist in understanding growth, economies of scale, or perhaps in identifying collusion motives. Understanding merger patterns could not only prove beneficial for the savvy investor, but also help shape anti-trust policy.

Confirmation of DNA Methylation Differences in Umbilical Cord Blood From Autism Subjects in the MARBLES Study

Julia Jianu

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

Autism spectrum disorders (ASD) encompass a variety of neurodevelopmental disorders with characteristics of reduced social interactions and communication. MARBLES (Markers of Autism Risk in Babies: Learning Early Signs) is a prospective, longitudinal study with the goal of finding early biomarkers for ASD. As a part of the MARBLES study, differences in DNA methylation between ASD subjects and controls were examined through whole-genome bisulfite sequencing (WGBS) in umbilical cord blood. WGBS identified 7 significant differentially-methylated regions (DMRs) that were hypermethylated in ASD. Bisulfite pyrosequencing was used to confirm the results at 6 of these DMRs. Our results showed a significant correlation between pyrosequencing and WGBS data for the DMRs at MAPK4, PAX8, ADARB2, RBM46, LMTK3, and DEFB. In addition, DMRs at LMTK3 and DEFB showed significant differences in methylation across the entire pyrosequenced region between ASD subjects and controls, although all DMRs had trends that were consistent with the WGBS data. Overall, these results provide technical validation of these 6 regions as ASD DMRs in umbilical cord blood. Future work will include biological validation of these DMRs using an independent group of subjects, in order to establish them as predictive biomarkers of ASD.

Pain Responses in Dairy Calves Receiving Injection With or Without Topical Anesthetic

Reyna Jimenez

Sponsor: Cassandra Tucker, Ph.D.
Animal Science

Dairy calves are routinely administered medicines, vaccines, and anesthesia via injection. Although injections are painful, little is known about methods to alleviate this pain. The aim of this study was to determine if lidocaine-prilocaine cream, a topical anesthetic, reduced calves' pain response to a subcutaneous injection around the cornual nerve. Calves were assigned one of two treatments: lidocaine-prilocaine cream at the site of injection (n = 10) or no cream (n = 9). Dependent variables, used as indicators of pain, included behavioral (eye widening, escape attempts) and physiological (heart rate, eye temperature) measures. We predict that calves that received anesthesia prior to the injection will show less eye widening and fewer escape attempts during the procedure, and a smaller magnitude of change in heart rate and eye temperature in the 5-minute period following the injection. Determining whether a topical anesthetic is effective in reducing pain during a common husbandry procedure is an important step towards improving calf welfare.

Enhancer Regulation of OCT4 Transcription in Canine Pluripotent Stem Cells

Robert Jimenez

Sponsor: Amir Kol, D.V.M., Ph.D.
VM: Pathology, Micro, & Immun

The ability of pluripotent stem cells (PSCs) to differentiate into all cell types in the body establishes them as an invaluable tool for regenerative medicine. PSCs can be differentiated or kept in a pluripotent state in vitro. The pluripotent state itself has two states, naïve and primed. Naïve cells are thought of as the "ground state" of pluripotency and are a promising area of research as they have greater developmental and proliferative potential. OCT4 is a key transcription factor that is responsible for pluripotency maintenance. In human and murine PSCs, OCT4 transcription is regulated by its distal enhancer (DE) in the naïve state, while in primed PSCs, OCT4 is regulated by its proximal enhancer (PE). The regulatory networks that govern naïve pluripotency in dogs are unknown. I hypothesize that canine PSC are in the primed state and therefore OCT4 transcription is regulated by the proximal enhancer. To test my hypothesis, I created two plasmids each containing a Luciferase reporter gene regulated by a minimal promoter, with either the canine DE or the PE. These constructs will be transfected into canine PSC by electroporation and luciferase activity levels, as determined by a luminometer, will indicate enhancer activity.

Consensus decision making in the emergence behavior of the Mexican free-tailed bat (*Tadarida brasiliensis*)

Ruiheng Jin

Sponsor: Margaret Crofoot, Ph.D.
Anthropology

The Mexican free-tailed bats (*Tadarida brasiliensis*) are known to have large synchronized nightly emergences, in which the whole colony emerges from the roost in a single column. Prior to emergence, the bats will come out of the roost, and fly under the roost. The echolocation calls will also increase in amplitude and reach a maximum prior to emergence. This offers an opportunity to study how group decisions are made in this species. We are interested in how the bats decide when to emerge and how they synchronize the emergence. We hypothesize that the timing of emergence is decided by a consensus decision. We will attempt to determine the communicational cue that is used to facilitate the consensus decision making; and explore the possible influence of temperature and light intensity on the timing of emergence. This study was conducted at the westside bypass roost in the Yolo bypass wildlife area. We used a EchoMeter 2 by Wildlife Acoustics to record echolocation calls; a GoPro to document the emergence with photos and/or videos; a DSLR camera to record the activity under the bridge. Environmental parameters measured include temperature and light intensity.

Exposure to Naphthalene Induces Inflammation in an Adult Mouse Asthma Model

Eunice Jin

Sponsor: Laura Van Winkle, Ph.D.

VM: Anat Physio & Cell Biology

Naphthalene (NA) is an abundant urban air pollutant produced by combustion. Air pollution exposure has been linked to asthma. Ovalbumin (OVA) exposure induces a mouse model of "asthma" and causes inflammation characterized by the release of pro-inflammatory cytokines, including Tumor Necrosis Factor- α (TNF- α) and Interferon- γ (IFN- γ), from white blood cells. To generate the asthma model, adult male C57BL6 mice were injected with OVA at day 0 and were challenged at day 14, 15, and 16 with aerosolized OVA. To study the NA effect on OVA responses, mice were injected with 200 mg/kg of NA in Corn Oil (CO) on day 16 prior to the last OVA aerosol exposure. Control mice received vehicle (CO-only) and were not treated with OVA. Bronchoalveolar Lavage Fluid (BALF) from the lungs was collected at 3 hours post-exposure. NA-only mice had higher levels of TNF- α compared to IFN- γ ; in contrast CO exposed OVA mice had higher levels of IFN- γ , while CO-only mice had the lowest levels of both. NA exposed OVA mice showed an increased level of neutrophils and eosinophils along with a significant increase of TNF- α and IFN- γ in the BALF compared to all other groups. NA exposure increases OVA-induced lung inflammation.

Whiteness Improvement on Citric Acid Treated Crosslinked Cotton Fabrics by Fluorescent Whitening Agents or Blue Dye in H₂O₂ Bleaching System

Shaotong Jing

Sponsor: Gang Sun, Ph.D.

Textiles & Clothing

Citric acid (CA), an environmental friendly compound, can be employed as an effective formaldehyde-free crosslinking agent in anti-wrinkle treatment for cotton fabrics. However, the fabric treated by CA would become yellow because of the aconitic acid formed during the reaction. A traditional H₂O₂ bleaching process of cotton fabrics which is usually carried out under alkaline condition would lead to hydrolysis of ester bonds connecting cellulose chains and CA, thus decreasing the anti-wrinkle performance. This whitening process has limited practical applications on cotton fabrics. To remove the yellowness and preserve a decent anti-wrinkle performance of the CA treated fabrics, we explore a new bleaching approach. Since blue and yellow are complementary colors in the subtractive color model of color perception, blue dyes or fluorescent whitening agents are used to restore whiteness of the CA treated fabrics. Low concentration of H₂O₂ under neutral condition was implemented to improve the whiteness. Selected blue dyes, fluorescent whitening agent and H₂O₂ concentrations, bleaching time and temperature were varied to achieve the best result. Whiteness, wrinkle recovery angle and tensile strengths of the fabrics were measured to evaluate the whitening effects of the CA crosslinked cotton fabrics.

"Treasure or Trash?": The Role of Subjective Evaluations in Memory Decisions

Simran Johal

Sponsor: Simona Ghetti, Ph.D.

Psychology

Previous work indicates that preschoolers can use their subjective evaluations to guide memory decisions (Hembacher and Ghetti 2014), but older children sometimes fail to do so (Hembacher and Ghetti, 2013). We hypothesized that this discrepancy could be explained by the decision complexity required by the memory task. We investigated how metamemory guides decision-making in 6- and 7-year-old children (N = 52) and adults (N = 52). Participants completed a memory test in which decision complexity was manipulated between groups: one group could submit as many responses as they wanted towards a future reward (Unlimited condition), while the other group had to choose a select number of their best responses (Limited condition). Compared to the Unlimited condition during which participants could apply some single criterion to all trials, the Limited condition required additional comparison processes to decide which select trials should be used towards the future reward. As predicted, results show that children in the Unlimited condition use subjective evaluations as a basis for decision-making, but this pattern was dampened in the Limited condition. This result suggests that metamemory guides decision-making even in young children, but decision demands may play an important role in the development of this process.

Solvothermal Synthesis of Bi₂Se₃ Platelets

Virginia Johnson

Sponsor: Kristie Koski, Ph.D.

Chemistry

Bi₂Se₃ is a two-dimensional (2D) material, thermoelectric, and topological insulator that has been the subject of many recent investigations. It has been shown that chemically grown (solvothermal) Bi₂Se₃ has electronic properties equal to that grown through molecular beam epitaxy yet with cheaper cost and quicker growth times. Creating larger solvothermally grown Bi₂Se₃ nanoplates is an attractive avenue of research due to the vast potential for these plates. After their synthesis it is possible to alter the material properties of the platelets. In this talk, I will present the solvothermal synthesis of bismuth selenide (Bi₂Se₃) using polyvinylpyrrolidone and ethylenediaminetetraacetic acid as ligands in the solvent ethylene glycol. This procedure is able to generate 20-100 micron hexagonal crystalline plates. By altering synthesis conditions, the size and shape of these plates is varied. Co-solvents, pH, and mixing procedure prior to heating are used to examine the correlation between these variables and resultant plate size.

Growing Up Treated Differently: Experiences of Donor-Conceived Adults

Jessica Johnston

Sponsor: Joanna Scheib, Ph.D.
Psychology

Families created through donor insemination (DI) are becoming increasingly visible in society. Historically DI was used by heterosexual couples facing male infertility, but growing numbers of female same-sex couples and single women are accessing this form of assisted conception. Previous research indicates that DI children are well-adjusted and comfortable with their origins (Scheib & Hastings 2012). However, little is known about the role of stigma due to their different family type. The current study explores the experiences of 47 DI adults, most of whom grew up knowing about their family's donor origins. Using phone interviews and online questionnaires, we investigated whether the adults experienced any different treatment by others based on their assisted conception family type. Participants were born into families with two mothers (46.8%), a single mother (29.8%), or a mother and father (23.4%). Over half of participants reported being treated differently; some positively, others negatively or just differently. Few participants cited their DI family origins as the basis for this treatment; more commonly they attributed it to having a single or two mothers. These findings are important in understanding the experiences of DI adults and others' treatment of non-heteronormative families.

Pigmentation Plasticity and its Impacts on the Monarch Butterfly (*Danaus plexippus*)

Asia Jones

Sponsor: Santiago Ramirez, Ph.D.
Evolution & Ecology

Monarch butterflies (*Danaus plexippus*) are most well-known for their migration spanning 30 degrees of latitude. However, several aspects of their larval biology remain understudied. Because of this spectacular migration, their larvae must be able to tolerate a wide range of temperature and light levels during development. Previous work shows that larvae reared in cooler temperatures are darker than those in warmer temperatures, so I aimed to fill in gaps about other possible cues to induce color changes. I raised monarch caterpillars from eggs in a series of experiments to determine the role of light and temperature in influencing larval coloration. I photographed these caterpillars throughout their development to determine when this morphological divergence occurs and raised them through adulthood to record differences in adult color and size. I also switched caterpillars between treatments to determine if larval coloration was plastic later in development or if this coloration becomes fixed in early stages. Caterpillars from multiple treatments were also placed in natural conditions to determine if color had an impact on fitness. Preliminary results show that color is indeed plastic in later larval stages and there do appear to be differences in color in adults that correlate with larval temperature treatment.

Comparative Evaluation of Agricultural Pesticide Usage in Knights Landing and Capay Valley, California

Tiffany Jow

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

Knights Landing(KL) and Capay Valley(CV) are both communities in Yolo County surrounded by agricultural fields. CV specializes in organic crops. KL residents expressed concerns about elevated exposure to potential carcinogens due to proximity of agricultural pesticide applications and they invited UC Davis researchers to further investigate. This study quantifies the amount of applied pesticides, carcinogenicity of pesticide active ingredients, and crop-specific pesticide application longitudinally from 2011-2015 in KL and CV. Pesticide application reports were retrieved from the Pesticide Information Portal(PIP) from the California Department of Pesticide Regulation. The weight of pesticide applied was normalized to either agricultural acreage or total acreage in the 2 KL and 3 CV zip codes included in the PIP data. Carcinogenic chemicals were identified using the U.S. EPA Standard Evaluation of Pesticides for Carcinogenic Potential and the IARC Monographs. We found that four times more total pesticides by weight and eight times more carcinogenic pesticides by weight were applied in KL compared to CV. Therefore, KL community exposures to agricultural pesticides are potentially higher than CV, supporting the concerns raised by the KL community members.

Separate VS Common Mechanisms in Simple Perceptual Decision-Making

Elizabeth Jun

Sponsor: Timothy Hanks, Ph.D.
MED: Neurology

Decision-making is a fundamental function of our conscious brain. Here, we study a simple decision-making paradigm, where subjects have to decide when they detect different types of changes in a stochastic ('noisy') stimulus, in order to investigate if there is a common or separate mechanism for detecting different types of changes. In our experimental design, human subjects listen to a train of auditory clicks, with a starting average click-rate that either increases or decreases in various degrees. Subjects have to detect when the average click-rate changes within a time period and report in what direction. Based on the subjects' change detection and direction reports, we examined the timecourse over which subjects varied their focus on detecting increases and detecting decreases. Our experiments will allow us to examine whether strategies for detecting increases or decreases are correlated or independent. The nature of the correlations provide insight into whether these two decisions are supported by shared or distinct neural mechanisms. By studying the neural mechanism of how various types of information are represented and factored into how we decide and act, we can expand our knowledge of the computational processing that underlies our complex interaction with the world.

Bovine Milk Osteopontin and Recombinant Osteopontin are Resistant to *in vitro* Digestion

Paul Kaeser

Sponsor: Bo Lonnerdal, Ph.D.
Nutrition

Osteopontin (OPN) is a highly phosphorylated glycoprotein and is abundantly present in human milk. OPN is a pleiotropic protein involved in multiple biological processes, including cellular proliferation and immune modulatory functions. OPN exerts its multiple functions by binding to its receptors on the surface of target cells and initiates signaling pathways. Human milk OPN has been found to be resistant to *in vitro* digestion and may play roles in intestinal development in infancy. In infant formula, different forms of OPN may be used. Here, whether bovine milk OPN (bmOPN), recombinant human OPN (rhOPN) and recombinant bovine OPN (rbOPN) are resistant to *in vitro* digestion was investigated. To explore this, OPN samples were dissolved in water or infant formula and the pH value was adjusted to 4.0 and pepsin was added. Subsequently, the pH was adjusted to 7.0 and pancreatin was added to mimic digestion in infants. The undigested and digested OPN samples were analyzed by SDS-PAGE and stained with Coomassie blue or immunoblotting probed with an OPN antibody. The results showed that all three OPN sample were partly resistant to *in vitro* digestion, suggesting that these forms of OPN may show bioactivity in the intestine during infancy.

debugR: A Debugging Tool for R

Aaron Kaloti

Sponsor: Norman Matloff, Ph.D.
Engr Computer Science

Debugging a program the right way is challenging for many computer science students. This is primarily due to how much time one must invest to learn how to use a debugging tool. It is easy for students to fall into the mindset of “change something until it works”. Recently, vulnerabilities in Intel chips dating back to 1995 were revealed, indicating that sensitive user data has been at risk for years and Intel chip developers did not even know it. This shows that strong debugging skills and an eye for where bugs may lie are important. Our tool – debugR – is a tool for both: a) teaching debugging, and b) experimenting with the development of new debugging techniques. This tool is meant for debugging programs written in the language R. It provides the user the ability to see the code as he/she is debugging it, and provides a variety of features to help the user debug. The tool uses our recently implemented downloadable package named “rcurses”, which is what allows the debugging tool to manipulate the text and colors of the user’s terminal window to provide him/her a helpful interface for his/her debugging efforts.

A New Model of Rodent Intraventricular Hemorrhage

Kimia Kamal

Sponsor: Gene Gurkoff, Ph.D.
MED: Neurological Surgery

Intraventricular hemorrhage (IVH) is defined as the eruption of blood in the cerebroventricular system. The neurological sequelae in patients with IVH is wide ranging including permanent motor and sensory deficits and hydrocephalus. Clinically persistent and significant cognitive deficit and memory deficits which prevents return to work and decrease in quality of life measure has also been described. We hypothesized that IVH causes a decrease in neurogenesis from stem cells in the hippocampus, which results in impairment learning and spatial memory. To test the hypothesis, IVH was created in Sprague-Darley rats by taking autologous arterial blood from the femoral artery and injecting this into lateral ventricle. Prior to perfusion, Bromodeoxyuridine (BrdU) was injected into the rats to label newly born neurons to help compare neurogenesis in the dentate gyrus. The ventricular volume expansion was also assessed to account for effects of mechanical injury from the injection. Injection of blood and aCSF led to a significant persistent increase in the size of the frontal horns compared to no injection sham surgery controls after 1 week. There was however no significant difference in the size of ventricles between blood and vehicle injections in the 1 week period.

Effect of Ozone Inhalation on Lung Surfactant Protein-D Expression in Rhesus Macaques

Sean Kao

Sponsor: Angela Haczku, M.D.,Ph.D.
MED: Div Of Internal Med

Ozone (a toxic air pollutant) causes airway inflammation and chronic pulmonary disease. SP-D is an immunoprotective molecule in the lung. SP-D deficient mice have enhanced susceptibility to ozone-induced inflammation. SP-D expression increases in response to ozone in mice, to facilitate resolution of inflammation. We studied ozone exposure of Rhesus macaque non-human primates, as it was important to extend our findings in rodents to a more appropriate disease model. We hypothesized that ozone-induced lung inflammation would increase the expression levels of SP-D in the macaque lung. Baseline bronchoalveolar lavage (BAL) was collected from macaque airways followed by 7 days rest, then exposure to 0.3 ppm ozone. 12 hours later (post-ozone), BAL was collected again. Cellular inflammation was assessed and reducing and Native-PAGE (western blot) was performed on cell-free BAL supernatant to determine SP-D expression. Our preliminary data shows that that Rhesus SP-D is detectable via western blot, although the effect of ozone exposure remains unclear. Our study will reveal if the data generated in mouse models on the importance of SP-D is relevant to primates, a highly translatable animal model for lung disease.

Using Fluorescence Resonance Energy Transfer (FRET) to Assess AKAP7 Dimerization and Function

Irina Karashchuk

Sponsor: Julie Bossuyt, D.V.M., Ph.D.

MED: Pharmacology

The contraction and relaxation of cardiac muscle cells is caused by cycles of release and uptake of Ca^{2+} from the sarcoplasmic reticulum (SR). The speed and amplitude of cycling Ca^{2+} is partly regulated by phosphorylation of phospholamban (PLB) by protein kinase A (PKA). To improve the direction and rate at which PKA finds PLB among its many other protein targets, PKA is bound by A-kinase anchoring protein 7 (AKAP7) which directs it to PLB. However, details on how AKAP7 is involved in PLB phosphorylation are largely unknown. We hypothesize that AKAP7 dimerizes and that while one monomer phosphorylates PLB and releases it to find another PLB to phosphorylate, the second monomer keeps AKAP7 grounded to the SR. Furthermore, dimerizing would increase the size of the AKAP7 complex, allowing it to act as a scaffold for many other signaling proteins. To test this, we generated green and red fluorescent fusion proteins of AKAP7 on both C- and N-termini. After confirmation of the fusion protein via western blotting, we used fluorescence resonance energy transfer (FRET) to assess the AKAP7 interaction. Our experiments provide new insight into the molecular regulation of AKAP7 function.

The Impact of Acculturation and Enculturation on Physical Health Outcomes

Praveen Karunatileka

Sponsor: Nolan Zane, Ph.D.

Psychology

Previous research suggests that acculturation to one's mainstream culture is associated with better mental health in students, while enculturation to one's heritage culture is associated with problems in mental health. However, little is known about the effects of acculturation and enculturation on physical health. By gathering online survey data from 11 male and 49 female ethnic minority UC Davis students (age: $\mu = 20.23$, $s = 3.56$), this study examined the effect of acculturation and enculturation on two aspects of physical health-- physical functioning and vitality (energy), in addition to emotional well-being. Enculturation to one's heritage culture was positively associated with physical functioning, vitality, and emotional well-being. However, acculturation was only positively correlated with vitality and emotional well-being, but not significantly related to physical functioning. When acculturation and enculturation were included in the same regression model, only enculturation emerged as a significant predictor of physical functioning and emotional well-being. Neither acculturation nor enculturation appeared as significant predictors of vitality when both were accounted for in the same model. Future research should investigate how different ways of incorporating enculturation and strengthening one's heritage identity can enhance health outcomes.

Towards Self-Driving Car: Lane Line Detection

Devashish Kashikar

Sponsor: Chen-nee Chuah, Ph.D.

Elect & Comp Engr

With the recent re-emergence of Deep Learning, many computationally expensive applications can be performed in real-time. In particular, autonomous vehicles features such as Lane Line Detection can be implemented using Computer Vision. Through our independent senior design project, conducted during Fall and Winter Quarters of 2018, we were able to perform real-time lane line detection at 99 fps. Therefore, we would like to present this work for the reference of future development. We have tested lane line detection model on a custom track; the demo car model was able to navigate and stay within the lane lines using this computer vision algorithm.

Expression Analysis of Fruit Cell Wall Modifying Enzymes in a Non-Ripening Tomato Mutant

Derek Kawahara

Sponsor: Barbara Blanco-Ulate, Ph.D.

Plant Sciences

Ripening is a complex biochemical and physiological process that results in fruit softening. POLYGALACTURONASE (PG), responsible for the loss of firmness, and EXPANSIN (EXP), responsible for cell wall relaxation and softening, are key enzymes that are present and active during ripening. The goal of the project is to analyze the effect of PG and EXP on fruit softening in a non-ripening mutant, rin (ripening inhibitor). The project used the untransformed wild type rin and three transgenic lines (rin+PG, rin+Exp, rin+PG+EXP) which were fused with the E8-ethylene inducible promoter. First, endpoint PCR was used to confirm the genotypes of the transgenic lines. Next, the transgenic lines were subjected to air and ethylene control treatments to induce PG and EXP expression. Firmness was measured after the treatments to observe discrepancies between genotypes. Lastly, RNA will be extracted for gene expression analysis using quantitative reverse transcription PCR. PG and EXP gene expression data will be compared to the firmness and cell wall analysis performed by collaborators from the Universidad de la Plata, Argentina. The experiments will provide a greater understanding of the biochemical role of cell wall modifying enzymes during tomato fruit ripening.

Variability of Growth of Cyanobacterial Cultures Under Differing Optical Conditions

Megan Kaye

Sponsor: Dawn Sumner, Ph.D.
Earth And Planetary Sciences

Microorganisms are adaptable niche lifeforms that can serve as model organisms through which biogeochemical processes can be modeled, demonstrated, and tested. Here, emphasis is focused on the effect of varying light on the generation of biomass across a gradient of available light. The amount of ambient light decreases, and a photo gradient effect is simulated with shade cloth. The shade cloth allows control over ambient light and provides a 10% and 50% ambient light condition to be generated in the lab. The experimental setup has the rest of the experiment under constant conditions with variation in light being the variable of inquiry. The cyanobacteria used in this experiment are cyanobacteria *Lyngbya* and *Oscillatoria*. The experiment will quantify if light influences morphology, density, and cell counts of the cultures. Optical density measurements will be made, and subsequent data analyzed to try and capture a growth curve. Understanding patterns of development of mats may lead to a more informed understanding of the biogeochemical patterns behind the formation of mats on a larger scale. Testing if light has an influence on mat formation is important to understanding the morphology and growth of mats before their potential preservation into the fossil record.

Methamphetamine Use and Heart Failure: Prevalence, Risk Factors, and Predictors

Amanda Kelly

Sponsor: John Richards, M.D.
MED: Emergency Medicine

Our aim was to investigate methamphetamine users who develop heart failure. Demographics, vital signs, echocardiography and labs were compared between patients with normal versus abnormal BNP. 4,407 were methamphetamine-positive, 714 were screened for heart failure, and 450 (63%) had abnormal BNP (prevalence: 10.2% versus 6.7%, methamphetamine-positive versus negative). For methamphetamine-positive patients, there was a tendency for higher age and male gender with abnormal BNP. A higher proportion of Whites and former smokers had abnormal BNP and higher heart and respiratory rates. Echocardiography revealed disparate proportions for normal LVEF and severe dysfunction (LVEF < 30%), LV diastolic function, biventricular dimensions, and pulmonary arterial pressures between subgroups. For methamphetamine-positive patients with abnormal BNP, creatinine was significantly higher, but not Troponin I. Logistic regression revealed predictors of abnormal BNP and LVEF < 30% in methamphetamine-positive patients: age, race, smoking history, elevated creatinine, and respiratory rate. Methamphetamine-positive patients have a significantly higher prevalence of heart failure than the general emergency department population. The methamphetamine-positive subgroup who develop heart failure tend to be male, older, White, former smokers, and have higher creatinine, heart and respiratory rates. This subgroup has greater biventricular dysfunction, dimensions, and higher pulmonary arterial pressures.

Comparative Analysis of Meiotic Progression in Transgenic Mice with Varying Expression of RNF212 Gene

Muhammad Khan

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

Meiosis ensures crossover formation between homologous chromosomes for proper chromosomal segregation, and, thus, safeguards against aneuploidy. RNF212 is an essential regulator of crossover formation, and, moreover, sufficient dosage of RNF212 is required for crossover assurance. Rnf212 haploinsufficiency led to reduced number of crossovers in a mouse model. To understand this further, our lab created transgenic mouse lines expressing varying copy numbers of the Rnf212 gene. We observed a positive correlation between the number of Rnf212 gene copies and the crossover marker, MLH1 foci. To further understand the effect of elevated crossovers on meiotic prophase I progression, we focused on analyzing the stage of crossover formation in wild type and transgenic mice. Mouse spermatocyte spreads were stained with an axis marker (SYCP3), crossover marker (MLH1), and the pachytene substage marker histone H1 variant (H1t). Our data suggests that an increase in RNF212 copy number only increases the number of crossovers without having a significant effect on meiotic prophase I progression.

A Critical Analysis of UC Davis Student Housing's Investment in Whiteness

Angela Kim

Sponsor: Kimberly Nettles-Barcelon, Ph.D.
Gendersexuality Womensstudies

I examine how UC Davis Student Housing's administrative practices and professional staff silence the voices of student employees with marginalized identities to reinforce white hegemony and then favor white people in the rehiring process. I argue that Student Housing has created a culture of fear within the workplace, where the threat of termination is felt disproportionately by employees of color and marginalized genders. I interview thirteen gender diverse student employees and former administrative staff of color to acquire firsthand narratives of how internal racial structures govern their experiences working for Student Housing and to establish a pattern of discriminatory behavior by Student Housing's predominately white professional staff. I conduct autoethnography to facilitate a reflection on my taxing experiences as a woman of color working for Student Housing for two years. I contextualize my analysis by comparing the statistics of UC Davis's racial demographics and Student Housing's (re)hiring racial demographics of 2017. My thesis contributes to the scholarship on manifestations of race- and gender-based discrimination in the neoliberal workplace, economic survival for gender-diverse people of color, and the neoliberalization of the university.

Dimensional Weighting Modulates Reaction Time for Object Identification in a Visual Search Task

Boyoung Kim

Sponsor: Joy Geng, Ph.D.
Psychology

Prioritizing the feature dimensions of a target object that distinguish it from distractors can help optimize visual search. This phenomenon, known as dimensional weighting, increases the activity of neurons representing the prioritized dimension, and leads to faster localization of the target. Questions of whether we can measure these weighted representations prior to search are still unanswered. The aim of the current study is to understand if dimensional weighting extends to complex objects and if subjects can be biased to encode dimensions, weighted by distractor context, prior to search. Subjects, (n=20) completed 350 trials searching for a target "squid" defined by two unique dimensions: antennae and tentacles. For half of the subjects, the antennae were diagnostic of the target squid 80% of the time, whereas the tentacles are diagnostic 80% for all others. We hypothesized that subject reaction times will be faster when weighted dimension correctly predicts which feature distinguishes the target. Further, we predict that subjects will spend more time encoding that dimension prior to search, indexed by longer looking times on features of that dimension. These results would suggest that subjects actively encode relevant dimensions of complex objects as they learn which dimensions are relevant for weighting.

Effects of Prior Sleep Duration and Age on Waking Alpha EEG Power in Early Adolescence

Elizabeth Kim

Sponsor: Ian Glenn Campbell, Ph.D.
MED: Psychiatry & Behav Sci

Alpha power increases when eyes are closed in waking electroencephalogram (EEG), and this increase is diminished following sleep deprivation. We report effects of varying time in bed (TIB) and age on waking alpha power in early adolescence in this 3-year longitudinal study. 77 children, age 9.85 to 14.0 years (mean=12.2 in Year 1), completed 4 nights of each TIB restriction schedule of 7, 8.5, or 10 hours, after which they participated in performance and sleepiness testing in the laboratory. Waking EEG was recorded 4 times, 2 hours apart, in the laboratory while the subject alternated between periods of having their eyes closed or open. EEG recordings from electrodes placed in O1 and O2 were analyzed with FFT on 5 second artifact free epochs. O1 and O2 alpha power more than tripled with eyes closed and this effect increased with increasing TIB. TIB effect on waking alpha significantly increased with age and did not differ between sexes. Waking alpha EEG power is significantly diminished by sleep restriction in adolescents. This finding raises the possibility that alpha power is a sensitive indicator of sleep dependent recuperation and encourages further study over a wider age range and sleep durations.

Buffering Capacity of Different Food Products as Related to Simulated Gastric Digestion

Kaela Kim

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

Although food digestion happens throughout the day, it is not fully understood. Catabolism in the gastric environment is a complex process influenced by many properties, such as buffering capacity, which represents the resistance to change pH after adding acid or alkali. The objective of this study was to understand buffering capacity of two bean products: refried and whole black beans. Black beans were ground in a food processor for one minute with 70 mL of liquid, for similar consistency as refried beans. Buffering capacity was analyzed by measuring pH after titrating 0.5mL of 0.2M HCl until pH 1.5. Moisture content was determined gravimetrically by drying at 110°C for 18h. The buffering capacity of black beans was 4.09 mL HCl per unit pH reduction, and of refried beans was 4.15 mL HCl per unit pH reduction. Refried beans had a higher moisture content than black beans (78.3% and 76.7%, respectively). The higher buffering capacity of refried beans may be due to their higher oil content. These results suggest that gastric digestion of a food may vary depending on its macronutrient composition. It is important to understand the relationship between buffering capacity and food properties to optimize digestion and nutrient absorption.

Motor Development as it Relates to Mental Rotation During Infancy

Kathryn King

Sponsor: Lisa Oakes, Ph.D.
Psychology

Independent sitting is an important milestone in infant development that affords infants the opportunity to grasp and manipulate toys, influencing their ability to explore the properties of objects in their environment. Mental rotation, or the ability to manipulate visual representations of objects, also develops during infancy. Since cognitive abilities do not emerge in isolation, we are interested in measuring the relationship between mental rotation and motor development across different age groups. To assess this, we are testing infants in a replication study of a mental rotation change detection task and measuring infants' motor development during a play session using the Alberta Infant Motor Scale (AIMS). We predict that infants who show a greater level of mental rotation in the task will also show more advanced motor development, reflected by the AIMS score. Knowing how sitting and crawling influences cognitive abilities will further our knowledge about the interplay between these two areas of development.

Exploring Student Interactions with Graduate and Undergraduate Teaching Assistants in Chemistry Laboratories

Pooja Kini

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 TA's and the ES's, 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 TA's or ES's and how the teaching styles may vary between the two lab instructors. Student inquiries and TA/ES 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. The results will also be used to assess the overall success of the Emerging Scholars program and suggest improvements to enhance the role of ES's in the labs.

Pollinator Variation Between Natural and Constructed Environments

Cody Kiniry

Sponsor: Rachel Vannette, Ph.D.
Entomology/Nematology

To inform pollinator conservation efforts, it is important to compare floral preferences among different environments. Here, I compared the differences in pollinator visitation between a natural environment, the UC Reserve, and a constructed environment such as field plots at Bee Biology Road. The aim of this study is to determine if there is a significant difference in diversity and density of pollinator visitation between the natural and constructed environments. Floral species common in attractiveness and blooming period were targeted at both sites. Those floral species were observed from 2 pm to 4 pm for 5 minutes each over the course of two months. Pollinator visitation was recorded and analyzed for abundance and variation between the two study sites. I found that pollinator communities differed between sites and plant species also differed in pollinator communities that visited them, and communities shifted between sites for a given plant species. These results suggest that context influences floral visitation patterns.

Sprouting Up: Effectiveness of Short-Term Science and Sustainability Program in Early Elementary School

Jane Kinner

Sponsor: Cary Trexler, Ph.D.
Education

In an increasingly technology-based society, the intersection between people and science is more important than ever. Unfortunately, this is not well-represented in elementary education as science instruction, especially in low-income schools, has become a low priority compared to subjects mandated by federal standardized testing. Some students depend on short-term interventions to get exposure to scientific concepts and sustainability practices. Sprout Up is a club that places college students in classrooms to teach the value of science and environmental stewardship through hands-on lessons and experiments. This study evaluated the effectiveness of Sprout Up's 8 week program in several classrooms in Yolo County. Through a qualitative interview, six teachers provided input on the program's strengths and weaknesses, which will be used to modify curricula and redesign professional development for its future student instructors. This research has important implications for the future of science education and how to best serve low-income students and communities.

Spatiotemporal Regulation of Protein Kinase D Signaling in Cardiomyocytes by RAAS

Anna Kirillova

Sponsor: Julie Bossuyt, D.V.M., Ph.D.
MED: Pharmacology

The Renin-Angiotensin-Aldosterone system (RAAS) is a major endocrine/paracrine system with a key role in regulating the cardiovascular system. Its role in the pathogenesis of cardiovascular diseases such as hypertension, cardiac hypertrophy and atherosclerosis is well established and is targeted therapeutically. Several studies recently suggested a for protein kinase D (PKD), a regulator of cardiac hypertrophy, in modulating the RAAS. How RAAS affects PKD signaling in the heart remains to be understood. To examine the spatiotemporal dynamics of PKD signaling triggered by RAAS in adult cardiomyocytes, we used subcellularly targeted PKD biosensors (DKARs, D Kinase Activity Reporters) to track PKD activity and GFP-tagged PKD1 to visualize kinase translocation throughout the myocyte. Confocal fluorescence microscopy was used to analyze DKAR signals and GFP-PKD1 localization in response to angiotensin II and aldosterone. These experiments will clarify the spatiotemporal regulation of PKD signaling in cardiomyocytes and provide new insight into the functional role of PKD in the heart.

Exploring the Relationship Between Saccades and Covert Attention

Kelsey Klein

Sponsor: George Mangun, Ph.D.
Psychology

In studies of covert visuospatial attention, which typically instruct subjects to maintain eye gaze at one location while shifting their attention elsewhere, trials during which the subject makes eye movements are typically excluded. This is because eye movements would alter the position of a target stimulus on the retina, which could affect the neural and behavioral responses due to factors such as the cortical magnification factor. However, eye movements and attention are intimately related in natural vision, and this raises the question of whether eye movements toward a relevant stimulus location may also potentiate the effects of attention. In a series of 2 experiments, we separately explore the effects of the cortical magnification factor by varying eccentricity (Exp 1), and the attentional effects of making concomitant eye movements, while controlling for eccentricity (Exp 2). Using electroencephalography (EEG) and eye-tracking, the results of Experiment 1 suggest that fixation eccentricity influences the amplitude and distribution of scalp-recorded event-related potentials in a manner that may mimic attention effects. In Experiment 2, we are using eye-tracking and behavioral measures of attention to directly test whether eye movements in the direction of a to-be-attended location potentiate the effects of attention, while holding stimulus eccentricity constant.

Technoeconomic Analysis of Large-Scale Microencapsulation of Bioactives in Cross-Linked Alginate Microcapsules (CLAMs)

Lucille Knowles

Sponsor: Tina Zicari, Ph.D.
Biological & Ag Engineering

Microencapsulation of bioactive compounds in cross-linked alginate microcapsules can stabilize the cargo, offer long-term shelf stability and control the timing of cargo release. However, there is an unmet need for an industrially scalable method to microencapsulate bioactive compounds. Current methods involve spraying the cargo with an alginate solution into a calcium chloride bath, then separating and drying the microcapsules – a process that requires several costly unit operations. At UC Davis, we recently patented a novel process to form cross-linked alginate microcapsules (CLAMs) by spray drying, a single unit operation. To compare the UC Davis process against the conventional process, both were modeled using SuperPro Designer. These processes were modeled to produce 750 kg of empty CLAMs and then scaled up to 1,000 kg, 5,000 kg and 10,000 kg fish oil loaded CLAMs. An economic analysis was done on each model to compare the UCD CLAMs process and the conventional process. In every case, the UCD CLAMs process was found to take less time, require less equipment and was, overall, more economically efficient.

Developments in Antisemitism During Late Antiquity: A Rhetorical Analysis

Ethan Kogon-Schneider

Sponsor: Carey Seal, Ph.D.
Classics

The evolution of Christianity is closely linked to Imperial Roman legislation. The first few centuries CE marked the time when Christians toiled to distinguish themselves from Judaism. One common method was through writing and rhetoric. Often, accompanying these early Christian writings were inherent antisemitic undertones in order to separate it from its roots. Yet, they also suffered heavy persecution from the Roman government. With the sanctification of Christianity by Constantine, however, Roman Christian antisemitic rhetoric became more pronounced and more explicit. The rhetorical and linguistic development as Christianity went from persecuted sects to a tolerated religion and then again to a mandatory, popular, and centralized faith reflects not only the political environment, but the security of Christian thought as well. As more people started following the religion, Church fathers felt more protected by the political authority to mercilessly express their thoughts on Jewish religion. This new brand of explicit antisemitism established Christian views of Judaism not only well into the Medieval Era but also into modern and contemporary times. In short, the shift from implicit to explicit antisemitism closely follows imperial Roman legislation.

Linking Probability of Two Closed Curves

Aparna Komarla

Sponsor: Francisco Arsuaga, Ph.D.
Molecular & Cellular Bio

In DNA Topology, the linking probability of closed curves can be used to understand the structural properties of genomes. It may help understand the action of certain enzymes, which are molecules that can link and unlink circular DNA molecules. Consider two DNA molecules in a test tube, two of which form topological circle. One can ask the obvious question: What is the probability that the molecules are linked; that is, they have non-zero linking number? From the geometrical point of view the problem is complicated since molecules in solution have no fixed shape. We tackle this problem using topological consideration. Here we use differing closed polygons to estimate the linking probability of two close curves. Our results suggest that the linking probability of two closed curves is a non-increasing function of the distance between the center of masses. This agrees with theoretical results which suggest that confinement promotes entanglement complicity.

Incorporating a Socio-Scientific Issue Into the General Chemistry Curriculum to Improve Student Engagement

Jennifer Kopetzky

Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

This study attempts to improve the relevance of chemical education as perceived by students through the introduction of controversial topics into chemistry curriculum, with a focus placed on socio-scientific issues (SSI). Considering its political and economic relevance, Hydraulic Fracturing was selected as a suitable SSI. A lesson plan was developed and designed to stimulate self-directed learning by allowing students to contrast and defend different viewpoints on hydraulic fracturing. A group of General Chemistry students were first given an extensive Prezi on Hydraulic Fracturing to provide a base knowledge on the issue. The students were split into groups of four, with each member representing the views of a Politician, a Scientist, an Environmentalist, or an Oil Company Representative. Hydraulic Fracturing was analyzed through each perspective. Pre and post-discussion quizzes as well as a survey were administered to gauge how much was learned from this activity as well as student perception of the activity. The findings elucidate that most of the students who participated viewed the lesson plan as relevant and interesting. These results indicate that by contextualizing the chemistry curriculum through a socio-scientific issue, students are able to view the relevance of chemistry beyond the classroom environment.

Guanosine as a Modulator of Glutamate Excitotoxicity in Traumatic Brain Injury

Ioannis Kournoutas

Sponsor: Bruce Lyeth, Ph.D.
MED: Neurological Surgery

Traumatic Brain Injury (TBI) is a growing public health problem in the United States; it is estimated that 1.7 million people sustain the injury annually. Many studies have shown that TBI causes excessive release of the excitatory neurotransmitter glutamate, which has been implicated in the accompanying neuronal cell death/damage. Guanosine is an endogenous nucleoside that has shown broad-spectrum neuroprotection in a variety of in vivo and in vitro animal models. Studies have suggested that it modulates the glutamatergic system by increasing glutamate uptake and interacting with glutamate transporters. A recent 2016 study by Gerbatin et al. was the first to investigate the neuroprotective potential of guanosine as it relates to TBI. Their findings demonstrate that a single dose of guanosine protected against TBI-induced neuronal loss and maintained glutamate uptake post-injury. The aforementioned study by Gerbatin et al. investigated guanosine's efficacy in TBI neuroprotection in the short-term (8 hours). Given that glutamate excitotoxicity is a phenomena that can last days, it remains unknown whether these protective properties would maintain beyond the acute-phase. In the present study I take the next step and investigate the nucleoside's potential as a pharmacological strategy in an extended-time study.

Direct Synthesis of Indazolones via N–N Bond Formation Between Primary Amine and o-Nitrosobenzaldehyde

Niklas Kraemer

Sponsor: Mark Kurth, Ph.D.
Chemistry

Indazolones are biologically active molecules, which have been found to demonstrate anti-cancer, anti-tumor, anti-inflammatory, and analgesic properties, making them intriguing synthetic targets. A novel one pot synthesis of indazolones based on the Davis–Beirut reaction, pioneered by our group, has been discovered. By way of various o-nitrobenzylalcohols a wide variety of primary amines can be transformed into indazolones via intermolecular N–N bond formation in up to 86% yield. Mediated by base, this reaction relies on the key o-nitrosobenzaldehyde intermediate. This simple observation spawned the proposal that the reaction pathway could be pursued using ultraviolet radiation in place of base. These modified reaction conditions were shown to successfully synthesize indazolones in comparable yields, thus expanding the potential applications of the reaction. Furthermore, a successful large-scale indazolone synthesis demonstrates the feasibility of our reaction in safely mass producing indazolones. By use of relatively benign and affordable starting materials, we have been able to synthesize indazolones in an efficient one pot strategy. Thus our work presents an excellent pathway towards the synthesis of a variety of the very biologically interesting indazolones.

The Mismanagement of Type 2 Diabetes in Low Income Communities and the Role of Policy and Infrastructure

Caroline Kravitz

Sponsor: Catherine Brinkley, D.V.M., Ph.D.
Human Ecology

This research is a literature review analyzing the intersection of public health and urban planning with a focus on the prevalence of Type 2 Diabetes in low income communities, specifically the built infrastructure and how it has contributed to the rise of chronic illness amongst low income populations. This presentation seeks to answer the questions: how does one's area of residence play a role as a determinant of one's health? How does the built environment, or lack thereof, within low income communities contribute to Type 2 Diabetes and a person's inability to control the illness and its side effects. This research looks at various aspects of low income communities, such as access to healthy foods, walkability of neighborhoods, education, treatment of patients, access to primary care versus emergency services, and capacity of low income adults to focus on health issues when considering all of the other aspects of life they have to deal with. Additionally, this research utilizes case studies to understand how public health officials and urban planners have worked together to improve infrastructure in such communities and how this has impacted the overall health in communities.

Mapping Adult Neurogenesis Progenitor Clustering in Mouse Hippocampus

Milana Krush

Sponsor: Hwai-jong Cheng, M.D., Ph.D.
Neuro Physio & Behavior

The dentate gyrus (DG) of the hippocampus, vital for mental functions such as learning and memory, is one of few brain regions where adult neurogenesis occurs. We seek to enhance understanding of adult neurogenesis and subsequent neural integration into preexisting synaptic networks as a function of developmental stage in order to assess potential for neuroplasticity throughout adulthood. Currently we are using transgenic mice with Gli-1 promoter activated Cre-Estrogen Receptor recombinase activity in newly dividing neurons to conditionally express tdTomato fluorescent protein post Tamoxifen injection for various time periods to examine whether and how newborn neurons form clusters. DG sections are compiled into three-dimensional images using light sheet fluorescence microscopy, after which cell bodies are mapped using IMARIS computer software. We will conduct comparisons of statistical analyses to best evaluate cell body clustering patterns as indicative of neuronal progenitor pools to determine migration and distribution across the DG at a given age. Our primary interest is characterizing clustering morphologies across developmental stages to ascertain whether results match preliminary hypotheses of decreasing extent of stem cell migration with age. Such differences in clustering have salient implications for adult neurogenesis and integration in terms of age-related potential for neuroplasticity.

Synthesis, Characterization, and Reactivity of a Bis(imino)pyridine-ligated Al^{III} Complex

Sheila Kulkarni

Sponsor: Louise Berben, Ph.D.
Chemistry

Catalysts, or substances that lower the activation energy of a reaction, are a significant research topic in green chemistry. Transition metals are common catalysts because they readily participate in electron transfer, or redox, reactions; however, these metals are often dangerous and expensive. On the other hand, light, abundant metals like aluminum can be complexed to redox-active ligands to demonstrate transition metal-like behavior with a lower environmental cost. Previous work in the Berben group studied the reaction of a bis(imino)pyridine aluminum(III) hydride ($^{\text{Ph}}\text{I}_2\text{P}^2\text{-}\text{AlH}$) with adamantyl azide, yielding an aluminum-amido adduct which forms by proton abstraction from the ligand itself. This project aims to explore the reactivity of the analogous chloride complex ($^{\text{Ph}}\text{I}_2\text{P}^2\text{-}\text{AlCl}$) with adamantyl azide and other oxidants. The products of these reactions would be studied using NMR spectroscopy and X-ray crystallography. Investigating these reactions and characterizing their products would illuminate how main-group metals like aluminum cooperate with redox-active ligands to participate in electron-transfer reactions.

Human Milk Protease Kinetics: Quantification of Peptide Release During Digestion

Nithya Kumar

Sponsor: J German, Ph.D.
Food Science & Technology

Human milk is not simply a composite source of proteins, fats, and carbohydrates used to fuel the infant, but is an evolutionarily-tailored source of unique bioactive compounds. Specifically, human milk's endogenous proteolytic system delivers peptides to the infant that may have functions beyond amino acid delivery such as immune defense, antimicrobial action, and regulatory function. In previous research, we have qualitatively characterized peptides released by human milk proteases post-digestion. With this peptide map in hand, we are now looking at protease kinetics to discover and quantify when peptides are released during digestion. Peptides samples are recovered at various time points during simulated digestion and temporally analyzed using quantitative mass spectrometry. Digestion models at varying pH levels are used since infant stomach pH varies from 2 to 5 depending on the development of their gastric secretion system. Premature infants have especially underdeveloped gastric secretion and higher stomach pH, so it is necessary that we examine this impact on peptide release during digestion to guide premature infant feeding practices. This protease kinetics study is expanding the human milk peptide map into two dimensions and furthering our understanding of the human milk proteolytic system.

Secondhand Smoke Exposure Modifies Stress-Induced Arrhythmia Burden in Mice

Soundarya Kumaravelu

Sponsor: Chao-yin Chen, Ph.D.
MED: Pharmacology

Both secondhand smoke (SHS) exposure and stress decrease heart rate variability (HRV), an index of autonomic function and a risk factor for arrhythmia, the major cause of cardiac sudden death. However, we lack data on the interplay of SHS exposure and stress on arrhythmia burden. Thus, I investigated whether these two environmental variables interacted synergistically. I hypothesized that SHS exposure exaggerates acute stress-induced arrhythmia. Mice were exposed to SHS or filtered-air (FA) for up to 12 weeks and underwent monthly restraint stress tests. Electrocardiograms (ECGs) were recorded with telemetry and analyzed for arrhythmias at 2 hour intervals: resting baseline, restraint, and post-restraint recovery. Compared to FA, SHS did not change the frequency of premature ventricular contractions (PVCs) at rest. As expected, restraint stress increased the number of PVCs in both groups. In the FA group, the stress-induced increase in PVCs declined over time. In contrast, the SHS exposed group showed only a transient reduction in the stress-induced response. The data suggest that SHS exposure may increase cardiovascular consequences by attenuating the adaptive response to acute stresses associated with daily living.

Analog-to-Digital Converter to Measure Electron Lifetime for Liquid Purity Monitor

Madhuri Kumari

Sponsor: Sudhindra Tripathi, Ph.D.
Physics

The LUX-ZEPLIN (LZ) experiment uses liquid Xenon based detectors in the search for dark matter. While it is important to use liquid Xenon that is as pure as possible, there are bound to be impurities in the detector such as O₂ and H₂O. The liquid purity monitor (LPM) aims to monitor the concentration of these impurities by measuring the attenuation of free electrons drifting under the influence of an applied electric field. A pulsed UV light source releases electrons from a photocathode, which then drift through liquid Xenon until they are collected on an anode electrode. By comparing the amount of charge emitted from the photocathode to the amount of charge collected on the anode, the concentration of impurities can be determined. The charge signals from these electrodes are sent to an amplifier and then digitized with a Red Pitaya analog-to-digital converter which can perform the pulse-to-pulse analysis online. Preliminary results and future plans will be presented.

Healthcare in the San Joaquin Valley: Current Challenges and Successful Strategies

Sonam Kumari

Sponsor: Michelle Ko, M.D., Ph.D.
MED: Public Health Sciences

The San Joaquin Valley comprises the economic hub of California in agriculture, oil, and land development, yet one out of four families live below the poverty level. Myriad poverty-related challenges lead to poor health outcomes and barriers to consistent quality healthcare. Such challenges include unreliable transportation, limited educational opportunities, poor working conditions, toxic environmental exposures, unstable housing, food insecurity, lack of health insurance coverage, and competing financial needs. Healthcare providers in other rural and underserved communities are attempting to address these challenges by providing both clinical and social services addressing the needs of those in poverty, but the extent to which services are available, utilized, and meaningful for residents of the Valley is not known. This project employs a mixed-methods approach of quantitative analyses using data from the Health Resources and Services on community health centers and rural health clinics, and qualitative analysis based on semi-structured interviews to gain insight on primary care provider perspectives. Our findings suggest that while all health centers serve underserved communities in the Valley, services are limited and dependent on location. Furthermore, healthcare providers are hampered by insufficient grants and reimbursement rates to effectively address poverty-related determinants of health.

Market Driven Poverty Alleviation Programs in the United States: The Political Economy of the Kiva United States Program

Grace Kumetata

Sponsor: Luis Guarnizo, Ph.D.
Human Ecology

My research engages current institutional structures surrounding Microfinance, online philanthropy platforms, and the role of the entrepreneur and the nature of self-employment in technocratic discourses of development. The analysis begins by analyzing the growth of microfinance lending in the global south, and its recent implementation in the United States, as a development and poverty-alleviation strategy. It is framed against the dominant neoliberal discourses concerning flexibility of work, passion-driven work, and entrepreneurial spirit as the main forces guiding individuals to overcome poverty and achieve community development. This project is an exploration of the characteristics of Kiva, the online platform that serves as a microfinance lending marketplace which, until recently, was solely operating in the global south. This research examines and critically compares the approach Kiva employs in the global south and the global north by focusing on Kiva's program in Oakland, CA. The research specifically addresses the following questions: 1) Why is Kiva expanding operations into the United States? 2) Is Kiva's model promoting self-employment or entrepreneurship? 3) What are the intersecting priorities for Kiva Oakland and the City of Oakland?

Variable Activity of the Dotted Maize Transposon

Brandon Kung

Sponsor: Jeffrey Ross-Ibarra, Ph.D.
Plant Sciences

Transposable elements (TEs) are sequences of DNA that insert themselves into other places in plant and animal genomes. Most resulting changes are difficult to observe, but certain TEs in maize are responsible for creating dark spots on kernels. We used one such TE system consisting of Dotted (Dt) and rDt. Dt is a TE that codes for proteins allowing movement, while rDt lacks this coding. Movement of Dt and rDt occurs during growth and kernel development. It has been shown that activity of these TEs, as seen by the extent of spotting, is related to the amount of protein present encoded by copies of the Dt TE. We wanted to determine if rDt also contributes to differences in activity. We obtained kernels from eight strains of interest and, using PCR, identified three independent insertions of rDt into a1, an anthocyanin producing gene. We identified that the presence and orientation of rDt vary between strains, and that orientation is associated with activity as measured by spot size. By crossing plants with differing Dt and rDt content, we are generating different combinations of autonomous copies with different rDt orientations to determine the ultimate regulation of TE activity in this system.

Hippocampus Gene Expression in Rat Pups Following Supplementation with Milk Fat Globule Membrane and its Various Components

Bernice Kwan

Sponsor: Bo Lonnerdal, Ph.D.
Nutrition

Human milk can have effects on gene expression within the brain, specifically the hippocampus which is responsible for the development of memory and learning. Milk fat globule membrane (MFGM) is thought to contain nutrients which support brain development. Using a rat pup model, this study investigated MFGM and its elemental effect on hippocampal gene expression. Pups were assigned to groups and supplemented with one of five treatments; MFGM, phospholipid concentrate, sialic acid at two concentrations and non-fat milk as a control. Supplements were provided daily from birth to postnatal day (PD)21. Four genes were studied using PD14 and PD21 hippocampus samples; Glutamate Receptor 1 (GluR-1), Brain Derived Neurotrophic Factor (BDNF), ST8 Alpha-N-Acetyl-Neuraminide Alpha-2,8-Sialyltransferase 4 (St8Sia4) and Dopamine Receptor D1 (DrD1); Cyclophilin A (Cyc A) was utilized as a control. When amplified through polymerase chain reaction (PCR), the MFGM treatment groups showed the highest expression of all genes in the PD21 groups. However, gene expression in PD14 samples was increased for a majority of the genes, suggesting a higher sensitivity to change when compared to PD21 samples. These results suggest that MFGM, a component of human milk, can impact the developing rat pup brain.

Characterization of Embryonic Stem Cell Derived Retinal Ganglion Cells

Stephen Kwong

Sponsor: Anna La TorreVila, Ph.D.
MED: Cell Biology & Human Anat

Glaucoma afflicts 60 million people worldwide and causes Retinal Ganglion Cell (RGC) death, resulting in visual degradation and eventual blindness. This blindness is irreversible since the mammalian retina has little to no regenerative capacity, thus, cell replacement therapies are a potential approach to treating glaucoma. Currently, the lack of donor tissue is an obstacle to developing feasible cell replacement therapies. However, RGCs can be generated in vitro from stem cells (SC), and may be used as a source of donor cells. Our group and others generate SC-derived RGCs using a three-dimensional organoid technique, however, the number of RGCs generated in these cultures is relatively low. To increase RGC production in SC-derived RGC cultures, we aim to manipulate the progenitor cells that produce RGCs in vitro. Understanding when RGCs are made in vitro is essential to accomplishing this goal. To determine when SC-derived RGCs are produced in vitro and to characterize SC-derived RGCs, we performed birthdating studies to determine when RGCs are generated and analyzed gene expression that is characteristic of RGCs by immunocytochemistry and quantitative PCR. The results of this work will suggest when progenitors in SC-derived RGC cultures must be targeted to maximize the yield of SC-derived RGCs.

Observed Mother-Child Interactions: Associations Between Preschoolers' Social Behaviors, Temperament, and Their Mothers' Cognitive Functioning

Sumon Kyaw

Sponsor: Daniel Choe, Ph.D.
Human Ecology

The way in which children react and interact with the world, or their temperament, impacts their social behaviors, particularly with their mothers during early childhood. However, few studies examine the relationship between mothers' cognitive functioning and young children's temperament-related behavior. This ongoing study examines associations between maternal self-regulatory and intellectual functioning, and preschool-age children's temperament and observed social behavior. A sample of 9 mother-child pairs (M=38 years, SD=1.3, 9 female; M=4.5 years, SD=4.428, 4 female, respectively) were video-recorded for two interaction tasks, Free-Play and Clean-Up, and later coded at individual and dyadic levels using the Parent-Child-Interaction-System. Mothers were administered an intelligence test to assess intellectual ability, computerized tasks to measure self-regulation, and parent-reports to measure child temperament. Preliminary findings suggest that maternal self-regulation is associated with several aspects of children's observed social behavior and temperament, with different associations seen across different tasks. Maternal intelligence, while showing correlations with child behavior, seems to be unrelated to temperament. Further explorations will clarify the direct effects of mothers' intelligence and self-regulation on children's behavior. These findings are important because children's positive social behaviors are crucial for their healthy development and positive future outcomes.

Socioeconomic Status and Cortisol Stress Reactivity in Children and Adolescents

Jennifer La

Sponsor: Camelia Hostinar Caudill, Ph.D.
Psychology

Youth are exposed to a variety of social environments that may affect their future well-being. Previous studies have shown that lower family income can lead to lower academic performance and heightened behavioral reactivity in children and adolescents, particularly during early development. However, the particular pathways involved are unclear. To examine the effects of parental socioeconomic status on youth's physiological reactivity, we measured youth's salivary cortisol levels during the Trier Social Stress Test, which is a laboratory procedure comprised of a public speaking and mental arithmetic task. We recruited 162 participants, comprised of children aged 9-10 and adolescents aged 15-16, to participate in the study, which also included questionnaires. Through this study, we predict that lower parental socioeconomic status is related to higher stress reactivity. This study may help identify risk factors for high stress reactivity in youth and suggest new targets for interventions to help low-income youth cope with stress.

Inside-Out Chemistry: Synthesizing Polymers in the van der Waals Gaps of Bi₂Se₃

Gabriella Lahti

Sponsor: Kristie Koski, Ph.D.
Chemistry

Bismuth selenide (Bi₂Se₃) is a two-dimensional (2D) layered material that consists of a series of covalently-bonded layers separated by a van der Waals gap (>700pm). Metals can be inserted into the gap using organometallic decomposition, as with nickel via intercalating zero-valent tetrakis(triphenylphosphine) nickel into Bi₂Se₃ in an air-free reaction. A metal like nickel can also be used to catalyze reactions such as polymerization of organic species. Combining these two capabilities of nickel, it may be possible to synthesize polymers inside the van der Waals gap of layered Bi₂Se₃. This strategy will be a new type of chemistry that we deem "inside-out synthesis" as it occurs inside a layered host and is a material chemistry similar to bottom-up or top-down synthesis. Ni-intercalated Bi₂Se₃ along with the organic molecules liquid styrene and gaseous propylene will be shown as precursors in performing this chemistry. A variety of characterization techniques including XRD, Raman, and electron microscopy are used to analyze the material's structure and composition further as we explore inside-out chemistry.

The Effect of MicroRNAs on VEGF Secretion in Human Retinal Pigment Epithelial Cells (ARPE19)

Andrew Lai

Sponsor: Zeljka McBride, Ph.D.
MED: Ophthalmology

Diabetic retinopathy can lead to major vision loss that arises from abnormal growth of blood vessels in retina, called retinal neovascularization. Prior studies have exhibited a correlation between the introductions of different types of microRNAs with the expression of VEGF, a signal protein that induces the growth of blood vessels. We have identified a set of microRNAs dysregulated in ocular fluids from patients with proliferative diabetic retinopathy. Our goal was to test whether these circulatory microRNAs can induce VEGF secretion in in vitro cell cultures of ARPE19 cells. In this study, we transfected ARPE19 cell cultures with microRNA mimics miR-155, miR-92A, miR-320b, or a scrambled control. VEGF concentrations were measured in cell media by ELISA, while RNA isolated from the transfected cells were used for gene expression analysis of VEGF mRNA and candidate miRNAs using Taqman qPCR. The ELISA results showed upregulation of VEGF expression with one of the 3 candidate miRNAs. The qPCR results exhibited a positive correlation between miRNA 155 and VEGF expression within a 24-hour transfection period. Our results suggest that miRNAs dysregulated in ocular fluids with diabetic retinopathy have a potential to regulate VEGF expression in ARPE19 cells.

Dissection of the Microtubule Binding Properties of Tau Protein and its Effects on Cytoplasmic Dynein Motility

Aileen Lam

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

Tau, a microtubule associated protein, is a primary constituent of the protein aggregates found in the brains of Alzheimer's patients. These aggregates alter the movement of motor proteins along microtubules, potentially contributing to the disease phenotype. How tau binds to microtubules is currently under investigation. Here we use single molecule assays to study recombinant tau binding to microtubules. Using this system, we observe that tau forms patches along the microtubule, suggestive of cooperative binding. We generated various versions of tau protein to determine which region of the tau protein is responsible for this binding. To do so, we examined different constructs of tau using TIRF microscopy and concluded that the tau projection domain is necessary for tau patch formation. In addition, we have studied how tau patches affect the movement of motor proteins along microtubules. We observe that tau patches hinder kinesin transport, as previously reported, but cytoplasmic dynein is able to navigate through tau patches, suggesting that tau affects microtubule-based transport asymmetrically. Together, our data suggest that tau has a unique mode of binding to the microtubule that may be important in the regulation of active transport within neurons, providing important new insights into tau-mediated neurodegeneration.

The Nitty Gritty: How Perception of Schools' Fairness Relates to Grit and Academic Achievement

Tricia Lam

Sponsor: Tina Zicari, Ph.D.
Biological & Ag Engineering

Research has linked the personality trait of grit (i.e., perseverance and determination) with conscientiousness and academic performance. Given the benefits of grit, we were interested in what factors may influence whether a student has grit. Specifically, we wanted to know if students who believe that the school system rewards hard work (i.e., meritocracy) were more likely to have grit, and if this explains achievement. We had 152 participants (gender: female = 113, male = 11, other = 28; age: M = 21.35 years, SD = 2.77 years) from college classes. We found a marginally significant mediation, such that students with stronger meritocratic beliefs were more likely to have grit ($\beta = .20, p < .05$), and in turn, these students had higher GPAs ($\beta = .19, p = .05$). This suggests that people who believe that hard work leads to success in school are more likely to persevere in pursuing their goals, and thus have higher achievement. Interestingly, meritocratic beliefs were not directly related to GPA ($\beta = .08$) or math skills ($\beta = .08$), which further suggests that grit is the critical component in understanding how academic performance relates to beliefs about the value of hard work in school.

Investigating Thermogenesis in *Zea mays*

Nathaniel Langlois-Ackerson

Sponsor: Jeffrey Ross-Ibarra, Ph.D.
Plant Sciences

Thermogenesis is often thought of solely as an evolutionary adaptation of animals; however, numerous plants are also known to exhibit thermogenic behavior. In previously studied thermogenic plants, the alternative oxidase pathway is proposed to be responsible for heat production through its ability to uncouple respiration. Alternative oxidase (AOX) interrupts the electron transport chain, oxidizing ubiquinone and becoming the terminal electron acceptor, a process that generates heat. Three AOX genes are known to have arisen in *Zea mays*, and have been found to be inducible in times of respiratory stress. Due to the three AOX genes present in *Z. mays*, we hypothesize that thermogenesis may have arisen in lines to protect shoot meristematic tissue from low temperatures. Selective pressures for thermogenesis are most expected in highland adapted lines. Using thermal imaging, I set out to phenotype highland and lowland lines throughout their development to detect possible thermogenesis in temperatures near 15°C. I have compiled a list of genes involved in the AOX pathway and will determine if any exhibit signs of selection in highland lines using previous *Z. mays* enrichment studies. I will also use co-expression networks to investigate selection of regulatory genes involved in the AOX pathway.

Synthesis of the Ergoline Framework Through Witkop Cyclization

Alexander Lara

Sponsor: Mark Mascal, Ph.D.
Chemistry

Ergot alkaloids are a set of tetracyclic indole compounds, in which alkyl groups are attached at the 3 and 4 position. Derivatization of these compounds has led to the creation of more pharmaceutical compounds than any other natural product. These include pain relief medications, anti-migraine agents and anti-parkinsonian drugs. Current bio-fermentation processes limit the derivatization of the ergoline framework and therefore a fully synthetic method to this framework is desirable. Success of this process can be related to the total synthesis of the hallmark ergot alkaloid, lysergic acid. Current literature on the total synthesis of lysergic acid requires a minimum of 11 synthetic transformations from commercially available starting materials. However, none of these synthetic methods are practical for commercial manufacturing of the ergoline framework or lysergic acid. Our current project focuses on the construction of the C ring of the ergoline framework through Witkop cyclization, starting from enantiomerically pure D-Tryptophan. Development of the D ring of the ergoline framework will be achieved through simple Dieckmann cyclization. We expect to complete the framework in eight steps using simple and economical transformations, which would be the shortest synthesis to date.

Synthesis of Alkylidene Oxindoles for the Enantioselective Synthesis of Spirooxindole Structures

Manuel Larach

Sponsor: Annaliese Franz, Ph.D.
Chemistry

Spirooxindoles are important structural motifs because they are present in a number of naturally occurring bioactive products as well as in pharmaceutically relevant drugs. These compounds possess unique structural features that incorporate both oxindole and heterocyclic moieties fused through a quaternary spirocenter. Different synthetic routes have been developed to access various spirooxindole core structures; however, controlling the enantioselectivity and diastereoselectivity still remains a challenge. Therefore, synthetic methods that allow the synthesis of novel spirooxindoles while efficiently controlling the absolute and relative stereochemistry need to be further developed. Herein, I present the synthesis of alkylidene oxindoles that can undergo a novel [3+2]-annulation with silane nucleophiles in the presence of a Lewis acidic scandium catalyst to produce novel spirooxindole structures. The formation of alkylidene oxindoles involves the synthesis of a phosphonium ylide compound that is then reacted with an indole derivative. Reactions are monitored using thin layer chromatography and compound structures have been characterized using ^1H NMR spectroscopy. These alkylidene oxindoles have been applied as a valuable electrophile to access spirooxindole carbocycles in good yields and high enantioselectivity and diastereoselectivity.

Classification of Digestive Behavior for Raft-Forming Antacid Drugs via pH and Moisture Content Analysis

Emily Laskin

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

Alginate-based raft-forming antacids have been used to provide a physical barrier between stomach acid and the esophagus. These products gel in the stomach in the low-pH environment, preventing reflux. The effect of the gastric environment on alginate-based antacid solidification and the effect of commercial and lab-developed antacids on the gastric environment were characterized. Antacids were tested in pH 1 and 2 HCl and 5% acetic acid (AA). Incubations up to two hours were conducted to track pH change and raft moisture. pH was measured before and after incubation. Moisture was determined gravimetrically after drying. Alginate-containing antacids gelled in pH 1 HCl and AA. Non-alginate antacids did not gel. The average acidity change of the solution for commercial raft-forming antacids in pH 1 and 2 were $0.0255 \pm 5.29\text{E-}3$ and $3.89\text{E-}3 \pm 3.73\text{E-}4$ H^+ concentration, respectively. The moisture after 120 minutes of incubation of commercial product in pH 1 was 17.3 ± 1.87 g water/g dry matter, compared with 27.3 ± 3.29 g/g in the lab-developed formula. These findings indicate a higher moisture content in the lab-developed formula when compared with the commercially-available product.

Secondhand Smoke Exposure Impairs Vascular Reactivity in Mesenteric Arteries

Thanhmai Le

Sponsor: Manuel Navedo, Ph.D.

MED: Pharmacology

Secondhand smoke (SHS) has significant detrimental vascular effects, including enhanced vasoconstriction and hypertension. The mechanisms linking SHS exposure to these complications are unclear. Impaired vascular smooth muscle (VSM) function may be a key, yet poorly explored, contributing factor. In this study, we hypothesized that vascular reactivity of small diameter mesenteric arteries is altered in mice exposed to SHS. Mice were randomized into control (filter air, FA) and experimental (SHS) groups and exposed to either FA or SHS (Total Suspended Particle, TSP = $3 \pm 1 \text{ mg/m}^3$; 6 hrs/day, 5 days/week) for a 12 weeks period. After 12 weeks, mesenteric arteries from mice exposed to SHS showed higher ($P < 0.05$) myogenic tone compared to arteries from the FA group (15.7 ± 2 vs. 23.2 ± 2 FA vs. SHS, respectively). Moreover, we found reduced ACh-induced vasodilation in SHS arteries. Consistent with elevated myogenic tone, the resting membrane potential (V_m) of VSM cells isolated from mesenteric arteries of mice exposed to SHS was more depolarized than in cells from the FA group (-42.3 ± 3 vs. -35 ± 2 , FA vs. SHS, respectively). Our results suggest that SHS have deleterious effects on the vasculature that may involve changes in VSM function.

Lipid Oxidation in Meat from Broilers Fed Organic Diets with Cowpeas and Sunflower Meal.

Kirsten Leal

Sponsor: Annie King, Ph.D.

Animal Science

Presently, synthetic methionine is added to organic poultry diets. The National Organic Standards Board may soon curtail its use. Thus, organic diets with added synthetic methionine in a control (corn/soybean basal diet, D1), basal + 20% sunflower seed meal (D2), and basal + 20% cowpeas (black-eyed peas, D3) and those without synthetic methionine as basal + 20% sunflower seed meal + 20% unheated cowpeas (D4) and basal + 20% sunflower seed meal + 20% heated cowpeas (D5) were fed to broilers by a two-week regimen as starter, grower, and finisher. Overall results showed that 6-week-old broilers fed D5 had significantly decreased ($p \leq 0.05$) weight compared to D1. Feed conversion was comparable across all phases and diets. From these results, it was hypothesized that broilers fed D5 likely had less fat, favored by consumers, and would produce less lipid oxidation (lipid deterioration) under several processing and storage conditions. Thigh meat from broilers fed all diets will be analyzed for fat content and stored under processing and storage condition of cooked and heated, fresh; cooked and heated, refrigerated (4°C , 4 days); and cooked and heated, frozen (-20°C). Samples will be analyzed using a thiobarbituric acid assay to assess lipid deterioration.

Axial Elongation of Benthic Fishes and its Contribution to Morphological Diversity

Hye Yun Lee

Sponsor: Peter Wainwright, Ph.D.

Evolution & Ecology

Marine fishes display an incredibly high level of morphological diversity, with adaptations for life in a range of habitats. For this study, our primary interests surround the dominant mode of morphological diversity in the benthos. The benthic zone, or sea floor, houses a large diversity of species, ranging from flatfishes to predatory anglerfish, that all interact closely with the bottom substrate. Previous work has shown that body elongation is the primary feature of morphological variation in reef fishes, yet it has not been determined if this trend is applicable to all benthic fishes. We predict that elongation is the largest axis of morphological diversity among benthic fishes, relating to advantages such as maneuverability through crevices and increased ability to bury within the substrate. We used linear morphological measurements collected at the National Museum of Natural History to describe overall body shape and analyzed these data in a phylogenetic framework to estimate and compare shape variation in fishes in the series Ovalentaria and Eupercaria. Through this study, we attempt to validate that interaction with the bottom substrate is the major driver of elongation in benthic fishes and provide a foundation for further research on the evolution of fish morphology.

Kinematic Analysis of Mandibular Motion Before and After Mandibulectomy and Reconstructive Surgery

Monica Lee

Sponsor: Boaz Arzi, D.V.M.

VM: Surg/Rad Science

Mandibular tumors in dogs typically require surgical removal of a part or the whole mandible in a procedure known as a mandibulectomy. Segmental or rostral mandibulectomy leaves a critical-sized defect in the mandible which often results in substantial mandibular drift and decrease in quality of life. Without reconstruction of the mandible, mandibular movement may be painful, uncomfortable, and places stress on the joints and muscles responsible for mastication. Previous studies have successfully reconstructed the mandible bone by using a locking reconstruction plate and growth factors. However, kinematic data has yet to be obtained of a healthy mandible, a mandible after mandibulectomy, and a mandible after reconstruction with a locking reconstruction plate. In this study, mandibles were tested *ex vivo* using dog cadaveric specimens utilizing a custom built load frame to manipulate mandibular movement. Kinematic markers were fixated on the cadaver and cameras were used to track 3D angular and displacement changes. It was expected that mandibulectomy will result in more mandibular motion and instability and that reconstruction will reduce the instability to result in similar kinematics as an intact mandible. Obtaining kinematic data of the mandibles during these conditions can allow us to evaluate the benefits of mandibular reconstruction.

Does my Body Make my Head Look Big? Body-Head Shape Covariation in Cichlids

Anna Lee

Sponsor: Peter Wainwright, Ph.D.
Evolution & Ecology

Cichlids are a very morphologically and ecologically diverse vertebrate family, making them great model organisms for evolutionary studies. They vary widely in a number of morphological features, like overall size, fin shape, pattern of coloration, and body shape. Although we know that fish body and head shapes are influenced by habitat and diet, we still lack an understanding of the covariation between these features. Given that changes in body shape often impact head morphology, we are interested in the strength of this relationship and its impacts on cichlid diversity. This research expands on previous work in a small group of cichlids from Madagascar, which suggested a correlation between body and jaw shapes. Linear morphometric data, collected from the National Museum of Natural History, covers over 200 species of cichlid that we used for comparative phylogenetic analyses. We predicted high correlation between body depth and head depth, lower jaw length, and mouth width. This would not only suggest a constraint on the diversity of cichlid head shapes, but also offer insight on the evolution of body plans in other fishes.

Near Infrared Spectrometry (NIR) as a Fast and Reliable Tool for Fat and Moisture Analysis in Olives

Chiao Hwei Lee

Sponsor: Selina Wang, Ph.D.
Food Science & Technology

The evaluation of fat and moisture content for olive fruits is crucial for both olive growers and olive oil processors. Fat content is one of the primary parameters used to determine harvest time while fruit moisture influences the efficiency of olive oil extraction process. Standard method such as Soxhlet extraction used to determine fat content in olive fruits are both time consuming and labor intensive. Therefore, near-infrared (NIR) spectroscopy is proposed as a solution towards rapid and nondestructive analysis of olive fruit fat and moisture content. In the present work, a comparative study of the fat and moisture extraction methods was performed in order to determine the potential of NIR as an alternative methodology. Since particle size of the olive paste can influence the accuracy of NIR screening, the study of crushing degree was also investigated using three different grid sizes on a hammer mill, in addition to a blade crusher. Preliminary results indicate a good correlation between standard Soxhlet and NIR methods. NIR analysis using different particle sizes on the hammer mill was inconclusive; however, the crushing blade provides higher yield in both moisture and fat content in comparison to the hammer mill.

Cumulative Gene Dosage Effects of the Paralogous *Rnf212* and *Rnf212b* RING E3-Ligases on Crossing Over During Meiosis

Kevin Lee

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

Crossing over by homologous recombination during meiosis is essential for ensuring chromosomes equally separate into gametes. Improper recombination can result in aneuploidy, birth defects, or infertility. We have studied the function of Ring Finger Protein (RNF) 212 and its paralog RNF212B in meiotic recombination, revealing that both proteins are essential for crossing over and fertility in mice. Common alleles of *Rnf212* are associated with heritable variation in recombination rate in humans, and recent studies showed that *Rnf212b* is linked to recombination rate in Bovidae species. Consistent with these observations, mouse *Rnf212* and *Rnf212b* genes show dosage-dependent effects, meaning that heterozygous mice for either gene show a decreased number of crossovers. To investigate the relationships between the paralogs, we isolated testes from adult males and ovaries from fetal females, and prepared surface-spread meiotic chromosomes. Pachytene chromosomes were immunostained for crossover marker MLH1 and crossover numbers were quantified for individuals of different genotypes. Preliminary results suggest the dosage-dependent effects of *Rnf212* and *Rnf212b* heterozygosity are cumulative, meaning doubly heterozygous mice have fewer crossovers than either single heterozygote. This cumulative dosage appears to be smaller in females than in males, pointing to a sexually dimorphic effect of *Rnf212/Rnf212b* mutations.

Optimizing Etching Rates for DISC Patterning of Semiconducting P3HT:F4TCNQ Films

Owen Lee

Sponsor: Adam Moule, Ph.D.
Chemical Engineering

Organic photovoltaic devices (OPVs) provide a unique alternative to traditional inorganic solar cells in that they are mechanically flexible, low cost, and can be chemically manipulated for specific applications. However, OPVs generally have a much lower efficiency compared to their inorganic counterparts. One way to increase this efficiency is to pattern the cell on a nanoscale in order to maximize the energy captured from specific wavelengths while also minimizing energy losses due to reflection. But until recently, polymer-based photoactive layers in OPV devices were extremely impractical to pattern. Doping Induced Solubility Control (DISC) is a recently introduced photolithographic method for adjusting the solubility of dopant-polymer blends to create patterns with sub-micrometer resolution. DISC patterning has the potential to greatly simplify solution based device fabrication and is adaptable to current fabrication techniques. Here, we demonstrate how to optimize the etching rate for solution based patterning of thin films of poly(3-hexylthiophene) (P3HT) doped with the molecular dopant 2,3,5,6-tetrafluoro-7,7,8,8-tetracyanoquinodimethane (F4TCNQ) using a wide range of organic solvents.

Local Regulation and Potentiation of L-type $\text{Ca}_v1.2$ by Adenylyl Cyclase 5 During Diabetic Hyperglycemia

Elizabeth Lee

Sponsor: Manuel Navedo, Ph.D.

MED: Pharmacology

Elevated blood glucose, known as hyperglycemia (HG), is a metabolic abnormality of diabetes that has been associated with increased arterial myocyte contractility and consequently, excessive vascular constriction that can lead to high blood pressure and reduced blood flow. Increased arterial constriction in response to HG involves enhanced activation of L-type Ca^{2+} channels ($\text{Ca}_v1.2$) mediated by protein kinase A (PKA) phosphorylation of the channel. However, the upstream mechanism regulating PKA activity is not known. Here, we describe a critical role for adenylyl cyclase isoform 5 (AC5), upstream of PKA, in potentiation of $\text{Ca}_v1.2$. Electrophysiology and arteriography recordings in WT isolated cerebral arteries and arterial myocytes, respectively, showed that the specific AC5 and AC6 inhibitor 2,5,DDA prevented increased $\text{Ca}_v1.2$ activity and vasoconstriction in response to HG. Moreover, HG failed to enhance $\text{Ca}_v1.2$ channel activity and vasoconstriction in arterial myocytes and arteries isolated from AC5 knockout mice, which was not observed for AC6 knockout mice. Interestingly, a subset of $\text{Ca}_v1.2$ channels was found within nanometer proximity of AC5 in arterial myocytes with significantly higher association than AC6. Altogether, these findings suggest a role of local AC5 signaling in HG-induced increased $\text{Ca}_v1.2$ activity and vasoconstriction during diabetic hyperglycemia.

A Sequence of Polynomials Arising From Random Numerical Semigroups

Calvin Leng

Sponsor: Christopher O'Neill, Ph.D.

Mathematics

Numerical semigroups are sets of nonnegative integers that are closed under addition and appear in various fields of mathematics, including discrete optimization, combinatorial geometry, and number theory. From the study of the average behavior of randomly generated—in a manner analogous to the Erdős-Rényi model for random graphs—numerical semigroups, a sequence of polynomials emerges in several formulas that encode the expected properties of these semigroups, such as the number of minimal generators and the number of integers outside of the semigroup. The more of these coefficients we know, the closer we can approximate expected values of randomly generated numerical semigroups. In particular, the coefficients of these polynomials can be described combinatorially as counting generating sets with certain properties. There exist algorithms to compute these coefficients, but none run efficiently, i.e. in polynomial time. This project seeks to better understand these coefficient in hope of discovering computational shortcuts that will allow for a polynomial time algorithm.

Structural Assignment of Oleuropein Using Computational NMR

Arturo Leon Sandoval

Sponsor: Dean Tantillo, Ph.D.

Chemistry

Oleuropein is an extensively studied compound in olive oil that has been known to help with heart damage, be an antioxidant, and have other health benefits. Oleuropein aglycone, oleuropein that had its sugar removed, is the chemically active version of oleuropein that has 13 possible isomers. However, the exact structures of the dominant isomers that are prevalent in olive oil are not known. Previous research done on identifying the geometry of oleuropein involved conformational searching using oleuropein. However, these trials did not look at oleuropein aglycone which has a greater number of possible isomers. Therefore, in this study, we are using density functional theory (DFT) to assign the correct geometry as well as calculating the ^1H and ^{13}C chemical shifts of oleuropein for future NMR comparison. Our approach involves first truncating the oleuropein aglycone to look at the elenolic acid section that is chemically changing between isomers, then doing conformational searches for each of 13 proposed isomers, followed by stationary point analyses to determine the lowest energy conformations of each isomer as determined by DFT calculations. The results will be used to help build a model of oleuropein aglycone.

Deconstructing Chemical Signaling Between Root-Knot Nematodes

Joshua Leung

Sponsor: Valerie Williamson, Ph.D.

Plant Pathology

Root-knot nematodes (Meloidogyne) are found worldwide and are responsible for billions of dollars of agricultural damage a year. These nematodes are attracted to and infect roots at the root tip, siphoning off resources and inducing root knots. Meloidogyne emit compounds called ascarosides (Ascr), which are conserved pheromones amongst other nematode species. Little is known about how Meloidogyne respond to various ascarosides, so we are investigating Ascr18, the most abundant ascaroside emitted from root-knot nematodes. We also investigated Ascr9, which is not found in Meloidogyne and has a side chain that is 6 carbons shorter than that of Ascr18. Through various chemotaxis assays, we characterized the response of *M. javanica* to synthetically produced Ascr9 and Ascr18, and compared them to naturally emitted worm exudate (WED) from *M. javanica*. Ascr9 elicited little to no response in *M. javanica*, but Ascr18 was repulsive. Adding Ascr18 to root tip exudate from *Medicago* (MRE), which is by itself highly attractive, was also repellant, whilst Ascr9 had no effect. WED also was repellant, but increased attraction when combined with MRE. Insight into nematode pheromone signaling has the potential to improve agricultural management of root-knot nematodes and increase yields.

Body Elongation as a Major Feature of Diversification in Eupercarian Fishes

Timothy Leung

Sponsor: Peter Wainwright, Ph.D.
Evolution & Ecology

The extraordinarily diverse series Eupercaria contains fishes that live in a range of habitats. These fishes have adapted to their environments in countless ways that are evident in their body morphologies. Previous studies have shown that body elongation is the dominant mode of shape variation in reef fishes. This trend is driven by a number of factors, like feeding performance and defense against gape-limited predators, not all of which are unique to reefs. Our research focused on whether elongation is the dominant form of diversification across all marine Eupercarians in different types of habitats. We utilized an assemblage of linear body measurements collected at the National Museum of Natural History, spanning the four orders in the series (Perciformes, Gasterosteiformes, Scorpaeniformes, Lophiiformes). Using habitat data collected from the online database 'FishBase,' we performed comparative analyses of the aforementioned body measurements for species in these orders. We predicted that head depth, maximum body depth, and caudal peduncle depth, relative to standard length, would show the greatest trend in shape diversity. This study will have major implications for our understanding of morphological variation of fishes and the adaptive significance of body elongation.

Ultra-sensitive Colorimetric Detection of Chloropicrin on Nylon-6 Nanofibrous Membrane with Biological Thiols

Ho Ting Leung

Sponsor: Gang Sun, Ph.D.
Textiles & Clothing

Chloropicrin is widely used as a soil fumigant in agricultural production because of its high efficiency for soil-borne pest control. However, the over-exposure to chloropicrin of human beings, especially farm workers and nearby residents, can cause serious diseases and even cancer. The permissible exposure limit (PEL) of chloropicrin is regulated by US OSHA as 0.1 ppm. Highly sensitive and personal-used colorimetric sensors are effective methods for chloropicrin vapor detection to improve personal protection. In this research, the detoxification reaction between biological thiols and chloropicrin is selected as the detection reaction. The reactivity of five biological thiols is compared and analyzed based on the redox and nucleophilic substitution reaction mechanisms. Nylon-6 nanofibrous membrane was selected as a sensor matrix with ultra-high surface area to concentrate the chloropicrin vapor on the sensor surface to accelerate the reaction rate. An additional organic solvent was applied as an extra vapor sorbent to drive the reaction kinetically favorable further. The detection limit of chloropicrin is tunable in different biothiol systems. The lowest detection limit is achieved as 0.033 ppm in designed L-homocysteine sensor system by naked eyes, which is much lower than its PEL.

Automated Library Construction Using KAPA Library Preparation Kits on the Agilent NGS Workstation Yields High-Quality Libraries for Whole-Genome Sequencing

Megan Lew

Sponsor: Bart Weimer, Ph.D.
VM: Population Hlth & Reprod

A method was developed to automate the KAPA HTP Library Preparation kit for microbial whole genome sequencing. This method uses the Agilent NGS Workstation, consisting of the NGS Bravo liquid handling platform with its accessories for heating, cooling, shaking, and magnetic bead manipulations in a 96-well format. User intervention in multistep protocols is minimized through the use of other components of the workstation such as the BenchCel 4R Microplate Handler and Labware MiniHub for labware storage and movement. This method has been validated for sequencing on the Illumina platform and consists of three protocols: the first is for end repair to post-ligation cleanup; the second is used for library amplification setup; and the third is for the post-amplification cleanup. The modular design provides the end-user with the flexibility to complete library construction over two days, and is suitable for the construction of high-quality libraries from bacteria of various GC content. This combined solution produced a workflow that is suitable for production-scale sequencing projects such as the 100K Pathogen Genome Project.

Distorted Democracy: How Prisons Divert Vote Power

Sierra Lewandowski

Sponsor: Erik Engstrom, Ph.D.
Political Science

In an effort to ensure representative equality, the Supreme Court in *Baker v. Carr* recognized the principle of "one person, one vote" for the creation of legislative districts. Census Bureau data is utilized for the development of equal-sized districts through decennial population surveys. Whereas most individuals are considered according to their home address for the Census count, prison populations are counted at their "usual residence" or the address of the institution they are incarcerated in. Effectively, this rule results in the heightened allocation of representation and resources to individuals living in communities surrounding prisons. As prison populations are ineligible to vote, this practice diverts vote power and political clout disproportionately from urban districts to rural districts where prisons are predominately located. In the present study, the effect of state prison populations on the voting power of surrounding eligible voters is determined for the varying senate and assembly districts within the State of California for the 2011 redistricting cycle. Individuals living in districts with prison populations are seen to have a higher share of the total vote power than individuals residing in districts without prisons in California.

Molecular Role of p150-IC Interaction on Dynein's Activation

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. Within cells, dynein motor activity is autoinhibited and must be activated through the binding of dynactin, a multi-subunit complex. Dynein-dynactin interaction is mediated through a variety of adapter proteins that link dynein to dynactin and bridge the motor to its cargo. The interaction between p150 subunit of dynactin and N-terminus of dynein intermediate chain-2 (DIC2) was previously thought to regulate dynein-dynactin interaction. However, recent structural studies raise questions about the functional relevance of this interaction. We are interested in the role p150-DIC2 interaction plays in dynein's activation via dynactin. Using Flp-In T-Rex mammalian cell system and Big-Bac baculovirus system, we generated cell lines expressing a wild type DIC2 or a N-terminally truncated DIC2 to eliminate p150-DIC2 interaction. To compare complex formed with the two versions of dynein, and further understandings of the mutually dependent interactions between the three components, 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.

Optimization of Transfection Protocols to Study Calcium Channel Regulation in HEK-293 Cell Model

Liangying Li

Sponsor: Johannes Hell, Ph.D.
MED: Pharmacology

Human Embryonic Kidney (HEK-293) cell line is a common cell line that has been largely used as a tool to express genes that would produce recombinant proteins. Our lab uses HEK cells as the expression tool to produce mutants of calcium-modulated protein; we are accomplishing such production process by transfecting DNA of interest into HEK cells. My project, as a subproject of the general lab project, is to investigate potential optimizations to current protocols for DNA transfections. I am proposing two potential factors which may influence transfection efficiency, cell confluency at the time of transfection and the time allowed for DNA to precipitate in transfection reagents. In this project, I will be revising protocols of two transfection reagents our lab is currently using: calcium phosphate and Lipofectamine 2000. I will obtain the results of this project by observing the survival ratio of the cells and ratio of successful transfection under fluorescence. Based on these observations, I will make modifications to these protocols accordingly.

Examining Ethnic, Gender, and SES Differences in the Social Validity of Cognitive Behavioral Therapy

Jinmeng Li

Sponsor: Nolan Zane, Ph.D.
Psychology

This study examined ethnic, gender, and SES differences in the social validity of nine essential components of cognitive behavioral therapy (CBT): Learning the relationship between thoughts, feelings, and behavior; identifying emotions; identifying harmful/helpful thoughts; challenging harmful thoughts; changing and replacing harmful thoughts with helpful ones; understanding healthy activities; generating healthy activities; realistic selection of healthy activities; and setting future goals. The sample included 527 undergraduates (74.4% Asian American, 25.6% White American) recruited from a university research pool. Asian Americans considered 6 of the 9 treatment emphases to be less socially valid than White Americans. Many of the ethnic differences in social validity involved treatment sessions focused on the cognitive activities of CBT and the realistic selection of healthy activities. These findings support previous research indicating that Asian Americans tend to focus more on somatic factors than the cognitive aspects of mental health problems and are more likely to believe that avoiding negative thoughts enhances mental health. Orienting initial sessions to behavioral activation activities may be a more credible and effective way to implement CBT with Asian clientele. No gender or SES differences were found. This study demonstrates the utility of social validation for developing and adapting more culturally informed interventions.

Investigating Whether Neuronal Integration in the Aging Brain is Governed by Extrinsic Environmental, or Intrinsic Molecular Factors

Cindy Liang

Sponsor: Hwai-jong Cheng, M.D., Ph.D.
Neuro Physio & Behavior

Neurogenesis, the formation of neurons from the division of precursor cells, is crucial to learning and memory. In adult brains, neurogenesis occurs in a structure called the hippocampus. Following division, newborn neurons create functioning connections with the existing hippocampal circuitry in a process called integration. Neurogenesis can be elevated in young mice placed in enriched environments, which contain more exercise opportunities than standard environments. However, how environmental enrichment impacts neurogenesis and neural integration in adult or aged mice remains unknown. The Cheng Lab is testing two hypotheses: 1) neural integration during adult neurogenesis is primarily governed by extrinsic environmental factors, or 2) this integration is primarily governed by intrinsic molecular factors. To investigate these hypotheses, we are housing groups of adult and aged mice in enriched or standard environments. We are measuring neuronal integration by examining the density and size of boutons, or axonal swellings, in axons of adult-born neurons using Neurolucida, an analytical software. We are also morphologically identifying and recording the quantity of cell types within the hippocampus. We are interested in seeing if exposing adult or aged mice to enriched environments will change characteristic patterns of bouton density and size, which will signal changes in integration.

Determining Ions' Effects on Micelle Sizes

Wyatt Liao

Sponsor: Marjorie Longo, Ph.D.
Chemical Engineering

The addition of ions and charged surfactants has been shown in previous works to decrease the critical micelle concentration (CMC) when added to charged micelles. Using dynamic light scattering (DLS) to measure the sizes of dodecylamine hydrochloride (DAH) micelles with varying concentrations of sodium chloride, magnesium chloride, and sodium dodecylsulfate (SDS), it was found that the aggregate size generally increased with increasing amounts of charged molecules; however, an initial dip in the size of DAH with SDS indicated a phase change from spherical micelles to a lamellar array. By determining the number of molecules in the aggregate as well as the ionic concentration in the solvent, the strength of the micelles' intermolecular interactions was found through the calculation of the positive constant a . Values of a were found to increase when charged particles were added to the solution. From relating a to the theoretical change in free energy of micellization of DAH, the Gibbs free energy of micellization of the particle sizing method was related to past findings and was found to be greater than values obtained from CMC measurements.

Characterization of Crude Urease Extract from *Citrullus lanatus* Seeds as a Field Method for the Determination of Urea in Urine

Kahui Lim

Sponsor: Harold Leverenz, Ph.D.
Civil & Environmental Engr

A crude urease extract derived from watermelon seeds was characterized in the development of a field method to measure urea in dilute urine samples. The mass of ground seed used in the extraction process and the dose of the crude extract applied to urine were optimized by comparing the associated product formation curves for each varied parameter. Greater ground seed mass and larger dose volume corresponded to accelerated urea hydrolysis rates in both urea stock solutions and dilute urine samples. By performing an enzymatic activity assay, it was shown that at 21°C, the crude extract operates optimally at a pH of 8.1. Through a conductometric and unbuffered Michaelis-Menten kinetics experiment at pH 7.4, the K_m values corresponding to urea and fresh dilute urine were found to be, respectively, 2.146 and 10.05 mM. Finally, the V_{max} values were determined for urea and fresh urine, respectively, to be 0.010 and 0.0105 mM/s. In an unbuffered system, the urease was competitively inhibited by urine. Further research is needed to describe the enzyme extract's properties in a buffered system and to develop the practical applications of the field method.

The Manipulation of Memory In Situ and Abroad: Memorialization of the Holocaust in Museums in Europe and the United States

Emma Lingel-Gary

Sponsor: Heghnar Watenpaugh, Ph.D.
Art

This paper explores the memorialization of the Holocaust in museums in the United States and Europe. The institutionalization of Holocaust memory through the construction of museums and memorials is a process worth considering from a cultural, historical, and legal standpoint. The Holocaust, and its subsequent treatment by museum institutions, betrays the construction of memory as a tool for digesting the past and internalizing an historical event to a nation's identity and ethos. By examining institutions in the US and Europe, one can see the manipulation and utilization of Holocaust memory to perpetuate or even invent a national identity. In the construction of memory sites in the United States, most importantly on the National Mall at the United States Holocaust Memorial Museum, and in Europe, significantly in Berlin, Germany at the Memorial to the Murdered Jews of Europe, and in Warsaw, Poland at the Monument to the Ghetto Heroes, one can see the differences in commemoration and what they betray about the governments and bodies that institutionalize historical memory.

Niclosamide: A Potential Chemotherapeutic Agent for the Treatment of Bladder Cancer

Joseph Llewellyn

Sponsor: Maria Mudryj, Ph.D.
MED: Medical Microbiology & Imm

Niclosamide, an old anthelmintic drug, displays antitumor effects against various human cancer lines, such as leukemia, breast and prostate cancer. In castration resistant prostate cancer (CRPC), niclosamide was seen to inhibit both the expression level and activity of low-molecular weight forms of the androgen receptor (LMW AR) and significantly reduced the viability of the CRPC cell lines treated. The Mudryj lab previously tested if niclosamide would also inhibit the expression levels and activity of LMW AR found in bladder cancer (BC) cell lines, as well as reducing cell viability. Niclosamide inhibited LMW AR, reduced cell viability, and increased levels of cleaved-PARP (a biomarker for cellular apoptosis) in the two BC cell lines, UM-UC-3 and TCCSUP, that were treated. Therefore, we tested the hypothesis that niclosamide would reduce viability in other BC cell lines. We observed a significant reduction in cell viability in varying concentrations and periods of the treatments performed on each BC cell line used. These results support the hypothesis that niclosamide reduces viability of other BC cells. We conclude that niclosamide effectively acts as an anticancer agent against selected BC cell lines in a dose and time dependent manner.

Muscle Strength Improvement and ColQ Rescue in Endplate Acetylcholinesterase Deficient Mice Through Allographic Mesenchymal Stem Cell Therapy

Kristen Lo

Sponsor: Ricardo Maselli, M.D.
MED: Neurology

Congenital endplate acetylcholinesterase deficiency (CEAD) is an autosomal recessive human disease characterized by severe muscle weakness and fatigability. CEAD results from mutations in COLQ, a gene that encodes the collagen tail of the enzyme acetylcholinesterase (AChE). Mutations in COLQ result in defective ColQ proteins that are unable to anchor acetylcholinesterase at the motor endplate. This causes an excess of acetylcholine, endplate depolarization, and acetylcholine receptor desensitization, thus leading to neuromuscular transmission failure. Conventional treatments of myasthenia based on acetylcholinesterase inhibition are ineffective because patients with CEAD have insufficient acetylcholinesterase. We examined the effectiveness of genetically engineered allographic mesenchymal stem cell therapy to rescue ColQ function in colq knockout mice. Through behavioral testing, fluorescent microscopy, and repetitive nerve stimulation (RNS), we observe improvement in muscle strength and motor performance. Furthermore, we demonstrate the effectiveness of mesenchymal stem cells in secreting ColQ and restoring the enzyme acetylcholinesterase at the neuromuscular junction. Thus, genetically programmed stem cells are capable of ameliorating muscle weakness caused by defective ColQ proteins. This study provides compelling evidence in favor of the use of allographic mesenchymal stem cell therapy as treatment for human CEAD.

A Study on Bio-Activity of Lipase Immobilized on Varied Nanofibrous Membranes

Jeane Gladys Lo

Sponsor: Gang Sun, Ph.D.
Textiles & Clothing

Bio-activity of enzymes chemically immobilized on solid media has been studied because the covalent connection restricts conformational changes. Nanofibers are one dimensional materials, and nanofibrous membranes are made of nanofibers, which provide ultrahigh surface areas for chemical immobilization of functional groups. The activity of enzymes covalently immobilized onto the nanofibrous membranes could be improved due to the nanostructured morphology and increased amount of functional groups on the solid surfaces, as well as the affected conformation of the proteins. In this study, poly (vinyl alcohol-co-ethylene) (PVA-co-PE) nanofibrous membranes were fabricated by an electrospinning process with fibers in different diameters, followed by modifications with different reagents for immobilization of a lipase. Finer nanofibers were able to maintain the immobilized proteins more active. Chemical agent, disuccinimidyl carbonate (DSC) has high reactivity to amine groups of N-terminal of the lipase proteins but could also influence their bio-activities. Cyanuric acid (CC) can provide stable covalent connections between the fibers and the lipase with minimum influence on the protein activity. Attenuated total reflection Fourier Transform Infrared spectroscopy and ultraviolet-visible spectroscopy (UV-vis) were used to characterization of structures and bioactivities of the lipase immobilized on the nanofibrous membranes.

Ongoing Pain in Dairy Calves 3 Weeks After Disbudding

Beverley Loo

Sponsor: Cassandra Tucker, Ph.D.
Animal Science

Disbudding is a routine husbandry procedure in which a heated iron is used to cauterize the horn-growing tissue in dairy calves to prevent subsequent horn growth. This practice is painful and calves are sensitive to mechanical stimulation of the wound for several weeks after disbudding. However, there is limited research to evaluate the occurrence of ongoing, non-evoked pain after disbudding. To investigate this possibility, we used a conditioned place preference test. Disbudded (n=11) and sham (n=11) calves were trained to associate the effects of an analgesic injection (lidocaine) or control injection (saline) with the location and pattern of a visual stimulus. Seventeen days after disbudding/sham-disbudding, calves received a 3-day conditioning period to learn the drug/stimulus associations, following which they were given a choice between the lidocaine-and saline-paired stimuli. Sham calves avoided the lidocaine-paired stimulus while the disbudded calves displayed no preference. To conclude, we did not observe conditioned place preference 20 days after disbudding, but instead found that lidocaine is aversive to uninjured animals. Despite this challenge with our paradigm, disbudded calves were willing to make a trade-off between the pain of the lidocaine injection and the longer-term analgesia, providing indirect evidence that there is ongoing pain after 3 weeks.

Individual Differences and the Use of Verb Bias During Sentence Processing

Graciela Lopez

Sponsor: Debra Long, Ph.D.
Psychology

Verb bias, the frequency of a verb appearing in a given structure, may facilitate sentence processing acting as a cue to the syntactic structure. Simple direct object (DO) structures are generally read faster than complex sentential complement (SC) structures, but past studies have found that sentences are read faster when the verb bias (DO or SC) is consistent with the structure. In the current study, participants completed a self-paced reading task where they read temporarily ambiguous sentences that contained a DO or SC verb within a DO structure (e.g. "The goalie confessed the defeat with real heartbreak") or an SC structure (e.g. "The goalie confessed the defeat was really heartbreaking"). Language experience and working memory capacity (WMC) were measured with standardized individual difference measures (i.e. the Nelson Denny, operation span, and reading span tasks). This research investigates how individual differences, verb bias and sentence structure affect sentence processing speed. Preliminary analyses suggest that higher WMC and language experience lead to faster reading times, and that sentences are read faster when the verb bias is consistent with the structure.

Regulation of Extracellular Matrix (ECM) Expression Following Exercise

Christopher Lopez

Sponsor: Keith Baar, Ph.D.
Neuro Physio & Behavior

Age-dependent losses in skeletal muscle (SKM) mass (sarcopenia) and strength (dynopenia) represent a major health problem for our aging population, decreasing longevity and quality of life. Exercise remains the principle means to maintain strength, and this increases extracellular matrix (ECM) synthesis. Preliminary work suggests that load increases ERK1/2 signaling and the transcription factor Egr1 (early growth response 1) levels, and that this is required for ECM expression. To test this hypothesis, I am using C2C12 muscle cells to determine the relationship between ERK1/2 and Egr1. Drugs known to activate MAPK were added to C2C12 myotubes for one hour, alone or together with specific inhibitors of ERK1/2, complex I of mechanistic target of rapamycin (mTOR), protein kinase C, PI 3-kinase, and p38 MAPK: SCH-772984, rapamycin, xestospingon B, wortmannin, and BIRB-796, respectively. The cells were collected and Egr1 mRNA and protein were determined using qPCR and western blotting, respectively. In support of our hypothesis, the ERK1/2 inhibitor SCH-772984 prevented the increase in both Egr1 mRNA and protein, whereas rapamycin had no effect on Egr1. These data improve our understanding of how exercise regulates Egr1 levels, ECM expression, and muscle function.

How the Perception of a Learning Disability is Influenced by Generation Gaps

Catherine Lopez

Sponsor: Vai Ramanathan, Ph.D.
Linguistics

Dyslexia is a common learning disability that is identified in early childhood. Checking the signs of dyslexia early on can help educators adjust their teaching styles and monitor the progress of their student (Kormos & Smith, 2012; Foreman-Sinclair, 2012). However, what happens when these signs are overlooked? How does the student develop academically and adjust socially with dyslexia? Taking a look at the varying effects of dyslexia across three people from self- to professional-diagnosis required looking at factors such as age, generation, and cultural upbringing. This information allowed analysis of the language used by the participants about having dyslexia. Across the ages of 50, 26, & 18, self-perception changed across generations from negative to positive. Children educated past the year 2000 are encouraged to embrace their differences and not feel excluded by it. For those of the older generation are learning to do the same through their children. Attitudes are shifting from learning disabilities being abnormal to a new normal (Davis, 1997; Foreman-Sinclair, 2012). Knowing how children come to view themselves later on in life can provide a new strategy for educators on helping students with dyslexia.

The Effects of Cortical Thickness and Subcortical Volumes on the Relationship Between Anxiety and Peer Victimization in Adolescence

Kassandra Lopez-Lugo

Sponsor: Veronika Vilgis, Ph.D.
Center For Mind & Brain

Previous research has found a direct relationship between anxiety and peer victimization. Additionally, cortical thickness in the medial prefrontal cortex (mPFC) as well as hippocampal and amygdala volume have been found to differ between pediatric anxiety disorder patients and healthy youth. In this longitudinal study, we tested whether girls' anxiety levels at age 15 predicted peer victimization at age 17 and whether cortical thickness in the prefrontal cortex (PFC), hippocampal volume, and amygdala volume moderated the relationship between anxiety at age 15 and peer victimization at age 17. MRI scans were acquired from 145 girls at age 16. At age 15, 32 girls scored high, 45 moderate, and 68 low on the Self-Report for Anxiety Related Disorders (SCARED) questionnaire. Peer victimization at age 17 was measured with the Peer Victimization Scale (PVS). While there were no moderating effects of PFC cortical thickness, hippocampal volume, or amygdala volume between anxiety and peer victimization, the high anxiety group experienced significantly more peer victimization at age 17 than the low anxiety group. These results indicate that anxiety disorders in early adolescence greatly put teenage girls at risk for peer victimization in late adolescence.

Analyzing Multi-Taxa Animal Activity at Road Underpasses to Inform Transportation

Annabelle Louderback-Valenzuela

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

The Road Ecology Center (REC) at UC Davis is a multidisciplinary institution aimed towards ensuring sustainable roadways that maximize efficiency and minimize ecological disruption. Animal-vehicle collision is a major issue that affects both wildlife conservation and human safety. The REC aims to understand factors that contribute to roadkill incidence and measures that can be taken to prevent such conflict. Very few preventative measures are currently in use to reduce human-wildlife conflict on roadways. Underpasses are one of the most common means for allowing animals to travel without direct exposure to roads. The relative efficacy of underpasses is poorly understood, especially when comparing between taxa. This opens up a window for research examining whether animal activity at underpasses differs across taxa, and if so, what implications the differences carry. This project utilized wildlife trap cameras near underpasses to collect data with respect to species presence and activity. The use of wildlife trap cameras also sheds light on success of non-intrusive data collection in research.

MiR-22 Promotes Intestinal Proliferation by Regulating C/EBP δ

Shuhan Lu

Sponsor: Bo Lonnerdal, Ph.D.
Nutrition

MicroRNA (miRNA) is small non-coding RNA, which is involved in RNA silencing and post-transcriptional regulation of gene expression. MiR-22 is major miRNA in human milk exosomes. Exosomes are 40–100 nm membrane vesicles of endocytic origin secreted by most cells, and exosomes appear in human milk and bovine milk. Both human milk exosomes and miR-22 survive in vitro gastrointestinal digestion. Therefore, miR-22 may play a role in the development of the small intestine in infancy. To evaluate effects of miR-22 on the intestine, a human intestinal cell line (HIEC) was transfected with miR-22 using lipofectamine, and then RNA was isolated for microarray assay. The microarray results show that miR-22 promotes proliferation of HIEC cells. A proliferation assay (BrdU) was subsequently conducted to confirm that miR-22 enhanced proliferation of HIEC cells. Based on analysis of miR-22 target genes and the microarray results, C/EBP δ could be an important target. C/EBP δ is a transcription factor that mediates a variety of biological activities including cell cycle rest. In miR-22 transfected HIEC cells, C/EBP δ transcription was significantly inhibited. In summary, miR-22 may promote intestinal proliferation by down-regulating expression of C/EBP δ and thus improve intestinal development in breast-fed infants.

Functional Characterization of CplBD25 in the Searching Hyphae Development of *Cuscuta pentagona* (C. pentagona) Haustoria

Junqi Lu

Sponsor: Neelima Sinha, Ph.D.
Plant Biology

As a holoparasite, *C. pentagona* largely inhibit the growth and the quality of various cash crops, and it has already hindered the tomato production in California. Mechanically, *C. pentagona* infect the hosts via haustoria and use searching hyphae to seek the host xylem and phloem, which will provide water and nutrients respectively once the connection is formed. From our previous transcriptomic analysis of various *C. pentagona* tissues, CplBD25 has an extremely high expression level in pre-haustoria and haustoria. Additionally, according to our gene co-expression network (GCN), CplBD25 might be involved in haustoria development. We proposed that *C. pentagona*'s ability to invade host tissue might be largely deprived if the expression of CplBD25 is subdued by RNA interference (RNAi) through host-induced gene silencing (HIGS). We confirmed this hypothesis on the transgenic tomatoes with CplBD25 RNAi and the current results suggest that CplBD25 does promote the development of searching hyphae once haustoria penetrate the host cortex. This discovery will inspire the future research on understanding the parasitism of *C. pentagona* and have a huge potential in developing more sustainable agriculture for parasite controls.

Effective Strategies by Subnational Governments to Reduce Greenhouse Gas Emissions in Areas of Agriculture, Heavy Industry, and Net-Zero Buildings

Sara Ludwick

Sponsor: Lloyd Knox, Ph.D.
Physics

As governments around the world commit to keep global warming below 2°C, action by subnational governments becomes increasingly important to implement local legislation in line with this global goal. The Under 2 Coalition is a network of 205 subnational governments making up 40% of the global economy who have committed to reducing their greenhouse gas emissions 80-95% by 2050. Our student team looked at ways subnational governments around the world are effectively reducing their emissions within the sectors of agriculture, heavy industry, and net-zero buildings. The findings of this research will be compiled as a policy guide, showcasing best practices to assist governments as they develop their own legislation in line with this global goal. The collection of this data into a single resource will be a useful tool as more governments commit to reducing their emissions and seek examples of types of policies that have been successful. In this poster, I show top policies implemented by subnational governments addressing emissions from agriculture, heavy industry, and energy efficient buildings, as well as identify organizations known to support governments with initiatives in these sectors.

Scentery: Virtual Reality And Scent For Treating Stress

Elle Luo

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

Since the technology is advancing by leaps and bounds over the past decades, virtual reality (VR) has become a highlighted point for discussion in the field of emotional and behavioral therapy. This project introduces a novel approach to intertwine VR and physical objects for treating stress disorders by displaying calming visualizations and activating olfactory sensations. Users will experience different virtual reality scenarios that trigger scents. The VR scenarios immerse the user into the scenery of an ocean of lavenders, which bursts into a carnival of purple. The other scenario that user will experience is the scenery of rain in which user is surrounded by the virtual environment. The scents are related the VR scenarios to increase the immersive experience and to help users gain an emotional sense of enjoyment. Scentery was developed with Unity 3D for creating the 3D scenarios, Unity Remote for the camera control and viewer's perspectives, and Arduino for triggering the scents in the vaporizer.

Scentery: Virtual Reality And Scent For Treating Stress

Yi Luo

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Quality Control of Library Construction Pipeline for PacBio SMRTbell 10 kb Library Using an Agilent 2200 TapeStation System

Bao Luu

Sponsor: Bart Weimer, Ph.D.
VM: Population Hlth & Reprod

The PacBio RS II uses a single molecule real-time (SMRT) DNA technology to sequence molecules and detect DNA modifications in bacterial genomes. SMRT has enabled the understanding of key biomarkers pertinent to microbial genome stability, pathogenicity. It is a useful tool for use in creating robust diagnostics. As with many next generation sequencing technologies, the starting point is production of high molecular weight genomic DNA and high quality sequence production. Large scale high-throughput sequencing projects such as the 100K Pathogen Genome Project require methods that can rapidly assess quantity and quality of DNA in a multiplexed format to enable the use of a streamlined sequencing pipeline. In this study, the Agilent 2100 Bioanalyzer and Agilent 2200 TapeStation Systems were used to analyze sheared DNA and final libraries for sequencing. The 2200 TapeStation System's ability to analyze the various quality control steps required in library construction on a single platform proved to be advantageous in a high-throughput sequencing pipeline.

UC Davis Student-Run Clinics: Improving Patient Care to an Underserved Community

Gabriela Mackey

Sponsor: Lorena Garcia, Ph.D.
MED: Public Health Sciences

UC Davis is unique in that it is home to the most student-run clinics (SRCs) of any institution in the country. These clinics, which are primarily managed by undergraduate student volunteers, provide culturally-sensitive primary care to uninsured and underserved communities in Sacramento. Currently, there is limited information concerning patient demographics at each of the SRCs. The purpose of our study was to identify patient needs and demographic data to improve healthcare practices and foster interclinic collaboration. From 2014-2015, we administered over 1000 surveys to patients during clinic hours, using an 18-question survey that collected patient feedback and demographic information. Drawing from these responses, in addition to interviews with SRC leaders, has allowed our team to establish relationships between social and economic factors influencing an individual's experience within the healthcare system. We aim to use our research to identify SRC strengths and deficiencies to best tailor patient care within target populations.

A Comparison of Anxiety and Depression Symptoms Between Undocumented and Documented Mexican Immigrants in the United States

Madeline Maddox

Sponsor: Richard Robins, Ph.D.
Psychology

Approximately 11.7 million Mexican immigrants live in the U.S., of whom an estimated 5.6 million lack legal documentation. Previous research has shown that undocumented Mexican immigrants are an at-risk population for depression and anxiety disorders. Because undocumented immigrants have limited access to mental health care, understanding mental health differences between undocumented and documented populations is a concern for both public health and public policy. We examined the relationship between documented status and anxiety and depression symptoms using data from the California Families Project, a longitudinal study of 674 Mexican-origin families. Approximately 281 mothers and 172 fathers were undocumented, whereas 252 mothers and 81 fathers were documented. Participants self-reported their anxiety and depression symptoms using four scales from the Mini-Mood and Anxiety Symptom Questionnaire: general anxiety, anxious arousal, general distress, and anhedonic depression. Preliminary findings suggest that undocumented mothers have higher rates of anxious arousal and general distress symptoms than documented mothers, and undocumented fathers have higher rates of anxious arousal than documented fathers. These results provide initial support to suggest that undocumented Mexican immigrants living in America may be at risk for experiencing anxiety and depression symptoms, when compared to documented Mexican immigrants.

Genetic Mapping of *Botrytis cinerea* via Mitotic Mating

Matisse Madrone

Sponsor: Daniel Kliebenstein, Ph.D.
Plant Sciences

Botrytis cinerea is a pathogenic fungus that grows on a wide range of crop plants. As a highly versatile pathogen, *Botrytis* has many genotypic and phenotypic varieties, such as pigmentation, growth rate and rate of spore production. This large diversity makes understanding and managing *Botrytis* a challenge. Establishing the genetic basis of these different phenotypes by genetic mapping will enable better understanding of the natural variation and adaptability of *Botrytis*. Given that *Botrytis* does not readily undergo sexual reproduction, mitotic rather than meiotic recombination is being used in this research. Distinct isolates, grown together on a plate, can undergo mitotic recombination to create genetically unique spores. These spores are collected and grown as single spore isolates for phenotyping. The clonal spores from the phenotype plates are then grown on cellophane as a prelude to hyphal harvesting for DNA extraction. Combining the information on the phenotypes of the parental and recombinant lines with the DNA sequence data is the basis of the genetic map. This provides information on the genetic distance between genes that code for observable phenotypes. Thus far phenotypic results have showed clear evidence of successful recombination between two isolates.

Air Facilitated Droplet Formation for Cell Encapsulation

David Maginnis

Sponsor: Adam Abate, Ph.D.
UCSF: Bioengineering

3D bioprinting promises to enable the in vitro construction of engineered tissues, but current technologies are unable to assemble complex architectures with single cell resolution. We aim to develop a droplet microfluidic sorting device that will serve as the printhead of a single cell-resolution tissue printer that is capable of printing picoliter droplet-encapsulated cells onto a target surface. Droplet microfluidic encapsulation of cells currently requires an oil carrier to compartmentalize the microcapsules. These stable emulsions complicate tissue engineering applications, where microgels must combine to form complex structures. To overcome this impediment our device utilizes an air stream to shear an aqueous fluid stream into droplets. By using a biocompatible fluid as the aqueous stream, we can form droplets encapsulating individual cells that can be ejected from the device then sorted and ultimately printed. The advantage of this method is that the droplets can be easily merged upon printing. The device will be fabricated with soft lithography techniques using SU-8 as the mold substrate and PDMS as the stamp resin. Characterization of the device will be accomplished by exploring how droplet size, ejection, and formation rate depend on channel geometry, input flow rates, surface chemistry, and air pressure.

Ethnic Differences in Social Anxiety: The Mediating Role of Face Concern

Caroline Mai

Sponsor: Nolan Zane, Ph.D.
Psychology

Previous research has found consistent differences in social anxiety among ethnic groups. Specifically, Asian Americans have a higher propensity to experience social anxiety than White Americans. The goal of the present study was to determine what explains these previously found ethnic differences. We administered a social anxiety questionnaire to a sample of 426 college students (256 Asian, 170 White) and confirmed that Asian Americans were more socially anxious than White Americans. Asian Americans also reported greater face concern, or interest in maintaining one's face or the face of others, than White Americans. Moreover, face concern significantly mediated ethnic differences in social anxiety. That is, Asian Americans reported higher face concern than White Americans, and individuals reporting higher face concern were more likely to be socially anxious. Our findings suggest that social distress may have different cultural bases; threats to face may generate a considerable amount of anxiety, particularly among Asian Americans. When Asian Americans present with a lot of social anxiety, it would be helpful for clinicians to focus on face-saving strategies to reduce their distress.

Sending Electrons Outdoors: The Capacity of Food-Associated, Fermenting Bacteria to Reduce Extracellular Iron

Hui Ling Mak

Sponsor: Maria Marco, Ph.D.
Food Science & Technology

Lactic acid bacteria (LAB) are a diverse group of gram-positive bacteria found on plants and in animal and insect microbiomes. These bacteria are essential for many food and feed fermentations and are regarded to be beneficial members of the human microbiota. LAB are best understood for their fermentative pathways for energy generation and maintenance of redox balance by the reduction of pyruvate to lactic acid. In this study, we investigate another route by which LAB can maintain cellular redox potential with the aid of extracellular electron acceptors. Preliminary data indicate that the LAB *Lactobacillus plantarum* possesses a novel extracellular electron transport (EET) system that is conserved among other LAB species. This system is predicted to encompass a ~9 kb locus and include an NADH dehydrogenase (*ndh2*) and FMN-binding protein (*pplA*). The EET capacity of several *L. plantarum* strains from different food and plant sources was examined. A colorimetric assay was performed which measured the capacity of LAB to reduce extracellular iron. All tested *L. plantarum* strains could reduce iron except for strain 8.1, originally isolated from boza. A comparative genomic analysis of *L. plantarum* strains revealed differences in the N-termini of *ndh2* and *pplA*, which may affect EET capabilities.

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

Azza Malik

Sponsor: Suad Joseph, Ph.D.
Anthropology

The term “Yemen” was used by the West during 1900-1909 to largely discuss the Yemeni rebellion against the Turkish regime under Ottoman rule. I examined 462 articles published from 1900 to 1909, and critically analyzed 42 relevant articles where the term “Yemen” was used by the New York Times correspondents. I argue that there is a level of ambiguity regarding whether or not Yemen was considered an Arab state separate from the Turkish empire or both. I argue, that such ambiguity in representational agency resulted in the homogenization of Arabs as violent and revolutionary. Such representations occurred in the context of the British colonial project, where Britain and the Ottoman Empire contested over land and power in Yemen. These findings suggest that this ambiguous portrayal persists in news media today. The misrepresentation by the New York Times instilled into American society that people associated with an Arab identity/rule are uncivilized. This research is a part of an analytical project of the New York Times over 150 years conducted in Dr. Joseph’s Lab.

***Saccharomyces cerevisiae* DNA polymerase λ functions
in homology-directed DNA repair in cooperation with
DNA polymerase δ**

Benjamin Mallory

Sponsor: Wolf Heyer, Ph.D.
Microbiology & Molec Genetics

Pol λ (Pol4 in yeast) is a DNA polymerase involved in DNA double strand break (DSB) repair. While previous literature suggests Pol4 involvement in Non-Homologous End Joining (NHEJ), we show that Pol4 mutants displayed an increase in IR sensitivity unrelated to NHEJ. Using a number of recombination assays we have identified a function of Pol4 in Single Strand Annealing (SSA). Surprisingly, Pol4 mutants that also lacked the DNA binding protein Rad51 did not have an increased IR sensitivity, suggesting that Pol4 activity is only required in the presence of Rad51. Previous publications from our laboratory show that Pol4 and Pol δ can cooperate in DNA synthesis. We show that Rad51 presence at the primer junction of resected DNA inhibits Pol δ synthesis, whereas the addition of Pol4 is able to work with Pol δ to overcome this inhibition. To assess the mechanism by which Pol4 helps Pol δ , we designed a pull-down assay with DNA covered by Rad51. We were able to determine that Pol4 is capable of displacing Rad51, thus allowing Pol δ to carry out DNA synthesis. We conclude that Rad51 suppresses SSA by binding single strand DNA at the primer and removal by Pol4 is critical for DNA synthesis during SSA.

Adult Speech Variability Between Infants and Adults

Shelby Mancini

Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Adults tend to speak differently to infants than to other adults; for example, they exaggerate some speech sounds and their pitch patterns when communicating with infants. The current study further explores this phenomenon by investigating whether parents hyperarticulate, meaning how they exaggerate sounds in speech. We are examining how parents produce “t” sounds that occur within words because these change significantly between hyperarticulated and casual speech (e.g. “boddle” for “bottle”). We are also examining productions of “t” at the ends of words (e.g., hyperarticulated “hat” as “hat-tuh”, with a slight burst). Parents engage in a task with their infant and another task with an experimenter. The sessions are recorded and later analyzed for the target words. We expect hyperarticulation may highlight important elements and possibly function as a language teaching tool. Our preliminary data with 7 parents support that parents hyperarticulate more and show greater pitch variation when talking to infants than adults.

**Impact of a Culturally Sensitive, Personalized Health
Coaching Program on Type 2 Diabetes Management for
Uninsured Latino/a Patients at a Student Run Free Clinic**

Neha Mannikar

Sponsor: John Furlow, Ph.D.
Neuro Physio & Behavior

Diabetes diagnoses have been on the rise in America; however this burden is shared unequally, with a disproportionately high incidence in the uninsured Latino/a population. Patients generally lack resources, basic and culturally sensitive information, and the confidence to manage their diabetes. In order to address this problem, Clinica Tepati has established a Health Education (HE) program to provide patients with personalized, culturally sensitive health coaching. This research seeks to determine the effectiveness of HE on patients’ diabetes management, specifically looking at Hemoglobin A1c (HbA1c), blood pressure (BP), body mass index (BMI), and a coded stage of management score (SOMS). Patients were referred to the program by a physician or medical student, and received a free glucometer and testing strips. They attended in-person and over-the-phone appointments about once per month. HbA1c was measured prior to coaching and at three-month intervals, SOMS were assigned to each appointment, and BP and BMI were taken with every clinic visit. Preliminary results suggest a decrease in HbA1c, BMI, and improved SOMS. These findings will allow for program analysis and improvement, while serving as a foundation for greater-powered studies at Clinica Tepati and other student run clinics, altogether providing greater education and empowerment to this community.

How Can Web Design Empower People to Make Decisions About Their Mental Health?

Sophie Maquiling

Sponsor: Glenda Drew, M.A.
Design Program

In an exploration of information-based interactive design, I respond to the question, "How can web design empower people to make decisions about their mental health?" by designing and developing a web interface. Anxiety and depression affect about 1/5 of the population in high income countries, yet only 18-34% of adolescents and young adults seek help from others. Online mental health platforms have become a widely used strategy to respond to barriers that young people face in seeking help for anxiety and depression, but research calls for further discussion on implementing such platforms effectively. My project responds to barriers that young people face in seeking help for anxiety and depression and empowers its users to take a step further in making decisions about their mental health. I combine secondary research with user experience research including comparative analysis, ethnography, prototyping, and user testing to inform and consider the following design choices: interface goals and audience, layout, typography, multimodal content, web accessibility, and ethics in web development and communication. Overall, I seek to contribute insight to the information and interactive design fields about designing for online mental health platforms effectively.

Investigating the Association between Maternal Prenatal Vitamin Intake and Placental DNA Methylation in Autism Spectrum Disorder

Ria Marathe

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

Autism spectrum disorder (ASD) is defined as a group of neurodevelopmental disorders that affect 1 in 68 children in US. Multiple studies show a complex interaction between genetic and environmental factors in ASD. Prenatal vitamin use prior to conception has a significant protective effect for ASD in the child. This study is aimed at identifying DNA methylation differences between ASD and control placenta samples associated with maternal prenatal vitamin intake in a prospective study called MARBLES (Markers of Autism Risk in Babies: Learning Early Signs). DNA methylation data from MARBLES placentas samples was obtained by whole genome bisulfite sequencing. Differential methylated regions (DMRs) were found and validated by pyrosequencing (paired-end t-test, p value = 0.005). To explore the association between methylation, genotype, and prenatal vitamin use, I am using Sanger Sequencing to locate Single Nucleotide Polymorphisms (SNPs) inside the DMR (currently paired-end t-test, p value = 0.16). Significant association is found between methylation and prenatal vitamin on DMR region (currently paired-end t-test, p value = 0.04). This study is a step towards finding personalized preventative measures to reduce ASD risk by maternal prenatal vitamins.

Sliding Window Algorithm Used To Map Mutation Hotspots and Find Fatal Mutations

Juan Marcucci

Sponsor: Ian Korf, Ph.D.
Molecular & Cellular Bio

Using bioinformatics I have developed a tool to identify fatal mutations in model organisms when efforts to pinpoint the mutation through breeding and recombination analyses prove unsuccessful. The Korf Lab hypothesizes that identification of fatal mutations can be difficult if they are hidden in a cluster of other mutations, and that by mapping these mutation hotspots we can pinpoint potential candidates that cause fatality. I analyzed the genome of a *C. elegans* strain with an unidentified fatal mutation. I wrote a sliding window algorithm, which I programmed to extract single nucleotide polymorphism (SNP) mutations from an annotation file (GFF). Using the same file, I extracted the true length of each chromosome, given in the references, which then gave the parameters for the sliding window algorithm. The algorithm in turn displayed the mutation density at each position. I then uploaded this file to the UCSB genome browser graph tool to provide the final illustration. Based on the resulting image, there are many potential candidates; further analyses will narrow down the options. My next step is to graph the SNPs in protein-coding exons as they are the most likely candidates to bear the fatal mutation.

Meiotic Crossover Formation with Elevated Levels of RNF212

Mark Marfin

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

Meiosis is responsible for generating sperm and eggs in sexually reproducing organisms. During meiosis, paternal and maternal chromosomes pair to obtain at least one crossover, ensuring their accurate segregation. Crossover formation is highly regulated since errors in this process lead to infertility, pregnancy miscarriage, and congenital disorders. Our lab previously showed that a single copy of the *Rnf212* gene is insufficient for efficient crossing over (Reynolds, 2013). To explore the dosage effects of *Rnf212* we created transgenic mouse lines with varying numbers of the *Rnf212* gene. Using quantitative-PCR, the exact copy number of the *Rnf212* gene was determined for each transgenic line resulting in a series of lines that vary incrementally from 1 to 6 copies. To further correlate copy number with expression, we performed RT-PCR on RNA extracted from control and transgenic mouse testes. To determine the effect of elevated RNF212 level on crossover formation, we immunolabelled mouse spermatocyte chromosome spreads for a crossover marker (MLH1) and a chromosome axis protein (SYCP3). Our results suggest that RNF212 is a limiting factor for crossover formation.

Individual Personalities in Wood Ducks, *Aix sponsa*: Consistency of Behavior Maintained Over Ontogeny

Melissa Marshall

Sponsor: John Eadie, Ph.D.
Wildlife & Fisheries Biology

Many animals display differences in individual behaviors and in their responsiveness to environmental variation. When these differences remain constant across an array of contexts, they are viewed as individual personalities. Personality differences are an important dimension of biodiversity, influencing both ecological and evolutionary processes. Research on captive Wood Ducks, *Aix sponsa*, has shown that behavioral differences are consistent and repeatable throughout an individual's juvenile stage. However, it is currently unknown whether these behavioral traits carry over into the adult stage. My research addresses this question by examining the consistency of activity, boldness, and docility within and among individuals across life history stages. To do so, we conducted two types of standardized behavioral assays designed to measure these behavioral traits, Open Field Tests (OFT) and In-Hand Docility Tests (IHDT), during the juvenile and adult stage of 23 captive Wood Ducks (hatched in captivity in 2016 and 2017). By comparing behavioral tests conducted at different life stages, we can determine if individuals maintain their particular behavioral phenotypes throughout the first 1-2 years of life. The findings of this study will help researchers better understand the implications of personality differences, and the role intraspecific variation plays in ecological and evolutionary processes.

Breaking Down Barriers: Exploring Tactile Technologies for a More Accessible Campus

Zoe Nicole Martin

Sponsor: Susan Verba, M.F.A.
Design Program

Navigating our vast campus can be an everyday challenge, especially for visually impaired people. High numbers of bicyclists, pedestrians, buses, and more than 5,000 acres make UC Davis wayfinding particularly frustrating and difficult. California is among the states with the highest populations of visually impaired people, and statistics show that 57% of visually impaired youth pursue post-secondary education. Moreover, among college freshmen with any kind of disability, 13.3% report visual impairments. Yet limited resources are available to aid visually impaired people in finding their way around our campus. Through primary and secondary research, interviews, field trips, case studies, and iterative prototyping, this project will investigate standards and precedents for enhancing navigation via tactile (and other) technologies. The study aims to define tactile standards and to develop design interventions for breaking down navigational barriers, making UC Davis more accessible for visually impaired students and for faculty, staff, visitors, and the entire campus community.

Immigrant Backlash Latino and Asian Voting in the 2016 Presidential Election

Gabriel Martinez

Sponsor: Bradford Jones, Ph.D.
Political Science

With the rise of anti-immigrant sentiment felt across the United States. Will ethnic groups with strong immigrant ties turn out to vote against anti-immigrant candidates? Past research has historically shown low voter turnout for ethnicities with strong immigrant ties specifically Asian and Latino Americans in the United States. Although in 1990's, in response to anti-immigrant legislation and descriptive representation. Groups with strong immigrant ties, mobilized with pan-ethnic solidarity and turned out to vote. In the previous 2016 election, the largest conservative county in California, Orange County. Has for the first time since the depression voted for the more liberal candidate. I argue ethnicities with strong immigrant ties such as Asian and Latino felt threatened by the more conservative Presidential candidate proposed anti-immigrant policies and they turned out to vote. I compared majority and homogeneous Asian, Latino and non-minorities voting precincts in Orange Country during the 2012 presidential election in comparison to majority and homogeneous voting precincts 2016 to see if anti-immigrant sentiment caused voter turnout among these voting precincts.

Measuring Conductance of Single-Molecules using the Break-Junction Method

Daniel Mascareno

Sponsor: Joshua Hihath, Ph.D.
Elect & Comp Engr

Molecular electronics is an emerging research area that aims to uncover the electronic properties of molecules and use them to create transistors, switches, and other circuit elements. This area has high potential for the future because the improvements to silicon, the most used semiconductor in electronics, are approaching their limit so there is a demand for something new. Studying the conductivity of single-molecules is an important aspect of molecular electronics because it can tell you if the single-molecule can be a good electronic candidate. The break-junction technique is used to study the conductance of single-molecule junctions. This method is driven by measuring the current between two electrodes and having a single-molecule in between. By modulating the electrode separation, a single-molecule can be attached between the electrodes, and the I-V (Current-Voltage) characteristic to determine the conductance values. The reason why conductance measurements are crucial is because we are in the hunt for new and interesting single-molecules that are optimal and the break-junction method gives us the tools to study these single-molecules in greater detail. This research is fundamental to the progression of technology because transistors and other circuit elements are building blocks to many electronic applications like smartphones and computers.

E{du}motion: The Effectiveness of Documenting Students Learning Process Through Emotions Tracking in Improving Academic Performance and Decision Making

Bayan Mashat

Sponsor: Narine Yeghyan, Ph.D.
Communication

E{du}motion is an application for students in universities to document their learning process through tracking their emotions. The purpose of the app is to provide a tool for students to foster metacognition during learning processes from a journaling and emotional state framework. The application takes in user input, which is a selection of emotions, and stores it in a database to be collected and later represented graphically as metrics for user self-reflection. The data to be collected is the user's emotional trajectory throughout a day, a week, or an academic term, which is presented graphically for better usability experience. This application grants university students powerful understanding into which study experiences went well for them and which did not. It also grants them a powerful tool for developing their emotional intelligence and metacognition, for improving their own personal learning process, and for finding the study habits that lead them to success in their studies.

Virgin Beta Cells Persist When Pancreatic Islet Architecture is Perturbed

Mira Mastoras

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

Beta cells are essential to maintaining healthy blood sugar levels through the secretion of insulin. Loss or exhaustion of beta cells leads to diabetes, and thus a source from which to regenerate them is vital to finding a cure. Our lab has discovered virgin beta cells, a novel population of immature beta cells, that occur in a specialized neogenic niche at the interface between alpha and beta cells within mouse pancreatic islets. It is not known if virgin beta cells will persist in this specific location when the islet architecture is perturbed. To address this question, we investigated the effect of perturbed islet architecture in a mouse with a deletion of the glucagon receptor gene (gcgrKO), which leads to islets with an unusually high number of alpha cells at the periphery. We utilized immunohistochemistry and confocal microscopy to image gcgrKO mouse islets, and then analyzed them with a tool we have developed that quantifies cell type and location within the islet. Our preliminary findings suggest that these virgin beta cells persist and occupy the same neogenic niche found in islets with normal architecture. These results further our understanding of the micro-environment necessary to support virgin beta cells.

Factors Affecting Flowering Phenology in the Population of *Plantago lanceolata* in Davis, California

Gautam Mathur

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

Phenology shows the timing of recurring seasonal biological events, the consistency of which may determine the interactions between a population and its environment. In light of a changing climate, a broader awareness of environmental cues and phenology could prove to be crucial to understanding what key factors affect phenology. I will explore the relationship between traits, distribution, and phenology of the perennial *Plantago lanceolata* in Davis, California. Data on the size and spatial characteristics of *P. lanceolata*, is collected for populations of this species as part of Plant Pop Net, a collaboration of scientists spanning the globe studying *P. lanceolata*. Flowering phenology for 39 individuals was observed approximately every 5 days from April to July. Using R, a statistical software, we analyzed the variation in progression of phenological stages data within the population. We found variation in timing of reproductive onset (number of buds), flowering, and mature seed production within this population. I will use statistical analyses to test the hypothesis that individuals with a larger size will flower earlier and for longer periods of time, because they are more established than smaller sized individuals.

Assessing Behavioral Evidence for Replay of Neutral and Emotionally Arousing Information

Megan Maudlin

Sponsor: Charan Ranganath, Ph.D.
Psychology

One of the primary questions in memory research is to understand what is remembered and why. Consolidation transforms newly formed, vulnerable memories into a more stabilized state for long-term storage. Our study aims to assess the effects of emotionally arousing stimuli on memory replay in a sequence learning experiment. Replay, a mechanism thought to support consolidation, involves the reactivation of neuronal networks that were active during initial encoding. Rodent investigations have found that replay events occur in the forward, or same order of activation during encoding, and also in a backward order, suggesting that a similar process might occur in humans. To assess evidence for this hypothesis, we designed a behavioral task where participants learn sequences of objects and then are re-exposed to pairs of items from the sequences after a consolidation period. During re-exposure, we predict facilitated processing for pairs presented in the forward and backward direction. We also predict that emotionally arousing stimuli will elicit greater facilitation compared with neutral stimuli. This line of investigation has clinical implications for post-traumatic stress disorder, which is suggested to result from the over-consolidation of emotionally traumatic memories.

Late Stage Cervical Cancer Diagnosis in Adolescents and Young Adults in Relation to Insurance Type

Taylor McCarthy

Sponsor: Theresa Keegan, Ph.D.
MED: Div Of Internal Med

Recent studies using cancer registry data in the United States have found an association between private and public insurance at diagnosis and late-stage cervical cancer diagnosis, with these findings likely relating to reduced access to healthcare. However, prior studies have been unable to differentiate patients who were previously uninsured and enrolled on emergency Medicaid from those who were enrolled in Medicaid prior to diagnosis. Therefore, using California Cancer Registry linked to Medicaid enrollment data, we examined the impact of health insurance type on stage at diagnosis. We identified 3,584 cervical cancer patients diagnosed at ages 15-39 years and used multivariable logistic regression to consider factors associated with late stage at diagnosis. Most (50.1%) patients were privately insured, while 23.3% were continuously enrolled in Medicaid prior to diagnosis, 7.9% were on discontinuously enrolled in Medicaid prior to diagnosis, 13.1% received Medicaid at diagnosis, 2.0% were uninsured and the other 3.7% had unknown insurance. Compared to those who were privately insured, young women who were uninsured had discontinuous Medicaid or were Medicaid insured at diagnosis had an approximately two-fold increased likelihood of being diagnosed with late-stage disease. Our findings suggest that lacking health insurance hinders the early detection of cervical cancer.

Land Management at Russell Ranch Modifies Heavy Metal Bioavailability

Natalie Mcelroy

Sponsor: Sanjai Parikh, Ph.D.
Land Air & Water Resources

Soils formed on alluvial parent material containing serpentinite, such as those deposited by Putah Creek in Davis, CA, may be geogenically enriched in heavy metals such as Copper (Cu), cadmium (Cd), chromium (Cr), arsenic (As), nickel (Ni), zinc (Zn), and Lead (Pb). Over time, changes in land use may influence the bioavailability of these metals. Soils at Russell Ranch, under agriculture management (organic, conventional, unfertilized) or left wild (grassland and riparian oak woodland), are being evaluated by a 4-step sequential extraction method (BCR) developed by the European Commission's Standards, Measurements and Testing Programme to assess changes in heavy metal availability across land use. Total Cu and Zn were significantly enriched in the organically managed plots, likely due to long-term poultry manure additions. Conventionally managed soils had significantly greater Cd than the others, likely due to trace levels in phosphorous fertilizers. Soils from all management systems had relatively high levels of Cr, Ni, As and Mn and low levels of Cd and Pb; all from geogenic sources. Heavy metal impact across diverse land managements will be elucidated from bioavailability as determined by the extractions. The data will provide important insight for land management regarding risk assessment and contamination of heavy metals.

Investigating the Role of *fgfr2* and *wnt4a* in Zebrafish Sex Determination

Alexander Mcnamara

Sponsor: Bruce Draper, Ph.D.
Molecular & Cellular Bio

The mechanisms of sex determination in zebrafish (*Danio rerio*) are not well understood. In mammals, studies suggest that Wnt4 (wingless-related MMTV integration site 4) represses male gonad development by down regulating Fgf9 (fibroblast growth factor 9). *wnt4a* in zebrafish is the ortholog of mammalian WNT4 and previous studies have shown *wnt4a* mutant zebrafish develop predominantly as males. Although zebrafish lack a distinct paralog to the mammalian FGF9, the zebrafish genome contains fibroblast growth factor receptor 2 (*fgfr2*), the FGF9 receptor required for male sex determination in mammals. By RT-PCR, we observed adult male testes express higher levels of *fgfr2* mRNA than female ovaries. This suggests *fgfr2* is involved in male sex determination. To test this hypothesis, we analyzed CRISPR/Cas9 induced *fgfr2* mutants. Mutants were generated by crossing animals double-heterozygous for *wnt4a* and *fgfr2* mutations. Single *fgfr2* mutants were assessed for a female sex bias, and double mutants for *fgfr2* and *wnt4a* were analyzed for an epistatic relationship between these two genes. At 90 days post fertilization, the fish were genotyped and sex ratios were determined. Analysis supports the hypothesis that *fgfr2* may be involved in male sex determination and further suggests *wnt4a* is epistatic to *fgfr2*.

The Cascading Effects of Megafires on Shrub Density and Avian Community Composition

Joaquin Meckler-Pacheco

Sponsor: Rahel Sollmann, Ph.D.
Wildlife & Fisheries Biology

Climate models predict warming throughout the Western United States, extending the length of the fire season while reducing snowpack and precipitation and increasing fuel loads. In addition, years of fire suppression have created more homogenous, denser stands with a large amount of understory vegetation, thus increasing the risk of larger, more severe fires. Such catastrophic fires may reshape species distributions and alter vegetation types, with potentially irreversible and detrimental ecosystem impacts. Avian communities are strongly affected by these "megafires," with some species decreasing and others increasing in abundance following the disturbance, due in part to changes in forest structure driven by fire severity. I used point count and vegetation data from an intensive field study carried out in El Dorado County to investigate the effects of shrub density and tree mortality on avian community structure in burned and unburned forest of the Sierra Nevada. I found that species richness and abundance was strongly correlated to forest structure. However, the measured effects varied by both species and burn severity. By understanding how bird communities respond to fires, we will be better able to predict the cascading ecosystem effects under the increasing fire risks associated with climate change.

Alternating Pacing Induced Spatially Discordant Alternans in Cardiac Tissue

Mikhail Meller

Sponsor: Daisuke Sato, Ph.D.

MED: Pharmacology

Heart disease remains to be the highest cause of death in the United States. The heart is an extremely complex nonlinear system and mathematical and computational models have been used to understand dynamical mechanisms of arrhythmias. Cardiac alternans are a phenomenon where the heart experiences a beat to beat oscillation in strength of contraction between strong and weak despite having a constant heart rate. This behavior is a precursor of arrhythmias and has been frequently reported in patients with severe heart failure. Such variations in heart behavior can be observed by measuring the electrical activity of cardiac myocytes. In this study, using a physiologically detailed computational model of ventricular tissue, we investigated the mechanisms of alternans. We found that alternans can be induced when action potential waves originate from two sites. Alternans also become an out-of-phase pattern in tissue (spatially discordant alternans). This pattern is amplified as the distance between two pacing sites increases. We also varied model parameters, which affect action potential propagation such as the pacing frequency and ion channel conductivity. Alternating ectopic foci have been linked to bidirectional ventricular tachycardia. Our results explain how alternating ectopic foci induce spatially discordant alternans in the heart.

Can Children Use Statistical Learning to Learn Dual Object Labels?

David Mena Roman

Sponsor: Katharine Graf Estes, Ph.D.

Psychology

Word learning is a complex process that begins early in language development. We are investigating how infants pair objects with labels using statistical learning. Statistical learning can be characterized as learning to detect structure based on monitoring patterns in information given through sensory input and through that deciding on what fits. Based on results from past studies, we know that adults can use statistical learning to connect the correct label for an object. This process is cross-situational statistical learning, which entails gaining statistical evidence across ambiguous word-label associations to learn new object names. Adults can implement cross-situational statistics to learn two labels for an object by tracking dual labels across labeling events. We are testing whether young children (35-37 months of age) can perform cross-situational learning to acquire dual labels for objects. We predicted that young children would learn that objects may have dual labels because this is common with bilinguals. Preliminary evidence from monolingual 3-year-olds (n=12) suggests that children at that age are not able to learn that an object may have two labels using cross situational statistics.

Regulation of the NF- κ B Inflammatory Pathway by Malonate in Mucosal Epithelial Tissue During HIV Infection

Abigail Mende

Sponsor: Guochun Jiang, Ph.D.

MED: Medical Microbiology & Imm

Human Immunodeficiency Virus (HIV) infection currently affects an estimated 36.7 million people by destroying the immune system through CD4⁺ T cell depletion and disrupting the integrity of gut mucosa. While much is known about the interaction between HIV and CD4⁺ T cells, little is known about HIV-induced damage in the intestinal epithelial mucosa, which is a major site of viral persistence. A greater understanding of inflammatory signaling networks in the gut mucosa damage would lead to more effective therapies in combination with antiviral therapies (ART). A recent study in the Dandekar lab using SIV-infected rhesus macaques as an HIV model showed an increase of malonate metabolism in the gut, which was associated with a disruption of epithelial integrity. Malonate upregulation has been associated with other chronic inflammatory diseases such as diabetes. Preliminary in vitro data found malonate induced epithelial disruption, which is associated with NF- κ B activation in the colonic Caco-2 cells. These findings demonstrate the importance of cellular metabolism in the gut in regulating the immune response to HIV infection and other inflammatory diseases.

The Regulation of Yes-Associated Protein (YAP) Localization in Cardiac Myocytes by Protein Kinase D1 (PKD1)

Laura Mendoza

Sponsor: Julie Bossuyt, D.V.M., Ph.D.

MED: Pharmacology

Protein Kinase D1 (PKD1) is a multifunctional kinase known to be involved in multiple cell processes and activities, including cell proliferation, actin dynamics, gene expression and protein translocation. Due to its diverse biological functions, PKD signaling has become a potential therapeutic target in cancer and heart failure. Recently, Yes-associated protein (YAP), a transcriptional regulator with a critical role in cell growth and survival, was identified as a PKD target in cancer and intestinal epithelial cells. However, whether PKD regulation of cardiac hypertrophy likewise involves YAP modulation remains unknown. Here we test this using immunocytochemistry to visualize the spatiotemporal distribution of YAP in cardiomyocytes isolated from wildtype and cardiac-specific PKD1 knockout mice. Angiotensin II and insulin were used as stimuli. Activation of the YAP pathway was also assessed by western blotting. Our results show that PKD feeds into the YAP pathway and point to YAP as a previously unknown mediator of PKD hypertrophic effects.

Verifying the Feasibility of HTP-3 as a Marker During Female Meiosis in *C. elegans*

Zihan Meng

Sponsor: Francis McNally, Ph.D.
Molecular & Cellular Bio

Female meiosis is critical for the development of embryos. Down Syndrome and a high proportion of miscarriages are caused by non-disjunction during female meiosis in human embryos. In order to understand female meiosis, especially the mechanism of asymmetric meiotic spindle positioning and polar body extrusion, a combination of experiments has been developed in McNally lab at UC Davis. Currently, I am testing the feasibility of using HTP-3, a meiotic chromosomal axis protein, as the marker for distinguishing between different chromosomal structures during anaphases by staining GFP: HTP-3 *C. elegans* with anti GFP antibodies. Preliminary results indicate that HTP-3 only appears on the chromosome during metaphase I but not other phases including anaphase I, anaphase II and Metaphase II. This preliminary result suggests that HTP-3 cannot serve as a marker during anaphase in female meiosis. For future directions, I will test more candidates' protein to verify their feasibility of serving as markers during anaphases in female meiosis.

Contact Among Young Adults Who Share the Same Open-Identity Sperm Donor: Interest and Experiences

Sofia Meola

Sponsor: Joanna Scheib, Ph.D.
Psychology

When individuals use donor insemination (DI) programs to have children, multiple families are often formed with assistance from the same sperm donor. Generally, this means that similarly-aged children are genetically-linked across families. Initially, these families do not usually know each other. Thus, these children can be described as donor-linked peers. This study included donor-conceived adults (n=47), all of whom received their donor's identity. The sample was 68.1% female and 31.9% male. Participants ranged from ages 19 to 29 years. Participants were born into families with two mothers (46.8%), a single mother (29.8%), or a mother and father (23.4%). About half of participants grew up with sibling(s) in their household, while about half of participants did not grow up with a sibling(s) in their household. Twenty-two participants made contact with a donor-linked peer(s), and twenty-five had not made contact. Using phone-interviews and online-questionnaires, this study examines the interests, motivations, and experiences of contact among young adults who share the same open-identity donor. Participants overwhelmingly reported positive experiences from contacting donor-linked peers and reported that donor-linked contact improved their overall experience with donor information-release.

Engineering a New Meaning: How the Discourse Community of Engineers is Changing

Ashley Metcalfe

Sponsor: Daniel Melzer, Ph.D.
University Writing Program

There are two major stereotypes when thinking of engineers: the majority of engineers are men and engineers are difficult to work with. The perception of engineers in our society affects the decision making process in students choosing their career path. Without a clear consensus of what it is like to be an engineer, students might be led into the wrong direction while pursuing their degree. The research question addressed in this paper is, "What is the validity behind these general stereotypes in the engineering community?" After researching several academic journals, a genre analysis was performed, as well as two surveys. Ultimately, results were that the majority of engineers are men, yet they aren't as difficult to work with as previously established. The discourse community of engineering is working towards a change to these perceptions. Engineers want their values of themselves to match the perceptions outsiders have on their community. This is important because it shows that the community wants to become more diverse and focus on the underlying themes of teamwork and collaboration. The next generation of engineers will have the opportunity to alter the definition of engineering and show that it is not designed for only certain people.

Characterization and Comparison of the Immunomodulatory Effects of the Soluble and Aggregated Forms of a Gut-Derived Microbe Polysaccharide

Svetlana Miakicheva

Sponsor: Jamal Lewis, Ph.D.
Biomedical Engineering

Over 23.5 million Americans are affected by various autoimmune diseases creating a need for therapeutic agents that suppress the inflammatory pathways caused by auto-antigens without leaving the host susceptible to other illnesses. One potential agent is Polysaccharide A (PSA) which comes from a gut bacteria, *Bacteroides fragilis*. Polysaccharide A is known to activate the anti-inflammatory CD49b+/LAG-3+/CD4 + /Foxp3- type 1 regulatory T-cells (Tr1) by stimulating immature dendritic cells (iDC). The goal of this study is to characterize and compare the immunomodulatory effects of soluble and aggregated PSA. Mixed lymphocyte reactions followed by cell-surface marker staining and ELISA assays were used in order to determine the efficacy of soluble PSA. Flow-cytometry data showed that CD4+ T-cells cultured with PSA-pretreated iDCs displayed the highest percentage of Tr1-type cell-surface markers. Those same cells excreted the highest level of IL-10, an anti-inflammatory cytokine. This preliminary data sets a foundation for base line percentage levels of Tr1 cells induced by soluble PSA. Future work will be concerned with the efficacy of PSA microparticles and their potential as a new treatment for autoimmune diseases.

Examination of the Mechanism for Debris Clearing Inside the Optic Nerve of Postnatal Mice

Alec Michael

Sponsor: Nicholas Marsh-Armstrong, Ph.D.

MED: Ophthalmology

With the goal of gaining further insight into the causes of glaucoma, I am investigating the mechanism of debris clearing inside the optic nerve in postnatal mice. I will be determining the role of astrocytes, myeloid cells, and additional cell types and structures in clearing myeloid debris that accumulates in the optic nerve after waves of cell death during axonal remodeling in developing mice. By tracking the location of these cell types and the accumulation of myelin debris at early time stages in postnatal mice, insight into the identity of cells performing phagocytosis during this process can be gained, and the possible effects of exosomes and perivascular channels on debris removal from the area can be monitored. Through the use of antibody markers and fluorescent microscopic imaging, I will track targets such as astrocytes, oligodendrocytes, macrophages, myeloid cells, myelin, blood vessels, laminin, and Mfge8 receptors, to determine how their interactions facilitate the removal of debris at this critical stage of axon remodeling.

The History of Adoption, Foster Care, and Orphanhood in America (1789-1851)

Sarah Mighell

Sponsor: Ellen Hartigan-o'Connor, Ph.D.

History

The history of adoption, orphanhood, and foster care in early America is a subject not often touched by historians. The years 1789-1851 were formative in America's definition of the family unit and roles within the family, the role of government and the law in familial affairs, and the importance of social responsibility for the nation's youth. The young republic faced issues of legal uncertainty for fostering or adoption in instances of indentured servitude, slavery, then-controversial interracial families, and traditional adoption narratives. Examination of important legal battles, court transcripts, journals and diaries of family members, records of orphanages and asylums, child welfare publications, and histories of societies dedicated to adoption and foster care give a full picture of the evolution of adoption in early America. State adoption acts passed starting in 1851 and most histories of adoption in America begin the same year, but the rich history of children's rights and agency, custody rights, benevolent societies and asylums, and child welfare began with the birth of the nation.

Body Elongation as a Major Feature of Diversification in Eupercarian Fishes

Analisa Milkey

Sponsor: Peter Wainwright, Ph.D.

Evolution & Ecology

The extraordinarily diverse series Eupercaria contains fishes that live in a range of habitats. These fishes have adapted to their environments in countless ways that are evident in their body morphologies. Previous studies have shown that body elongation is the dominant mode of shape variation in reef fishes. This trend is driven by a number of factors, like feeding performance and defense against gape-limited predators, not all of which are unique to reefs. Our research focused on whether elongation is the dominant form of diversification across all marine Eupercarians in different types of habitats. We utilized an assemblage of linear body measurements collected at the National Museum of Natural History, spanning the four orders in the series (Perciformes, Gasterosteiformes, Scorpaeniformes, Lophiiformes). Using habitat data collected from the online database 'FishBase,' we performed comparative analyses of the aforementioned body measurements for species in these orders. We predicted that head depth, maximum body depth, and caudal peduncle depth, relative to standard length, would show the greatest trend in shape diversity. This study will have major implications for our understanding of morphological variation of fishes and the adaptive significance of body elongation.

Deficits in Nest-Building Behavior in Male and Female California Mice After Subthreshold and Standard Social Defeat Stress

Vanessa Minie

Sponsor: Brian Trainor, Ph.D.

Psychology

Social defeat stress induces depression-like phenotypes in mice, which has made it an important model for studying neurobiological mechanisms of depression. Lack of motivation is a common symptom of human depression, so we tested whether stress affects motivation in mice. We evaluated nest building behavior, a daily task mice partake in, as a measure of motivation in male and female California mice. Previous studies in male C57Bl6/J mice showed that social defeat reduced nest building behavior. This study was conducted in California mice so that effects of stress could be studied in both males and females. We varied stress intensity by studying mice exposed to either a single episode of social defeat stress or three episodes. Our results show that there are similar deficits in nest building due to subthreshold and standard defeat stress in female California mice, but no effect in male California mice. The underlying physiological effects and differences between males and females as well as a mechanism for this behavior are unknown, but this study demonstrates that nest building behavior is more sensitive to social stress in females than males. Nest building assessment can be an important tool for studying depressive-like behaviors.

Comparison of 35S and nos Promoters in Genetically Transformed Alfalfa

Hana Minsky

Sponsor: Abhaya Dandekar, Ph.D.
Plant Sciences

Alfalfa (*Medicago sativa*) is an important plant for livestock and agriculture. Engineering of alfalfa, to enable it to better adapt to environmental stressors, grows increasingly important in the face of global climate change. One key tool for modifying the genome of alfalfa to introduce such traits is through *Agrobacterium*-mediated transformation. This requires isolating cells where *Agrobacterium* has transformed the alfalfa genome, and inducing them to form embryos. Genetic selection is achieved exposing plant cells to a compound that is normally toxic to them, such as an herbicide. The selectable marker gene chosen in this study encodes resistance to the herbicide glufosinate and will enable the alfalfa cells to regenerate embryos in its presence. The ability of the transformed plant cells to survive on glufosinate is influenced by the promoter sequence driving the expression of the selectable marker gene. Two promoters, 35S and nos, will be compared in this study. It is hypothesized that the transformations utilizing 35S promotion will occur at a higher rate, as 35S is a known strong promoter. Higher expression levels of the selectable marker gene will correspond positively with alfalfa embryogenesis. By comparing these two promoters, it will be possible to optimize future alfalfa transformations.

Effects of Visibility on Courtship Behavior/Success in Greater Sage-Grouse (*Centrocercus urophasianus*)

Kimberly Mitchell

Sponsor: Gail Patricelli, Ph.D.
Evolution & Ecology

A variety of factors may influence courtship behavior in Greater sage-grouse (*Centrocercus urophasianus*), a species of significant conservation concern. Visibility throughout a habitat can influence territorial behavior and social interactions in a variety of species. To determine if this is the case in sage-grouse, temporary visual barriers were placed on two study leks - the breeding grounds of this species. The barrier - a series of burlap walls designed to limit visibility, but not noise or movement - was periodically placed in an area of high sage-grouse activity. I compiled sage-grouse copulation data from days with and without the barrier present. In addition, courtship-related behavioral data was collected from sage-grouse within 5 meters of the barrier. Individual sage-grouse were identified and compared across days. Copulations and behavioral data were collected for 2 days prior to the construction of the barrier, to act as a comparative control. Preliminary results show that decreased visibility, through the presence of a barrier, has little impact on courtship behavior but may adversely affect overall mating success. Further understanding of the mechanisms and effects of visibility could assist in guiding conservation decisions regarding this species.

Arabian Nights: Deconstructing Terminology and Exoticization in the New York Times

Carina Mkrtchyan

Sponsor: Suad Joseph, Ph.D.
Anthropology

My research questions the exoticization of Islam, Arabs and the term Moslem* as found in the New York Times from 1900-1909. As a media analyst in Dr. Suad Joseph's lab, I study historical New York Times articles with the objective of tracing the genealogical representation of terms related to the Middle East and note the various discourses that often coincide with shifts in international politics, imperial interests and globalization. By addressing the changing uses of terminology in the media and understanding the way a broader narrative is constructed, stereotypes surrounding both historical and present perceptions of people and events can be discredited. My research studies the stylistic framework that was set up in the media over a hundred years ago as evidenced by misrepresentation, stereotyping, exoticization and compliments. These studies show that despite a reputation as the world's leading liberal newspaper, the New York Times often fails to provide an unbiased narrative in regards to the Middle East.

Comparative Evaluation of Agricultural Pesticide Usage in Knights Landing and Capay Valley, California

Daniel Moher

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

Knights Landing(KL) and Capay Valley(CV) are both communities in Yolo County surrounded by agricultural fields, but CV specializes in organic crops. KL residents expressed concerns about elevated exposure to potential carcinogens due to proximity of agricultural pesticide applications and they invited UC Davis researchers to further investigate. This study quantifies the amount of applied pesticides, carcinogenicity of pesticide active ingredients, and crop-specific pesticide application longitudinally from 2011-2015 in KL and CV. Pesticide application reports were retrieved from the Pesticide Information Portal(PIP) from the California Department of Pesticide Regulation. The weight of pesticide applied was normalized to either agricultural acreage or total acreage in the 2 KL and 3 CV zip codes included in the PIP data. Carcinogenic chemicals were identified using the U.S. EPA Standard Evaluation of Pesticides for Carcinogenic Potential and the IARC Monographs. We found that four times more total pesticides by weight and eight times more carcinogenic pesticides by weight were applied in KL compared to CV. Therefore, KL community exposures to agricultural pesticides are potentially higher than CV, supporting the concerns raised by the KL community members.

Law, Gender, and Mental Illness in Margaret Atwood's *Alias Grace*

Sofia Molodanof

Sponsor: Elizabeth Miller, Ph.D.
English

Margaret Atwood's *Alias Grace* (1996) is a novel of historical fiction that takes place in Canada during the 19th century, and tells the story of Grace Marks, a convicted "murderess," as she was labeled at the time. My thesis examines how the novel's use of narrative voice engages difficult legal, moral, and aesthetic questions about agency, intention, and culpability. Can one's mental health play a role in whether or not they can be considered guilty of murder?

Drawing upon my research on the historical case of Grace Marks, I consider the implications of the real possibility that Grace Marks suffered multiple personality disorder, and how that possible diagnosis might change how the novel is read. My paper shows how multiple personality disorder was configured legally in the past and how it relates to gender and legal precedents around mental illness. Since multiple personality disorder is widely considered to be a gendered diagnosis, this historical case and Atwood's treatment of it illuminate not only mental health diagnoses and legal history, but also how both areas are constructed by gender differences.

Understanding the Role of BAF-1 in *C. elegans* Female Meiosis

Manuel Mora

Sponsor: Francis McNally, Ph.D.
Molecular & Cellular Bio

It is widely known that Down Syndrome and a high number of miscarriages are caused by chromosome non-disjunction during meiosis. In many organisms, chromosome movement during meiosis is mediated by microtubules that attach to chromosomes through structures called kinetochores. However, meiotic chromosome movement in the nematode *C. elegans* has been reported to be kinetochore independent. This raises the question of how microtubules are attached to meiotic chromosomes during anaphase chromosome segregation. During meiosis, the nuclear envelope temporarily disassembles in order to facilitate chromosome segregation. BAF-1 is a nuclear envelope protein that has been observed reassembling around chromosomes during meiotic anaphase in *C. elegans*. I propose to confirm this observation and test the hypothesis that the nuclear envelope mediates microtubule attachment during meiotic anaphase. Anti-GFP antibodies were used to stain BAF-1 in meiotic embryos from a strain expressing GFP:BAF-1. The BAF-1 protein was found around the chromosomes throughout all stages of meiosis. The BAF-1 protein was found also observed around the sperm upon fertilization. These results confirm that at least one nuclear envelope protein is present around meiotic chromosomes during segregation. Further experiments with other nuclear envelope proteins will determine the exact role of the nuclear envelope during meiotic anaphase.

Strength of a Clean Sand Subjected to Cyclic Loading

Brian Morales

Sponsor: Aikaterini Ziotopoulou, Ph.D.
Civil & Environmental Engr

When subjected to rapid cyclic loading, loose to medium-dense saturated sands can liquefy and behave like a viscous fluid with minimal bearing capacity. The cyclic strength of a sand is a metric of a sand's resistance to cyclic (e.g. earthquake) loading. Cyclic strength and its dependence on loading duration are crucial to earthquake engineering applications. The laboratory Ottawa F65 sand is used extensively at UC Davis. As such, proper characterization of the sand's properties is crucial for liquefaction applications. Numerous researchers have attempted to characterize the strength of this sand with scattered results. In this work, cyclic undrained direct simple shear tests (DSS) were performed on Ottawa F65 sand under one overburden stress (100 kPa) to characterize its cyclic strength and its dependence on loading duration. Results are presented in terms of the applied cyclic stress ratio (CSR) versus the number of cycles recorded until liquefaction. Herein, liquefaction is defined as 3% single amplitude strain. The results obtained from these tests will be used to compare results from previous researchers and determine sources of errors leading to differences. The results are analyzed further by comparing the effects of the different cyclic strengths on the calibration of a constitutive model.

Investigation of the Reactivity and Stereoselectivity of Nucleophilic Additions to a-Chiral N-Sulfonyl Imines

Jose Moreno

Sponsor: Jared Shaw, Ph.D.
Chemistry

Nucleophilic additions to chiral, electron-deficient imines proceed with unexpected stereoselectivity and do not follow any current stereo-electronic model. The widely accepted Felkin-Ahn model is used to predict the products stereochemistry of nucleophilic additions to α -substituted acyclic carbonyls, but fails to predict addition products of analogous N-tosyl imines. Our current research seeks to investigate factors that influence stereoselectivity, including effects of solvents, temperature, chelatable and non-chelatable Lewis acids, and substituents of the imine substrates. Various substrates have been modified at the position α to the imine to explore effects that sterics and electronegative atoms may have on stereochemistry of products. The insight gained from this research will provide grounds for developing a novel stereo-electronic model to accurately describe, and reliably predict, the stereochemical outcomes of nucleophilic additions to electron-deficient imines. Furthermore, developing methods to provide stereocontrol for reactions of this type will provide new synthesis routes to produce lactam analogs of existing lactone-containing therapeutics.

Bioinformatic Analysis of Effector Protein Genes in *Bremia lactucae*

Yuji Mori

Sponsor: Richard Michelmore, Ph.D.
Plant Sciences

The downy mildews are plant pathogens that threaten many crops in commercial agriculture. These pathogens secrete effector molecules, which can suppress immune behavior in the host and render them susceptible. Selective forces act on the plant's defense mechanisms to evolve resistance to the parasites, but in response, downy mildew effectors also evolve to avoid host detection and remain effective in promoting virulence. The result of this interaction is rapid diversification within both the effectors and plant immune systems, which creates challenges in their overall study. I am computationally investigating 56 candidate effector proteins within the genome of *Bremia lactucae*, or lettuce downy mildew, as the foundation for determining their roles in pathogenicity. Using sequence data from 94 *Bremia* isolates, I generated pairs of consensus sequences (one per allele) and performed multiple DNA/protein alignments over each gene. At the same time, I constructed phylogenetic trees to describe evolutionary relationships between each region. Then, I quantified the amount of purifying or diversifying selection acting upon each gene, which led to the identification of four highly conserved sequences. For further analysis, I will attempt to correlate presence/absence of genes in each isolate with phenotypic data from infected lettuce varieties.

Ethnic Differences in Social Anxiety: The Mediating Role of Face Concern

Michael Morizono

Sponsor: Nolan Zane, Ph.D.
Psychology

Previous research has found consistent differences in social anxiety among ethnic groups. Specifically, Asian Americans have a higher propensity to experience social anxiety than White Americans. The goal of the present study was to determine what explains these previously found ethnic differences. We administered a social anxiety questionnaire to a sample of 426 college students (256 Asian, 170 White) and confirmed that Asian Americans were more socially anxious than White Americans. Asian Americans also reported greater face concern, or interest in maintaining one's face or the face of others, than White Americans. Moreover, face concern significantly mediated ethnic differences in social anxiety. That is, Asian Americans reported higher face concern than White Americans, and individuals reporting higher face concern were more likely to be socially anxious. Our findings suggest that social distress may have different cultural bases; threats to face may generate a considerable amount of anxiety, particularly among Asian Americans. When Asian Americans present with a lot of social anxiety, it would be helpful for clinicians to focus on face-saving strategies to reduce their distress.

Examining Vegetation-Grazing Interactions for Preservation of Grassland Bird Habitat

Catherine Movich

Sponsor: Kenneth Tate, Ph.D.
Plant Sciences

Grassland birds have been experiencing ongoing decline across North America for several decades due to changes in land use. Heterogeneous vegetation structure, a measurement in part dependent on variation in plant heights across a landscape, is crucial for supporting diverse habitats and healthy bird populations. While pre-European grazing and fire regimes maintained this habitat diversity, contemporary land management has favored uniform, intermediate level grazing. In Northeastern Oregon, The Nature Conservancy monitors vegetation structure on the Zumwalt Prairie, the largest remnant of the Pacific Northwest bunchgrass ecosystem, with the goal of collaborative, data-informed management for conservation and agricultural goals. This study examines multi-year monitoring data for relationships between vegetation structure, grazing utilization, and vegetation type to test whether pasture- and patch-scale grazing strategies can influence and shape landscapes for increased variability and improved grassland bird habitat. We predict that typically taller vegetation and lower levels of grazing will be independently correlated with higher structure and that there is an interaction between them to influence multi-scale heterogeneity. We aim to develop a Zumwalt-specific empirical model to guide management to increase diversity in vegetation structure through targeted and strategic grazing to better support grassland birds.

Inducible Thermal and Hypoxic Stress Tolerance in Juvenile Chinook Salmon (*Oncorhynchus tshawytscha*)

Gabriella Mukai

Sponsor: Anne Todgham, Ph.D.
Animal Science

Increased temperatures and low dissolved oxygen (hypoxia) are prevalent in rivers, presenting issues to its inhabitants. Chinook salmon have physiological mechanisms to tolerate periods of elevated temperature or hypoxia but it is unclear how salmon can tolerate these stressors sequentially. Our goal is to determine whether fish can tolerate hypoxic and thermal stressors differently after a preliminary thermal shock. This follows inducible stress tolerance concepts of heat hardening, where an organism's ability to tolerate elevated temperature is increased after an initial exposure to a heat shock, and cross-tolerance where exposure to one stressor increases tolerance to a different subsequent stressor, due to mechanisms activated from the preliminary heat shock. Fish were exposed to an acute elevated thermal stress and following 24 and 72 hours of recovery, were exposed to either another thermal shock or a hypoxic shock. To assess stress tolerance, we increased temperature or decreased dissolved oxygen levels at a constant rate and recorded the temperature or oxygen saturation when fish lost equilibrium. Global climate change is increasing the frequency of acute elevated temperatures and hypoxic conditions. Our results investigate how Chinook salmon tolerate repeated acute stressors in their environment.

Transcriptional Regulation of Transposable Elements During Hydra Embryogenesis

Nitika Mummidivarapu

Sponsor: Celina Juliano, Ph.D.
Molecular & Cellular Bio

Transposable elements (TEs) are mobile genetic elements that cause DNA damage by inserting themselves into genomic DNA. As organisms age, they lose control over TEs, which leads to genomic instability and contributes to the process of aging. The PIWI-piRNA pathway represses TE expression in animal germlines but also functions in the somatic stem cells of non-aging organisms, such as Hydra, where its somatic expression is necessary. Like Hydra, zebrafish express two cytoplasmic, non-redundant PIWI proteins. Briefly, during zebrafish embryogenesis, the PIWI protein loaded with piRNAs sense to TEs translocates into the nucleus. We observe the Hydra homolog of that PIWI protein, Hyli, in Hydra embryonic nuclei. We hypothesize that in Hydra, Hyli translocates into the nucleus during embryogenesis where it binds to nascent piRNA precursors and recruits epigenetic remodeling proteins to license piRNA clusters for transcription. If we further validate evidence of nuclear Hyli during Hydra embryogenesis, it would suggest a mechanism by which piRNA clusters are epigenetically distinguished from TE loci. Loss of TE control is emerging as a major contributor of aging. Thus, understanding the regulation of TEs in Hydra is particularly important due to its non-senescent phenotype.

Nitrogen Footprint of UC Davis

Miroslava Munguia Ramos

Sponsor: Benjamin Houlton, Ph.D.
Land Air & Water Resources

Reactive nitrogen is an integral part of human life and ecosystems. An excess of this resource contributes to a wide range of environmental and human health problems including worldwide declines in biodiversity, climate change, and compromised air and drinking water quality. A nitrogen footprint provides a standardized measure for the amount of reactive nitrogen released by an entity, such as a university, thereby guiding opportunities for reductions in excess nitrogen emissions. The Sustainability Indicator Management and Analysis Platform (SIMAP) developed by the University of New Hampshire Sustainability Institute will calculate both the nitrogen footprint and carbon footprint of UC Davis. We present the nitrogen footprint results for major sectors at UC Davis: food, utilities, transportation, research, and wastewater. The updated results add new data that contributes to a more complete accounting of upstream and downstream losses of reactive nitrogen. This quantitative measurement, as well as the predictive scenarios and projections provided by SIMAP, will aid in the formation of future abatement targets and sustainable management actions for nitrogen at UC Davis.

Novel Diterpenes in Maize Repress Growth of Major Fungal Pathogens

Ivan Munkres

Sponsor: Philipp Zerbe, Ph.D.
Plant Biology

The global population is predicted to reach 10 billion by 2050. Thus, improving crop yield to feed a hungry world is more critical than ever. Zea mays (maize) is an essential food and biofuel crop for much of the world's population, but the fungus Fusarium causes significant crop loss in maize each year. Preventing these losses would increase global food security. Diterpenes are a large group of anti-stress metabolites found in all plants. Our lab recently showed maize to produce a previously unrecognized group of defensive diterpenes called dolabralexins in response to Fusarium pathogens. The dolabralexins of interest include a hydrocarbon called dolabradiene, along with two similar compounds with different oxygen functional groups. One of these metabolites has also been shown to inhibit growth of several Fusarium species in vitro. To assay their antifungal efficacy, we first transform and grow Escherichia coli to produce sufficient quantities of dolabralexins. We then perform fungal assays in hopes of learning which Fusarium species are susceptible to dolabralexins and the importance of the oxygen functional groups. This research continues the progression towards global food security by providing an understanding of the structural-functional relationship of plant-derived antifungal molecules and different fungal species.

Mechanisms of Iron Acquisition in *Brucella abortus* Contribute to Growth in Placental Trophoblasts and Fetal Pathology

Ariel Munoz

Sponsor: Renee Tsois, Ph.D.
MED: Medical Microbiology & Imm

Brucellosis, a zoonotic infection caused by gram-negative bacterial genus Brucella, primarily causes infertility and abortion in the natural host (i.e. cattle) and a chronic debilitating illness or an "undulant" fever in dead-end hosts (such as humans). The immuno-evasive nature of this persistent intracellular pathogen is highlighted by its ability to avoid innate immune recognition. However, Brucella infection of the placenta in pregnant cows results in a strong host inflammatory response termed placentitis. Most studies on Brucella growth have looked at intracellular growth within macrophages, however, preliminary evidence in the Tsois Lab suggests that extracellular growth during infection of the placenta allows Brucella to reach high numbers in the host, which can promote horizontal and zoonotic transmission of this pathogen. Past experimental findings demonstrate that heme is a vital source of iron for B. abortus colonization and growth in trophoblasts of the mammalian host. We are utilizing Brucella iron uptake mutants to test the hypothesis that iron acquisition promotes extracellular growth of B. abortus in a mouse model of placentitis. Findings from this study may be applied towards targeting growth mechanisms in order to reduce B. abortus survival in animals.

Towards Self-Driving Car: Pedestrian and Traffic Sign Classification

Kalani Murakami

Sponsor: Chen-nee Chuah, Ph.D.
Elect & Comp Engr

With the recent re-emergence of Deep Learning, many applications that otherwise computationally expensive were made possible. In particular, autonomous vehicles features such as Pedestrian and Traffic Sign detection/classification can be further improved with Deep Learning. Through our Independent Senior Design Project, conducted during Fall and Winter Quarters of 2018, we have been able to develop initial results on such application. Not only were we able to detect pedestrian and classify traffic sign in real-time, but also to identify bottlenecks and difficulties. Therefore, we would like to present our work for the reference of future development. In a nutshell, we used a modified version of YOLOv2 detection/classification to achieve our goal. We were able to run the algorithm in 30 fps. Our bottleneck is the communication between the algorithm processor and the car.

Effects of Pro-Oxidants and Antioxidants on the Redox Signaling Pathway of Haustorium Initiation Using the Root Parasitic Plant Triphysaria

Maylin Murdock

Sponsor: John Yoder, Ph.D.
Plant Sciences

Parasitic plants have agricultural significance as they can be detrimental to a wide range of crop species. They are heterotrophic, acquiring much of their resources from host plants. An anatomical feature of parasitic plants is the haustorium, an organ that enables the uptake of nutrients and water from the host to the parasite. To further understand and control parasitism, we are investigating haustorium inducing factors (HIFs) and their effects on the parasite *Triphysaria*. The current model suggests that haustorium development is controlled by a redox signaling pathway. Our objective was to examine if specific pro-oxidants and antioxidants affect HIF induction of haustoria. We screened 84 chemicals from a redox library (Screen-Well redox library, Enzo Life Sciences) to determine if they affect haustorium formation. This was achieved by combining each chemical with the representative HIF, DMBQ, and setting up 3 biological replicates to test each chemical. We found that 24 out of the 84 chemicals significantly reduced haustorium formation. These results identify potential agents to control parasitic weeds by blocking the redox signaling pathway that initiates haustorium formation.

Investigating the Role of the Viral Protein Nla-Pro in Plant Immunity

Maneesha Muriki

Sponsor: Clare Casteel, Ph.D.
Plant Pathology

Overexpression of the viral protein Nla-Pro increases plants resistance to potyviruses and bacterial plant pathogens in transgenic plants. These results suggest that Nla-Pro is recognized by the plant as a PAMP or effector, eliciting changes in plant defense pathways. The goal of this study is to determine Nla-Pro's ability to elicit plant defense responses in host plants. To address this goal, we measured phytohormone induction and abundance of several transcripts related to defense signaling and induction. We used transgenic *Arabidopsis thaliana* which constitutively expressing Nla-Pro or the empty expression plasmid. Phytohormone production was measured using LC-MS/MS and defense transcripts abundance was measured using quantitative RT-PCR. Preliminary results demonstrate that Nla-Pro expression alters both jasmonic acid and salicylic acid production in plants and that presence of the insect vector may modulate this response. Additional experiments will be required to determine if Nla-Pro can be implemented in new resistance strategies for many crops.

Case Study of a Cholera Outbreak in the 21st Century.

Janice Mwaniki

Sponsor: John Furlow, Ph.D.
Neuro Physio & Behavior

Africa is burdened with high mortality and morbidity rates due to infectious diseases. In the recent Cholera outbreak in Kenya (August 2017), Western countries were well aware of the outbreak before local afflicted communities. As a result, increased mortality resulted because the at-risk communities did not know how to best contain the outbreak, and acquire resources for increasing patient burdens. Our hypothesis is that political instability aids in the lack of proper channels for communication and flow of resources during outbreaks of otherwise controllable diseases. From preliminary investigation, certain governmental officials informed the West first to solicit funds, prior to informing the populace at highest risk for infection. In this case study, we wish to discover current communication policies and strategic plans during a disease outbreak by interviewing health and government officials in Kenya. We will also conduct interviews with infectious diseases specialists at UC Davis, WHO Africa, and the CDC for ways to address outbreaks using a bottom up approach to complement the delayed top down approach, as observed in this case. The results of our study will contribute to a greater understanding of how otherwise controllable infectious diseases spread opportunistically via sociopolitical conditions and inadequate communication policies.

Exploring Changes in College Students' Self-Efficacy with the Integration of a Socio-Scientific Phosphate Module into General Chemistry Curriculum

Aryana Nabavizadeh

Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Chemistry may seem irrelevant to the college chemistry student, and this can affect their desire to learn or their ability to apply their learning to real-world situations. Most course content is taught abstractly so it can be challenging for students to see the value of chemistry in their everyday lives. This study investigates changes in students' self-efficacy by incorporating a socio-scientific problem into the general chemistry curriculum. The students explore the issue of phosphates as a limited resource with a digital Prezi presentation module. The module teaches the students the chemical properties of phosphate, its uses, and waste management strategies that can help preserve this limited resource. The students will take a pre- and a post-test to determine the effectiveness of the module with statistical tests. In addition, students' perceptions on their own willingness and capacity to learn chemistry will be collected through a questionnaire. NVivo, a qualitative analysis program, will be utilized to analyze the questionnaire data. This study provides insight for chemistry educators on how they can introduce socio-scientific problems into their curriculum, making the subject more relevant to students and changing the way they perceive their own abilities to learn the material.

A Deep Learning Approach to Sustainable Waste Management

Navid Nadvi

Sponsor: Ilias Tagkopoulos, Ph.D.
Engr Computer Science

According to the Environmental Protection Agency's (EPA) report, USA generated 254.1 million tons of trash in 2013. Compared to 1960 when USA generated only 88.1 million tons, the municipal solid waste generation has increased by a staggering 188.4%. Despite our best efforts to recycle and compost, we are lagging behind as we were only able to achieve a 34.3% recycling rate in 2013. Here, we propose to address the problem at the source by building an inexpensive smart trash can that takes trash images, processes them and then automatically segregates it into Compost, Recyclable & Landfill bins. We do this by implementing Convolutional Neural Networks (CNNs) and Computer Vision algorithms on a Raspberry Pi 3 to correctly identify the images of trash. Our dataset includes the 2527 labelled TrashNet images coupled with an increasing set of images acquired by our smart trash can. Preliminary results show a performance of 60% in trash classification, with further refinement under way. This project paves the way for intelligent, inexpensive and sustainable waste management across a wide spectrum of commercial and residential facilities.

***Prevotella copri* as a Biomarker for Cattle Feed Efficiency**

Negeen Najafi

Sponsor: Matthias Hess, Ph.D.
Animal Science

Cattle are a key component of the agricultural industry in the United States. There has been great effort in developing reliable and efficient strategies to identify animals with increased feed efficiency in order to reduce the overall feeding costs associated with animal production and to reduce the methane footprint of the cattle operation. A pilot study conducted suggested a potential correlation between feed efficiency of cattle and presence of individual bacterial species within the animals' feces. This correlation included an over 20-fold increase in abundance of *Prevotella copri* in fecal samples from high efficiency steers. To confirm this relationship, I extracted DNA from fecal samples of 6 high efficiency and 6 low efficiency steers, doubling the number of study subjects of the previous study. Using amplicon based metagenomics and primers that target the V4 region of the 16S rRNA gene, I investigated the relationship between efficiency and microbial community composition. Confirming the association between high feed efficiency steers and *P. copri* may be useful to quickly determine the feed efficiency of an animal and help cattlemen identify animals they want to use for breeding and beef production. This will in turn reduce feeding costs, maximizing the revenue of their operation.

Incorporating a Socio-Scientific Issue Into the General Chemistry Curriculum to Improve Student Engagement

Dhruv Nandakumar

Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

This study attempts to improve the relevance of chemical education as perceived by students through the introduction of controversial topics into chemistry curriculum, with a focus placed on socio-scientific issues (SSI). Considering its political and economic relevance, Hydraulic Fracturing was selected as a suitable SSI. A lesson plan was developed and designed to stimulate self-directed learning by allowing students to contrast and defend different viewpoints on hydraulic fracturing. A group of General Chemistry students were first given an extensive Prezi on Hydraulic Fracturing to provide a base knowledge on the issue. The students were split into groups of four, with each member representing the views of a Politician, a Scientist, an Environmentalist, or an Oil Company Representative. Hydraulic Fracturing was analyzed through each perspective. Pre and post-discussion quizzes as well as a survey were administered to gauge how much was learned from this activity as well as student perception of the activity. The findings elucidate that most of the students who participated viewed the lesson plan as relevant and interesting. These results indicate that by contextualizing the chemistry curriculum through a socio-scientific issue, students are able to view the relevance of chemistry beyond the classroom environment.

Elicitors of Plant Cell Death for Pathogen Resistance

Sanye Zehra Naqvi

Sponsor: Richard Micheltmore, Ph.D.
Plant Sciences

As a rapidly growing world population and changing climate conditions have begun to threaten food security, sustainability efforts have increasingly centered on augmenting crop production to enhance disease resistance in plants. The development of an innate immune response has given plants the ability to recognize the presence of potential pathogens and initiate an effective defense response. In turn, successful pathogens evolve to avoid recognition by the host. The arms race between plant and pathogen has led to a co-evolutionary struggle for dominance. For my research project, I conducted *Agrobacterium*-mediated infiltrations of several recombinant inbred lines (RILs) of lettuce in an effort to identify which plants had recognition of certain effectors, cloned from *Bremia lactucae*, the causative agent of lettuce downy mildew. In resistant plants, R (resistance) genes encode receptors that recognize effectors. This recognition elicits a hypersensitive response, characterized by cell death in the local region of the infection, thereby preventing the spread of the pathogen. Preliminary results show that the RILs are segregating for recognition of five different effectors, and the genes for recognition appear to be linked. Sequencing of the RILs combined with marker-trait association studies will reveal candidate genes for effector recognition.

Forward Lunge Mechanics: Does Allowing the Knee to Go Past the Toes Result in High Forces in the Anterior Cruciate Ligament?

Mohsin Naqvi

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

Lunges are a common exercise used to strengthen leg muscles and prevent knee injuries. Trainers often instruct athletes to make sure their lunge knee does not extend past the toes. Such mechanics are believed to cause large forces in the anterior cruciate ligament (ACL). Previous static analyses in our lab found no evidence to support this belief and instruction. Here, we conduct a dynamic analysis of forward lunges and estimate ACL forces. Participants will lunge with their knee behind and in front of their toes. Video, force plate, and electromyography (EMG) data will be collected during each lunge. Knee forces will be determined using inverse dynamics analysis. ACL force contributions to knee force will be estimated using a distribution analysis. A preliminary test of one subject resulted in peak tibial shear forces of 211 N, and -356 N for lunges with the knee behind and in front of the toes respectively. A positive tibial shear force typically involves loading the ACL while a negative value does not. Thus, the preliminary results do not support increased ACL loading when the knee goes past the toes. The next step is to test additional subjects and estimate actual ACL forces.

Observed Mother-Child Interactions: Associations Between Preschoolers' Social Behaviors, Temperament, and Their Mothers' Cognitive Functioning

Madhuri Narayan

Sponsor: Daniel Choe, Ph.D.
Human Ecology

The way in which children react and interact with the world, or their temperament, impacts their social behaviors, particularly with their mothers during early childhood. However, few studies examine the relationship between mothers' cognitive functioning and young children's temperament-related behavior. This ongoing study examines associations between maternal self-regulatory and intellectual functioning, and preschool-age children's temperament and observed social behavior. A sample of 9 mother-child pairs (M=38 years, SD=1.3, 9 female; M=4.5 years, SD=4.428, 4 female, respectively) were video-recorded for two interaction tasks, Free-Play and Clean-Up, and later coded at individual and dyadic levels using the Parent-Child-Interaction-System. Mothers were administered an intelligence test to assess intellectual ability, computerized tasks to measure self-regulation, and parent-reports to measure child temperament. Preliminary findings suggest that maternal self-regulation is associated with several aspects of children's observed social behavior and temperament, with different associations seen across different tasks. Maternal intelligence, while showing correlations with child behavior, seems to be unrelated to temperament. Further explorations will clarify the direct effects of mothers' intelligence and self-regulation on children's behavior. These findings are important because children's positive social behaviors are crucial for their healthy development and positive future outcomes.

Assessing Social Deficits in Mice with Experimental Autoimmune Encephalitis

Aida Nasirishargh

Sponsor: Lillian Cruz-Orengo, Ph.D.
VM: Anat Physio & Cell Biology

Multiple Sclerosis (MS) is an autoimmune disease of the central nervous system. Additionally, MS is sexually biased affecting more women than men. Symptoms of MS varies from motor disfunction, cognitive and sensory impairments, mood disorders and sociability, etc. There is a lack of basic research regarding the changes in social behavior during course of the disease and its sexual bias. Using the Experimental Autoimmune Encephalomyelitis (EAE) to model the disease in SJL inbred mouse strain -known to show the same sexual bias as MS- we addressed this deficit by studying changes in sociability with the Crawley's test. We distinguished the lack of sociability from the motor deficits associated with EAE by performing additional motor tests. Additionally, we compared the results of the SJL mice with the C57BL/6 mice, as mouse strain that doesn't show sexual bias on EAE. We are hoping this project will shed light on the effect of MS on difficulties that patients face in interacting with others which may consequently lead to a lower quality of life.

Intensified Temperature and CO₂-Acidified Seawater Increases Growth of Juvenile Antarctic Rockcod Otoliths

Andrew Naslund

Sponsor: Anne Todgham, Ph.D.
Animal Science

Unprecedented rates of carbon dioxide (CO₂) emitted to the atmosphere have been repeatedly observed to stress organisms to their physiological limits. As climate change continues to alter the abiotic conditions of seawater, marine fishes will be forced to acclimate and adapt to both warmer temperatures and acidified water. The plasticity of Antarctic fish is particularly challenged as high latitude oceans are experiencing an enhanced rate of temperature change. Otoliths, calcified structures found in a fish's inner ear used to sense movement and direction, develop based on physiological parameters such as growth, metabolism, and respiration, and have been shown to be affected by CO₂-acidified seawater. In this study, juvenile Antarctic rockcod (*Trematomus bernachii*) were exposed to projected PCO₂ (450, 850 or 1200 μ atm pCO₂) and temperature (-1 or +2°C) over a four-week period. Sagittal otoliths of fish sampled at 48 hours, 1 week, 2 weeks and 4 weeks were analyzed for shape and area. Initial results indicate warmer waters and high PCO₂ increase the growth rate of otoliths. This would suggest projected seawater conditions could affect the development of sensory functions in Antarctic rockcod.

Expanding Genetic Tools to Improve Tractability of the Parasite *Entamoeba histolytica*

Monica Lyn Natividad

Sponsor: Katherine Ralston, Ph.D.
Microbiology & Molec Genetics

The microbial eukaryote *Entamoeba histolytica* is a parasite that drives destruction of host tissues. It is responsible for the intestinal disease amoebiasis, which can result in ulcers and liver abscesses. We seek to understand the genetics behind trophocytosis (trogo-: nibble), *E. histolytica*'s unique cell-killing mechanism, as this understudied process likely contributes to pathogenesis. In order to study the mechanism of this intriguing process, we are expanding the repertoire of genetic tools in *E. histolytica*. We hypothesize that in addition to the current available selectable marker genes (hygromycin and geneticin resistance), blasticidin, puromycin, and zeocin resistance can also be used. We incorporated these new resistance genes into the *E. histolytica* expression plasmid. After generating the plasmids, we tested the transfectants and wild-type to the antibiotics to determine if drug treatment can be used to select for stably transfected amoebae. For blasticidin, we were able to distinguish between wild-type and transfected amoebae at 22 μ g/ml. Puromycin and zeocin transfections are currently underway. The results of this research are expected to improve genetic tractability of *E. histolytica* and will complement the efforts to establish a variety of reporter amoeba lines for pathogenesis studies.

Investigating the Homogeneous Electrocatalytic Reduction of Carbon Dioxide

Taruna Neelakantan

Sponsor: Louise Berben, Ph.D.
Chemistry

Current human activities, such as the unsustainable burning of non-renewable resources like fossil fuels, have contributed to the high CO₂ concentration (currently 408 parts per million) in our atmosphere. One viable solution is to harness this CO₂ and convert it to usable chemical fuels. Chemical fuels store massive amounts of energy in their chemical bonds. By converting carbon dioxide into usable fuels derived from a renewable resource, we can gear towards a more sustainable and carbon-neutral economy. My research uses electrocatalysis to assist in C-H bond activation to produce chemical fuels from CO₂. I studied the water-soluble compound [Fe₅N(CO)₁₄]⁻ and related iron carbonyl clusters featuring pendant phosphine ligands as potential C-H bond forming electrocatalysts, and used cyclic voltammetry to investigate the possible CO₂ reduction and proton reduction mechanisms of these clusters under aqueous and mixed organic/aqueous conditions. I also determined thermodynamic CO₂ binding constants electrochemically. My results show that although the reduction potential of [Fe₅N(CO)₁₄]⁻ is suitable for CO₂ reduction, the only product detected was hydrogen. Our increased knowledge of these iron cluster systems will allow us to develop better CO₂ reduction catalysts for sustainable fuel production.

New Tools for Studying Memory Consolidation

Sonya Nemes

Sponsor: Brian Wiltgen, Ph.D.
Psychology

The hippocampus is theorized to function as memory storage until memory is transferred to the neocortex in a process known as memory consolidation. The standard model of consolidation (SMC) posits that new memories are supported by both the hippocampus and the cortex. Over time, hippocampal reactivation strengthens cortical connections until hippocampal input is no longer needed for memory retrieval, as consolidated memories are fully supported by the cortex. An effective system is needed to test the involvement of hippocampal reactivation in memory consolidation. We use DREADDs (Designer Receptors Exclusively Activated by Designer Drugs) to selectively inhibit hippocampal neurons activated during learning. Neurons activated during trace fear conditioning were tagged with the inhibitory DREADD hM4Di via two separate systems: fos-tTA transgenic mice + AAV-hM4Di infusion, or wild-type mice with AAV-fos-tTA + AAV-hM4Di infusion. Tagged neurons were inhibited for 10 days using osmotic pump delivery of DREADD ligand C21. Following testing, brain tissue was stained for cFos, a marker of neuronal activity. Preliminary results suggest that C21 activates hM4Di receptors and inhibits active neurons. The results from this experiment will determine if the transgenic or virus cocktail model is more effective for prolonged neuronal inhibition.

The Effect of Mental Resources on Changing Attitudes

Rebecca Neufeld

Sponsor: Jeffrey Sherman, Ph.D.
Psychology

How do people decide whether they like a person? Previous research finds that the evaluation of others depends on the order in which one learns about them. The initial impression formed of a person tends to be generalized (i.e., applied across contexts), while the second impression becomes contextualized (i.e., tied to the context they are encountered in). Though contextualization of evaluations is well established, it's unknown whether this process relies on mental resources (i.e., whether people are cognitively busy). Restricting resources may increase, or decrease the extent to which evaluations are contextualized. When resources are low, individuals may prioritize information they learned first, or they may instead favor information learned second. To test this question we used an evaluative learning paradigm designed by Gawronski with the addition of cognitive load (e.g., rehearsing a 2-digit or 8-digit number). In this task participants form an impression of a person based on described behavior in different contexts (e.g., a yellow vs. blue background). We will examine the evaluation of the person in each context, based on whether participants were under high or low load. The findings of this research have important implications for understanding the conditions under which attitudes can change.

Analysis of a Putative Fosfomycin Resistance Gene in *Bifidobacterium breve* UCC2003

Brooke Neville

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

Antimicrobial resistance (AMR) is a growing crisis in the United States. AMR is becoming more common, even in commensal bacteria. A previous version of the ResFinder database identified a putative fosfomycin resistance gene in *Bifidobacterium*, but an updated version of the database removed the putative gene. Because fosfomycin is medically important for the treatment of UTIs in humans, this project tested for the presence of fosfomycin resistance in *Bifidobacterium*. The strain initially predicted to have fosfomycin resistance by ResFinder was *B. breve* UCC2003 which was shown to be resistant up to 1000 ng/ μ L of fosfomycin, far above the minimum inhibitory concentration (250 ng/mL) of bifidobacterial strains lacking the gene. The fosfomycin gene was PCR amplified, cloned into a pCR2.1-TOPO vector, transformed in *Escherichia coli* and the transformants were tested for fosfomycin resistance. While amplification of the fosfomycin gene was successful, cloning into *E. coli* did not produce fosfomycin resistance, to date. Additional work is ongoing to further determine if transferable AMR fosfomycin gene actually provides resistance in *E. coli*, a fact that would have important implications for human use of fosfomycin resistant bifidobacterial probiotics.

Developing Better Tools to Quantify Running Related Injury Potential: Estimating Ground Contact Forces From Wearable Devices

Brandon Ng

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

The vertical ground reaction force (vGRF) impact peak (IP), active peak (AP), and impulse developed when the foot contacts the ground during running are thought to contribute to running related injuries (RRI). However, data to test this is lacking. To address this limitation, we developed a model to estimate runners' vGRF IPs, APs, and impulses from hip acceleration data that can be obtained from a variety of wearable devices. vGRF IPs, APs, and impulses were calculated from vGRF data obtained from 35 participants running across a force plate. High (>10Hz) and low (<10 Hz) frequency acceleration peaks and the acceleration-time signal integral were calculated from hip acceleration data. Three general linear models were developed to estimate vGRF IP, AP, and impulse from sex, mass, and hip acceleration data for 25 randomly selected participants. The remaining 10 participants were used to validate the models. The IP, AP, and impulse models had R^2 and bias values of 0.22 and -1.52%, 0.80 and -5.13%, and 0.59 and 1.08%, respectively. These results suggest that the regression models allow vGRF AP and impulse to be estimated from hip accelerations, providing a new tool for studying the mechanisms of RRIs and the potential of their occurrence.

Differences in Grammatical Errors Made by Spanish- and Cantonese-Speaking Dual Language Learners

Juliana Ng

Sponsor: Yuuko Tonkovich, Ph.D.
Education

Dual language learners (DLLs) make consistent and systematic grammatical errors as they learn the societal language, English. This study examines the difference in grammatical errors made between Spanish- and Cantonese- speaking DLLs. It also studies the type of grammatical errors (i.e. lexical, syntactical, referential, and code-switching) that DLLs routinely make. This sample consists of a total of 146 children who were enrolled in six kindergartens (79 Cantonese- and 67 Spanish-speaking DLLs). Data was collected during Fall 2006. Children were asked to create their own narratives in English to tell the story of a wordless picture book, *Frog, Where Are You?* The children's narratives were evaluated on the types of grammatical error that were made. Inter-rater reliability was used to establish the internal validity of the study. Results indicate that the majority of the errors were syntactical, followed by lexical, and then referential. Few code-switching errors were evident, all of which were made by Spanish-speaking DLLs. Implications of this study will inform educators about which specific areas of grammar teachers should focus on with DLLs.

Respiratory Sinus Arrhythmia Predicts Young Children's Self-Regulation

C Michelle Ng

Sponsor: Daniel Choe, Ph.D.
Human Ecology

Self regulation is the ability to modulate one's reactions and responses, and serves as an important indicator of young children's development. Respiratory sinus arrhythmia (RSA) measures variability in heart rate and respiration, serving as a physiological marker of behavioral and emotional self-regulation. In a preliminary sample of nine children (M age = 53 months; SD = 4.18, 5 girls), we measured children's RSA values during a sitting baseline and as they completed eight self-regulation tasks, including Day-Night, Happy-Sad, Bird-Dragon, Reverse Bird-Dragon, Tongue Task, Dinky Toys, Gift Wrap, and Gift Delay. We calculated the difference in RSA between each task and the baseline to represent changes in RSA during self-regulation tasks, which we then compared to children's performance. Preliminary analyses suggest that higher RSA values during Gift Wrap is associated with high self-regulation and larger differences between baseline and task RSA predict poorer self-regulation in Bird-Dragon. This ongoing research quantifies children's self-regulation behaviorally and physiologically to help us understand how children adapt to different environments and respond to challenges. By observing self-regulation early in children's lives, steps can be taken to improve children's behavioral and emotional responses to stress.

Application of Antimicrobial Alginate Hydrogel Beads for Rapid Field Water Decontamination and Disinfection

Kristell Isabel Ng

Sponsor: Gang Sun, Ph.D.
Textiles & Clothing

Waterborne diseases caused by infectious microorganisms are currently one of the most significant human health concerns in the world. People need more access to clean water everywhere in the world. Data collected by the World Health Organization (WHO) reveals that about 2 million people die each year from waterborne diseases related to unsafe drinking water sanitation. Therefore, it is crucial to explore a new efficient and portable device to decontaminate and disinfect the water direct drinking. We prepared rechargeable antibacterial hydrogel beads by combining N-halamine precursor polyacrylamide and natural polysaccharide alginate. The hydrogel beads resulted with exert robust mechanical strength, high rechargeable chlorination capability, and contact-killing bactericidal efficiency, all originating from the synergistic effect of active N-halamine and double network hydrogel structures. We also demonstrated that the charged beads could decontaminate bacteria-contaminated water efficiently by direct filtration with promising high durability, capacity, and fluxes. The bactericidal hydrogel beads would be a promising candidate for various water purifying applications.

RY785, a Lead Compound for Diabetes Treatment, is Selective for Kv2.1 over Kv4.2 Potassium Channels

Michelle Nguyen

Sponsor: Jon Sack, Ph.D.
MED: Physiology & Membrane Biol

Voltage-gated potassium (Kv) channels are crucial for physiological electrical signaling, and are targets for treatment of cardiac, neurological, and endocrine diseases. The Kv2 family of these channels regulates neuron excitability as "delayed rectifiers". Previously, in a venture to create a new class of diabetes drugs, RY785 was discovered as a selective small molecule inhibitor of Kv2 channels. However, it was unknown whether RY785 has side effects on the Kv4 family of channels. Through whole-cell voltage clamp studies of Chinese hamster ovary (CHO) cells expressing rat Kv4.2 channels, I found that 1 μ M of RY785 has little impact on Kv4.2 channel currents. When compared to data obtained with rat Kv2.1 channels, we see that Kv2.1 currents are nearly completely inhibited at the same dose. The lack of side effects on Kv4.2 channels, combined with prior findings, suggests that RY785 is a valuable tool for functional studies of Kv2 channels. Thus, investigation of the mechanism of inhibition of Kv2.1 channels by RY785 will be of interest.

Poc5 is a Regulator of Centriole/Basal Body Assembly

Marina Nguyen

Sponsor: Mark Winey, Ph.D.
College Bio Sci Deans Office

Centrioles/basal bodies (CBBs) are microtubule-organizing centers that organize the microtubules of the mitotic spindle and cilia, respectively. CBB duplication is tightly regulated and disruption of this process can result in both aneuploidy during cell division and a subset of maladies known as ciliopathies. Poc5 transiently localizes to CBBs during new assembly which is suggestive of a role in CBB duplication. In order to understand the role Poc5 has on CBB duplication, we created *Tetrahymena thermophila* strains that are null of poc5. In these strains, we find a consistent overabundance of CBBs under varying temperatures. Our results indicate that Poc5 is a negative regulator of CBB duplication. My research focuses on whether varying Poc5 levels affect CBB production and whether re-introduction of Poc5 can rescue the original CBB phenotype. We generated an inducible poc5 expression construct in a Poc5 knock-out strain background. After inducing various levels of Poc5 expression, we measured the number of CBBs per condition. We have found that a medium level induction does not affect CBB phenotype, whereas low and high levels of induction result in a decrease in CBB production. We conclude that regulation of Poc5 is essential for stable CBB production.

Does my Body Make my Head Look Big? Body-Head Shape Covariation in Cichlids

Jennifer Anne Nguyen

Sponsor: Peter Wainwright, Ph.D.
Evolution & Ecology

Cichlids are a very morphologically and ecologically diverse vertebrate family, making them great model organisms for evolutionary studies. They vary widely in a number of morphological features, like overall size, fin shape, pattern of coloration, and body shape. Although we know that fish body and head shapes are influenced by habitat and diet, we still lack an understanding of the covariation between these features. Given that changes in body shape often impact head morphology, we are interested in the strength of this relationship and its impacts on cichlid diversity. This research expands on previous work in a small group of cichlids from Madagascar, which suggested a correlation between body and jaw shapes. Linear morphometric data, collected from the National Museum of Natural History, covers over 200 species of cichlid that we used for comparative phylogenetic analyses. We predicted high correlation between body depth and head depth, lower jaw length, and mouth width. This would not only suggest a constraint on the diversity of cichlid head shapes, but also offer insight on the evolution of body plans in other fishes.

The Home Stretch: Body Elongation Diversity of Pelagic Fishes

Vivian Nguyen

Sponsor: Peter Wainwright, Ph.D.
Evolution & Ecology

Among marine environments, the pelagic zone has the largest volume, nearly 1.4 billion cubic kilometers, and the greatest vertical range, 11,000 meters. Throughout this area, body shape is specialized to an incredible degree to overcome the open ocean – yet there is still great morphological diversity. While biodiversity can manifest in many forms, body elongation is the dominant mode of shape variation in reef fishes. To expand beyond reefs, we evaluated morphological diversity across a different habitat – the pelagic zone. Reefs possess limited space but high complexity, which contrasts the expansive yet structurally simple pelagic environment. We used linear body shape measurements from the National Museum of Natural History that span all spiny-rayed fishes and gathered habitat data from the literature. In order to analyze this dataset, we used a phylogenetic framework for comparative analyses. We predicted that certain morphological measurements, including head depth, maximum body depth, and caudal peduncle depth relative to standard length will yield the greatest diversity – and therefore that body elongation is the primary form of shape variation across pelagic fishes. Such findings would align with current thinking that body elongation diversity is a key manifestation of ecological differences across habitats.

TrpV1 and TrpA1 Regulates Skin Barrier Function and Itch Related Behavior in Imiquimod Mediated Psoriasis

Amanda Nguyen

Sponsor: Earl Carstens, Ph.D.
Neuro Physio & Behavior

Imiquimod (IMQ) is a topical medication used to treat basal cell carcinomas, and warts. In recent studies, application of IMQ has been used to create a mouse model for plaque psoriasis, a chronic skin disease characterized by scaly skin, and intense itch. Although IMQ-treated mice are valuable for studying psoriasis, aspects of its mechanistic pathway have not been verified. Here, we use TRPV1 knockout, TRPA1 knockout, and wild type animals in itch behavioral experiments to determine if IMQ induced itch is histaminergic or non-histaminergic. Previous research demonstrates that histaminergic itch depends on the ion channel TRPV1, while the non-histaminergic itch pathway is dependent on TRPA1. In our study, IMQ was topically applied to the rostral back over five consecutive days. Knockout and wild type animals were measured for spontaneous scratching and touch evoked itch (alloknesis) on days 0,1,3, and 5. Both knockout groups showed a significant decrease in response to alloknesis ($p < 0.01$) and a trending decrease in spontaneous scratching ($p > 0.05$). Mice treated with vehicle scored lower than their IMQ-treated counterparts ($p < 0.01$). This shows that IMQ increases itch sensation and sensitization through both histaminergic and non-histaminergic pathways.

Exploring Student 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 TA's and the ES's, 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 TA's or ES's and how the teaching styles may vary between the two lab instructors. Student inquiries and TA/ES 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. The results will also be used to assess the overall success of the Emerging Scholars program and suggest improvements to enhance the role of ES's in the labs.

Changes in Retinal Pigment Epithelial Morphology in Rhesus Macaques

Amy Nguyen

Sponsor: Glenn Yiu, M.D., Ph.D.

MED: Ophthalmology

Age-related macular degeneration (AMD) is the leading cause of blindness in the elderly due to damage to the central portion of the retina called the macula. AMD is characterized by retinal deposits known as drusen in the early stage and by atrophy of photoreceptors and retinal pigment epithelial (RPE) cells in more advanced stages. The goal of my study is to study how RPE morphology in Rhesus Macaques evolves with age and how RPE in the macula differs from those in the peripheral retina. Nonhuman primates are the only animals to possess a macula similar to humans and spontaneously exhibit drusen similar to those in AMD. To visualize RPE morphology in Rhesus macaques, we will employ and optimize tissue preparation of RPE flat-mounts, immunohistochemistry using antibodies against tight junction proteins (anti-ZO-1), and fluorescence microscopy methods. The results of this project will help further our understanding of RPE morphology in primates and provide insight into AMD pathogenesis.

Early Life Exposure to Ozone Air Pollution and Lung Collagen

Quynh Nguyen

Sponsor: Laura Van Winkle, Ph.D.

VM: Anat Physio & Cell Biology

Ozone is a gas that is created by the emission of nitrogen oxide (NO_x) and volatile compounds (VOC) from industrial facilities, motor vehicle exhausts, and electric utilities with the presence of sunlight. Exposure to a high level of ozone is correlated with respiratory diseases such as asthma and bronchitis, which are characterized by increased airway inflammation and collagen deposition. Collagen is a supporting framework of the lung that helps maintain the structure and expansion. Excess collagen fibers can deteriorate lung structure and function by decreasing the ability to expand and exchange gas. To determine the effects of ozone on collagen fibers in the lungs, 4 female and 4 male rat pups were exposed to filtered air or .5ppm ozone from day 7-28. At 4 weeks old and 8 weeks old, they were necropsied, the lungs were fixed, embedded into paraffin, and stained with the Masson's Trichrome. We discover that there was no difference in collagen deposition between 4 and 8 weeks old ozone exposed and filtered air lung tissue. We conclude that ozone exposure has minimal impact on the collagen deposition within the lung.

Hepatitis E Virus Nanoparticles as Insulin Oral Delivery Vector

Michelle Nguyen

Sponsor: R. Holland Cheng, Ph.D.

Molecular & Cellular Bio

The Hepatitis E virus (HEV) is a non-enveloped, fecal-orally transmitted RNA virus. Genetically modified, non-infectious HEV nanoparticles (HEVNPs) conserve the native viral structural stability, antigenicity, and cell binding capabilities. Modification of HEVNP's surface allows conjugation for site specific targeting in vaccine delivery and imaging-guided cancer treatment. Additionally, therapeutics such as ferrite, DNA, RNA, and proteins can be encapsulated, making HEVNP a suitable oral delivery system that targets gut mucosa. One such application is encapsulating insulin to treat diabetes. Oral insulin delivery is challenged by enzymatic and pH degradation in the gut. Other oral insulin vectors lack sufficient bioavailability, however HEVNP could be more efficient because it naturally targets the liver, a major organ in glucose homeostasis. In vitro experiments were conducted to evaluate the stability of HEVNP encapsulating insulin by exposing them to extreme pH and enzymes, mimicking gastrointestinal conditions. Transmission electron microscopy (TEM) visually confirmed presence of intact particles, showing stability in physiological conditions. Development of this drug delivery platform would improve diabetics' lifestyles by providing an alternative administration route.

Benchmarking DFT Approximations in Predicting Thermodynamic Hydricities

Minh Nguyen

Sponsor: Lee-ping Wang, Ph.D.

Chemistry

Hydricity is a measure of a molecule's ability to donate a hydride ion and is an important factor in choosing and designing catalysts to reduce greenhouse gases like carbon dioxide. Computational methods can aid catalyst design by predicting thermodynamic hydricities. We are benchmarking various density functional theory (DFT) approximations and atomic basis sets for their ability to predict thermodynamic hydricities. Experimental hydricities are commonly determined using a thermodynamic cycle involving the hydride ion, but one of the major problems in the direct calculation of hydricities is the inability of current methods to accurately predict the solvation free energy of the hydride ion in solution. To circumvent this issue, a linear correlation between the free energy change of hydricity half reactions and experimental hydricities values is employed to predict hydricities. This work will assist in deciding which DFT functionals and basis sets are best for computational prediction of hydricities in catalyst design applications.

Enhancing Mesenchymal Stem Cell's Abilities in Wound Healing with Fluoxetine

Duc Nguyen

Sponsor: Roslyn Isseroff, M.D.
MED: Dermatology

In the United States alone, it is estimated that over 29 million people are diagnosed with Type II diabetes. A commonly found medical problem in diabetic patients is chronic non-healing wound. These chronic wounds critically damage patients' quality of life and often result in amputations. There is a desperate need for a new therapy. Our lab recently discovered serotonin, a pro-reparative neurotransmitter, is being produced by mesenchymal stem cells (MSCs). However it is difficult to work with as it is light sensitive and possesses a short half-life in vivo and ex vivo. Fluoxetine, a selective serotonin reuptake inhibitor, can be used to increase the presence of serotonin already found in abundance within platelets recruited to the wound by preventing its degradation. I hypothesize that fluoxetine increases cutaneous wound healing by enhancing re-epithelialization, a vital step in wound healing. I will investigate the effects of fluoxetine on migratory speed of neonatal human keratinocytes (NHK) in vitro and re-epithelialization in an ex vivo cutaneous wound healing model.

Feather Based In Vivo System to Monitor Immune Response in Japanese Quail (*Coturnix japonica*)

Leilani Nguyen

Sponsor: Kirk Klasing, Ph.D.
Animal Science

Immunology has been a particularly difficult area of research for avian science. Most experiments that are used to test the immunocompetence of birds often require euthanasia or holding birds in captivity which heavily alters the immune system. The purpose of this project is to develop a technique to study the immune response of wild birds in a non-invasive way. Using a growing feather shaft as a "live test tube" to measure immune response has been successfully performed with chicken feathers. The goal is to modify that assay using biochemical techniques to make it applicable to a variety of avian species. Protocol involved plucking primary feathers from Japanese quail (*Coturnix japonica*) and injecting each growing feather with different doses of antigens. The feathers were trimmed down, leaving the bottom shaft with the growing tissues. Immune response in the feather is determined by extracting RNA and converting to cDNA which is sequenced to see if feather transcribed immune response genes. Currently, we are in the stages of sequencing the DNA for analysis. Success with this experiment could provide avian researchers with an accurate, non-invasive way to measure the innate immune response of wild birds.

The Middle East in U.S. Media Representation: An Analysis of the Term "Mussulman" in the New York Times (1900-1909)

Yasaman Nourkhalaj

Sponsor: Suad Joseph, Ph.D.
Anthropology

The term "Mussulman" is one of the variations of the word Muslim that was used by the West. I examined 220 articles published from 1900 to 1909 and analyzed relevant articles where the term "Mussulman" was used by New York Times (NYT) correspondents. Many articles portrayed "Mussulmans" in a manner that was essentializing and homogenizing. For instance, there was evidence that "Mussulmans" were as diverse as Christians, but they were portrayed as if they were all the same. They were often portrayed as revolutionaries who caused war, terror, and displaced Christian communities. The NYT articles often portrayed them as instigators of disorder leading to anarchy in countries inhabited by "Mussulmans" including Turkey and Kosovo. The reports at times represented them as having fanatic convictions and menacing attitudes towards Christians in places like Macedonia. The NYT also reported that some "Mussulmans" were mutilated or killed by Christian forces from Bulgaria implying that those perpetrators of violence should be punished as well. I argue that fundamentally, the "Mussulman" status was reduced to "failure" of civilization. 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.

Challenges and Solutions to Actigraphy in a Population Based Study

Gilliane Nwafor

Sponsor: Leah Hibell, Ph.D.
Human Ecology

Actigraphy is a useful method of objectively recording sleep, and has been validated with the previous gold standard of measuring sleep, polysomnography. The California Babies Project is utilizing this method to study sleep in Mexican origin families in the greater Sacramento area. Mothers, fathers, and their children wear actigraphs - computerized devices worn on the wrist (parents) and ankle (infants and toddlers) - to record sleep and wake activity. Subjective data, including sleep and wake times, were collected via daily diaries using the phone application, Metricwire. Data were collected over a period of eight nights in the families' homes and then coded in the lab using Action4 software and validated scoring algorithms. The subjective and objective data were evaluated simultaneously in the coding process to accurately determine the quality and quantity of individuals' sleep periods. We aim to further describe the details of the coding process and address challenges and solutions in working with actigraphy.

Phosphorylation of TIMELESS Regulates its Function in the *Drosophila* Circadian Clock

Christopher Ochoa

Sponsor: Joanna Chiu, Ph.D.

Entomology/Nematology

The circadian clock, a highly conserved molecular mechanism, 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 repress their own transcription and other clock-controlled genes in a time-of-day specific manner. As a light sensitive protein, TIM plays an important role in allowing 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, 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 melanogaster* fly lines carrying mutations in TIM phosphorylation sites, mapped by Mass Spectrometry. Circadian activity assays and TIM protein analysis are currently 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 higher TIM levels in the day compared to WT, possibly due to decreased light sensitivity.

Spatial Navigation in Aging: Associations with Episodic and Semantic Memory Measures

Daisy Ochoa

Sponsor: Beth Ober, Ph.D.

Human Ecology

Deficits in both spatial navigation and episodic memory occur in normal aging. There are two neurocognitive systems for spatial navigation: one is based on navigation learning; the other is based on map learning. A pilot study, in which the training for spatial-location memory involved either navigation or map training, obtained a significant dissociation between age group and training task; older adults showed a marked disadvantage on a spatial-memory outcome test after navigation, but not map, training. This poster focuses on predictive relationships between neuropsychological test performance and spatial memory accuracy, in the older (EN) and younger (YN) participant groups from the above-described study. I predict that, in both groups, neuropsychological measures of episodic memory will predict performance on the route-based learning task while measures of semantic memory will predict performance on survey-based learning task. 24 ENs and 24 YNs, who were presented with computer-based map and navigation training, followed by the judgment of relative direction (JRD) task. The mean JRD error for each training task was correlated with the neuropsychological test scores. Only two correlations were found to be significant or approach significance. These findings are encouraging, and prompt a replication and extension study.

Beyond Racialization Theory and Immigration Identity in Two Films and Two Short Stories

Chiamaka Okorie

Sponsor: Moradewun Adejunmobi, Ph.D.

African American African Stds

This research examines Onoso Imoagene's *Beyond Racialization Theory* about second-generation Nigerian identity formation as it applies to fiction: two films (*Alaskaland* by Chinonye Chukwu and *Mother of George* by Andrew Dosunmu), and two short stories ("The Arrangers of Marriage" and "Things Around my Neck" by Chimamanda Ngozi Adichie). It is important to know how Black immigrant communities in the US are defining themselves. The goal is to interrogate the extent to which second generation Nigerians in the US depicted in the *Alaskaland*, *Mother of George*, "The Arrangers of Marriage", and "The Things Aorund my Neck" support Imoagene's *Beyond Racialization Theory*. The purpose is to observe how second-generation Nigerian identity is portrayed in two films and two short stories. Most prior research about immigrant identity formation as depicted in fiction focus on the straight line assimilation theory, segmented assimilation theory, and/or racialization theory. However, this research specifically focuses on how second generation Nigerian identity formation in the United States is depicted in fiction, and concludes that they support Imoagene's *Beyond Racialization Theory*.

Inducible Thermal and Hypoxic Stress Tolerance in Juvenile Chinook Salmon: *Oncorhynchus tshawytscha*

Lorenzo Ray Olano

Sponsor: Anne Todgham, Ph.D.

Animal Science

Increased temperatures and low dissolved oxygen (hypoxia) are prevalent in rivers, presenting issues to its inhabitants. Chinook salmon have physiological mechanisms to tolerate periods of elevated temperature or hypoxia but it is unclear how salmon can tolerate these stressors sequentially. Our goal is to determine whether fish can tolerate hypoxic and thermal stressors differently after a preliminary thermal shock. This follows inducible stress tolerance concepts of heat hardening, where an organism's ability to tolerate elevated temperature is increased after an initial exposure to a heat shock, and cross-tolerance where exposure to one stressor increases tolerance to a different subsequent stressor, due to mechanisms activated from the preliminary heat shock. Fish were exposed to an acute elevated thermal stress and following 24 and 72 hours of recovery, were exposed to either another thermal shock or a hypoxic shock. To assess stress tolerance, we increased temperature or decreased dissolved oxygen levels at a constant rate and recorded the temperature or oxygen saturation when fish lost equilibrium. Global climate change is increasing the frequency of acute elevated temperatures and hypoxic conditions. Our results investigate how Chinook salmon tolerate repeated acute stressors in their environment.

Indigenous Peoples of Oaxaca and Their Relationship to Maíz in the 21st Century

Jissel Olea Lopez

Sponsor: Ines Hernandez-Avila, Ph.D.
Native American Studies

From generation to generation, the knowledge and connection to maíz has been passed down through storytelling, the tending of the land and native gastronomy. However, throughout the years, there has been a shift in the connection and relationship that the different generations of Indigenous Peoples of Oaxaca have with maíz. This project considers of importance the shift in the relationship, connection and interaction Indigenous Peoples of Oaxaca have with maíz, across generations and borders, due to the continuous commodification of maíz and neoliberal policies. Indigenous Peoples of Oaxaca, who live in Oaxaca and California, are witnessing and experiencing the displacement of their communities and their native maíz, as well as the transnational migration of their native communities to the United States. Through a mixed methodology, as well as the inclusion of art as a form of praxis, the aim of this research is to highlight how interrelated the commodification of maíz, neoliberal policies and transnational immigration impacts the perception and interaction Indigenous Peoples' of Oaxaca have with maíz within the context of living in California and Oaxaca.

Classification of Vocal Responses to Social Isolation in Female Domestic Piglets

Mariah Olson

Sponsor: Kristina Horback, Ph.D.
Animal Science

Monitoring the vocalizations produced by livestock in commercial farming can be used to remotely assess the welfare of the animals. The domestic pig is an ideal candidate for this type of assessment as it is a highly social and vocal mammal. Previous studies have broadly described vocal behavior in swine as being either high frequency (>1000 Hz) or low frequency (<1000 Hz), but a standardized description of the vocal repertoire of domestic swine has yet to be established. The goal of this research is to identify and describe vocalizations produced by juvenile female piglets during a 5 min social isolation test in an unfamiliar arena. Vocalizations were classified according to acoustic and spectral characteristics such as peak frequency, duration, frequency range, and harmonics. Six vocalization types were identified (noisy grunt, high grunt, local grunt, croak, squeal, and scream). This study will investigate the relationship between call types and behaviors displayed (exploration, freezing, etc.) while isolated. Call rate and frequency of call bouts are expected to covary with arousal level, but frequency of call types is not expected to predict arousal level. This research could have far-reaching implications for the non-invasive assessment of commercial swine welfare.

Bioengineered Human miR-34a-Containing Prodrug Processed into Mature miR-34a in Canine Osteosarcoma Cells

Amanda Ormonde

Sponsor: Luke Wittenburg, D.V.M., Ph.D.
VM: Surg/Rad Science

MicroRNAs (miRNA) are small, 21 nucleotide molecules that have significant implications for cancer treatment. Many cellular processes are regulated by miRNA through direct binding to messenger RNA and inhibition of translation into functional protein. Through their role as oncogenes or tumor suppressors, miRNA may promote or inhibit formation of some cancers, respectively. In osteosarcoma (OS), miR34a is a putative tumor suppressor. Low cellular expression of miR34a may play a crucial role in the development of OS, and increasing expression of miR34a in OS cells may lead to tumor suppression. We aimed to develop a quantitative real-time polymerase chain reaction (qRT-PCR) assay to quantify miR34a expression in canine OS cells following in vitro treatment with a novel, miR34a-containing prodrug. We hypothesized that a genetically engineered human miR34a-containing prodrug will be processed into mature miR34a within canine OS cells following transfection. We found that canine OS cells transfected with the prodrug showed increased miR34a expression compared to untreated cells, which was associated with reduced proliferation. These results support the hypothesis that treatment with the prodrug results in formation of mature, functional miR34a. Increasing cellular miR34a expression may be developed as a novel therapeutic option in canine and human OS.

Effect of Transposable Element Copy Number on Maize Phenotypes

Ellen Osborn

Sponsor: Jeffrey Ross-Ibarra, Ph.D.
Plant Sciences

Transposable elements (TEs) are sequences that increase in copy number in the genome when they jump to new positions. TEs are universally present in plant genomes and, though generally thought to be junk DNA, can affect the expression of genes important for plant fitness. In this study, we use a well-characterized TE insertion in maize to investigate whether variation in TE copy number can impact gene expression. A TE insertion 65 kb upstream of the teosinte branched 1 (tb1) increases the gene's expression relative to maize's wild ancestor, teosinte. This TE copy from the Hopscotch family is found in all modern maize and is largely responsible for branching differences between teosinte and maize. Preliminary results show that the 30 analyzed inbred lines each contain from 1 to 3 copies of Hopscotch, that copy number is positively correlated with tb1 expression, and that maize lines with basal branching have lower Hopscotch copy number. Because expression of tb1 also acts through inflorescence phenotypes, we estimate copy number for 4,500 progeny of a mapping population to identify whether Hopscotch copy number affects phenotypes. Together, these results suggest variation in TE copy number can modulate gene expression of tb1 and resulting phenotypes.

Ecology and Phenotype of *Plantago lanceolata* Across a Latitudinal Gradient

Danielle Osborne

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. Our study uses the protocol of PlantPopNet, an international project which aims to develop theory about the spatial dynamics of plant populations using data from *P. lanceolata* from populations around the world. At our site in Davis, CA, we will measure traits including flower characteristics, phenology, and physical dimensions of plants along transects. We will also record density within square meter plots. We will then compare fitness-related traits of *P. lanceolata* between three locations along a latitudinal gradient (Davis, CA, Oregon, and British Columbia) and between the past three years of survey data. We will use statistical tests to analyze the differences between these data for each region and each survey year. Past years' results suggest that differences exist between phenotypic traits in each region, and we predict there will be variation among survey years. The results of this study can be used to demonstrate geographical variation in *P. lanceolata*, and baseline data allows us to ask questions in the future about the factors influencing these traits, including climate, herbivory pressure, and disease.

Density Dependent Effects at Different Life Stages of the Blue Milkweed Beetle

Geoffrey Osgood

Sponsor: Louie Yang, Ph.D.
Entomology/Nematology

In any given population of organisms, population numbers are intrinsically controlled by facilitation and competition between individuals for a limited pool of resources in the environment. Facilitation, sometimes referred to as positive density dependent fitness, promotes population growth by rewarding organisms that cooperate with increased survival and fecundity. Competition, also known as negative density dependent fitness, can lead to a decrease in population growth when resources necessary to sustain the population are in short supply. In this study, we tested to see if there are opposite density dependent effects on fitness between the adult and larval life stages of *Chrysomelids*. This was tested by measuring the fecundity of adult beetles on plants with differing population densities in the wild and in a greenhouse. In the larval stage, the survival rate of differing densities of beetles on a single plant was measured to determine fitness. Thus far, we found that the greenhouse reared adult beetles exhibit negative density dependence, while the wild adult and larval populations have not yielded statistically significant data due to unexpectedly small sample sizes. This study demonstrates negative density dependence in the adult stage of a novel system with great potential for further experimentation.

Use of Noninvasive DNA to Determine Genetic Subdivisions Among Ecoregional Coyote Populations in the Sierra Nevada

Julia Owen

Sponsor: Benjamin Sacks, Ph.D.
Veterinary Genetics Lab

Coyotes (*Canis latrans*) are generalist predators continuously distributed in California across a wide range of ecological landscapes. Their presence has been shown to impact population dynamics of specialist species with more restricted distributions. Previous data from 2011–2015 suggests coyotes occupy high-elevation portions of the Sierra Nevada range where a small population of an endangered species candidate Sierra Nevada red fox (*Vulpes vulpes nescator*; SNRF) occurs. However, it is unclear whether these high-elevation coyotes are part of a stable population, or transient individuals that opportunistically move upslope during years of low snowpack. To answer this question and determine whether the Sierra Nevada range is a significant factor structuring coyote populations, we noninvasively collected DNA from coyotes throughout the greater Sierra Nevada region, including the western slope, the high-elevation crest, and the east side. For a wider geographic reference, we also included samples from the western foothills and the Great Basin in Nevada. We used microsatellites to genotype the samples and analyzed them for subdivisions related to elevation and geographic region. We discuss implications of coyote presence and dispersal into SNRF range and propose further research steps.

Domain-Specific Expertise Modulates Target Representation

Alexis Oyao

Sponsor: Joy Geng, Ph.D.
Psychology

Theories of visual attention postulate an “attentional template” that contains the task-relevant information in memory during visual search tasks. Recent studies suggest the quality of attentional template affects the visual search performance. In this study, we investigated how an expert’s specialized knowledge affects attentional templates and visual search performance. We compared target-identification efficiency between novices and experts in two domains (cars, birds). Participants placed car and bird images together in an “arena” based on their judged similarity, then completed a visual search task. Each participant saw a cue image (e.g., a bird), then located the cued target (e.g., a different exemplar from same species) when paired with a distractor. In the arena task, experts paired the objects based on their correct taxonomy, whereas novices paired the objects based on superficial qualities such as viewpoint. These results confirmed experts have a precise representation of taxonomic structure of objects in their domain of expertise. In the visual search task, experts generalized objects based on their species (or make and model) instead of the specific image. This suggested the experts’ attentional templates are more flexible than that of novices, which shows that their robust attentional template relies on the breadth of their knowledge.

The Role of Aging in Recall CD4 T Follicular Helper Cells and Antibody Responses

Mansi Pai

Sponsor: Smita Iyer, Ph.D.
VM: Ctr Comparative Medicine

The immune response is critical for protection against infections. Upon recognition of antigens and costimulatory signals, naive T-cells differentiate into effector cells. After antigen clearance, effector T-cells undergo apoptosis, the cells that remain constitute immune memory. Memory cells recall their effector functions upon antigen restimulation and form the basis of vaccine-induced immunity. Impairment of immunity with age (immunosenesence) decreases the quantitative and qualitative aspects of immune response to infection. The most observable age-associated change is decrease in provision of costimulatory signals, necessary for optimal priming of the immune response. The inducible co-stimulator promotes T-cell activation, proliferation and differentiation, and is critical for T:B-cell interactions. While impaired priming of immune responses with age has been widely reported, little is known about how aging impacts recall T/B cell responses. In this study, we determined whether recall responses to the measles vaccine, was impaired with age in Rhesus macaques. The data show that despite age-associated decrease in levels of ICOS expression, the magnitude of the recall antibody and cellular immune response was not significantly decreased. Our findings suggest that lower threshold of costimulation for recall responses together with a robust immunogen platform may overcome immunosenescence.

Using a Mouse Disease Model and Western Blot to Determine the Role of the *Snord116* Deletion in Prader-Willi Syndrome

Rebecca Palmer

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

Prader-Willi syndrome (PWS) is a rare human genetic disorder that causes hyperphagia, obesity, shortness in stature, hypotonia, irregular sleeping patterns, and mild mental retardation (nih.gov). This disorder results from a deletion of the SNORD116 non-coding RNA (ncRNA) on the paternal copy of chromosome 15. SNORD116 has previously been found to regulate circadian genes and the epigenetic response to light exposure. To study this loss of Snord116, a mouse disease model was created; these mice resemble the metabolic and neurologic symptoms of the human disorder. In my portion of this project, we will be using western blots to analyze the levels of epigenetic proteins in the brains of the Snord116 knockout mice as compared to the wild-type littermates at different times of the day. The proteins we will be analyzing include MeCP2, Fox2, Gapdh, and RBBP5. The results of this and related studies will help form therapies and treatments for patients with Prader-Willi syndrome.

Photodegradation Rate Differences of Impurities in Nature-Identical Snow Crystals

Oliver Palmer

Sponsor: Cort Anastasio, Ph.D.
Land Air & Water Resources

Solutes in natural snow can be present in several different reservoirs, including the quasi-liquid layer at the air-ice surface boundary and the liquid-like regions at grain boundaries within the ice matrix. Previous research suggests that photolytic reaction rates are higher in the quasi-liquid layer than in the internal liquid-like regions or in aqueous solution, however this research was done using freezing techniques which do not mimic the natural formation of snow. To examine these reactions in snow with accurate natural structure, we first created snow through the nucleation of supersaturated water vapor at below freezing temperatures. We then deposited chemicals onto the snow surface in a stream of nitrogen gas, and illuminated the samples using a filtered arc lamp to simulate sunlight. We removed samples periodically and measured the chemical concentrations using high performance liquid chromatography (HPLC). With this, we relate the resulting concentrations to the illumination durations and calculate the reaction rate constants. Results thus far show evidence of increased reaction rates within the quasi-liquid layer compared to rates for the liquid-like regions and aqueous solutions. These unexpected results may provide valuable insights into the photodegradation of chemicals in snow.

Site-Specific Incorporation Azido-Phenylalanine and Fluorescent Labeling of RecBCD Enzyme to Understand the Chi-Induced Conformational Changes in RecBCD Enzyme

Xuankang Pan

Sponsor: Stephen Kowalczykowski, Ph.D.
Microbiology & Molec Genetics

RecBCD-mediated homologous recombination is the major DNA repair pathway in *E. coli*. RecBCD enzyme is a heterotrimeric protein complex comprised of RecC, RecB and RecD subunits. It binds to the broken dsDNA end, unwinds and degrades the dsDNA. During the DNA unwinding and degradation process, the RecBCD enzyme recognizes an octameric regulatory DNA sequence, known as Chi (Crossover hotspot instigator; 5'-GCTGGTGG-3'). Chi recognition attenuates the nuclease activity and also unravels the RecA loading function of the RecBCD enzyme. The Chi-dependent regulation of biochemical properties of RecBCD enzyme is attributed to its conformational change upon Chi-recognition. However, the structure-functional relationship is poorly understood. To understand the Chi-induced conformational changes in RecBCD enzyme, we site-specifically-incorporated unusual amino acids at desired positions on RecBCD enzyme. We chose RecB^{Q985}, RecB^{Q1011}, RecB^{Q1096} and RecB^{L1167}; and RecD^{K383} and RecC^{E195} to incorporate Azido-phenyl alanine (AzF). The incorporated AzF are labeled with Alexa-488 and Alexa-555 fluorophores to measure the Förster Resonance Energy Transfer (FRET) between the fluorophores. These fluorescently labeled proteins will be analyzed using single-molecule FRET experiments to determine the Chi-induced conformational changes and their correlation with altered biochemical properties of RecBCD enzyme.

Lighthouse Project: An Implementation of Machine Learning to Make Math Easy

Abha Pandey

Sponsor: Venkatesh Akella, Ph.D.

Elect & Comp Engr

Linear Algebra, or matrix manipulation, is used to solve a variety of problems. However, not every problem can be solved by hand. The Lighthouse Project aims to recommend linear algebra tool-solvers to users by employing supervised machine learning and parallelization. The recommendations were tested in two ways: using train-test-split on the datasets, and k-fold cross validation. Datasets were then fed into algorithms to determine predictions of good, bad, or fair. The algorithms used were: K-Nearest Neighbors, Random Forests, Voter Feature Interval, C4.5, LibSVM, BayesNet, and Alternate Decision Trees. For testing, the datasets were either split into 66% training data and 34% testing data, or implemented as 10 fold cross validation. Random Forests, Voter Feature Interval, C4.5, and ADTree showed the best results with train-test-split. Random Forest and Voter Feature Interval each had 66% predictor for the good class, 62% for the fair class, and 75-80% for the bad class. BayesNet and LibSVM on the other hand, only predicted a single class as the sole winner. K-Fold cross validations results were Voter Feature Interval and Random Forest predicted 23-48% for goods, 76-96% for fairs, and 54-89% bads.

Ethnic Differences in Social Anxiety: The Mediating Role of Face Concern

Joseph Pang

Sponsor: Nolan Zane, Ph.D.

Psychology

Previous research has found consistent differences in social anxiety among ethnic groups. Specifically, Asian Americans have a higher propensity to experience social anxiety than White Americans. The goal of the present study was to determine what explains these previously found ethnic differences. We administered a social anxiety questionnaire to a sample of 426 college students (256 Asian, 170 White) and confirmed that Asian Americans were more socially anxious than White Americans. Asian Americans also reported greater face concern, or interest in maintaining one's face or the face of others, than White Americans. Moreover, face concern significantly mediated ethnic differences in social anxiety. That is, Asian Americans reported higher face concern than White Americans, and individuals reporting higher face concern were more likely to be socially anxious. Our findings suggest that social distress may have different cultural bases; threats to face may generate a considerable amount of anxiety, particularly among Asian Americans. When Asian Americans present with a lot of social anxiety, it would be helpful for clinicians to focus on face-saving strategies to reduce their distress.

Food Waste and Ethno-Cultural Perceptions

Erika Pantoja

Sponsor: Luis Guarnizo, Ph.D.

Human Ecology

This project aims to understand the relationship between food waste and class & ethnicity. Specifically, it seeks to understand how food waste occurring at the point of distribution (i.e., retailer level) is perceived by employees. Studies demonstrate that consumers' wasteful behavior, lack of knowledge and education are important factors that make worsen the problem. However, no studies focus on the extent where retailers' policies determine when food should be disposed of or if those policies coincide with workers' own perceptions that examine the relationship between workers' sociodemographic characteristics, such as ethnicity, gender, and class position, and their own perceptions of food and food waste. How does food relate to workers' class position, gender and ethnocultural significance of food and food management? Data will be collected from two retailers in the San Francisco Bay Area: a branch of a corporate, big box store and a small size, minority-owned mini-market catering to an ethnic clientele. Ultimately, my hypothesis is that smaller stores, because of their status in the community as a provider of ethnocultural perceptions of the value of food, produce less food waste than a big box store who might have an interest in profit margin rather than food waste.

On Medical Ethics: A Virtue Theory Approach

Wesley Park

Sponsor: Jan Szaif, Ph.D.

Philosophy

(Promissory) Aristotelian virtue ethics has enjoyed a revival of modern scholarship. Among the so-called neo-Aristotelians, philosopher Rosalind Hursthouse has published *On Virtue Ethics*, an authoritative book on the normative framework of virtue ethics. In her account, Hursthouse expounds and defends the central topics of virtue, human flourishing (eudaimonia), rationality, and right action. Prior to this work, however, medical ethicists Edmund Pellegrino and David Thomasma published useful insights into how the virtues might benefit medical ethics and practice, which have remained relatively hidden in obscurity. My main project is to take the thesis that the virtues will benefit contemporary medical ethics, inspired by Pellegrino and Thomasma's arguments, and make improvements in light of Hursthouse's subsequent account of neo-Aristotelian virtue ethics. After I have done this, I will then test the novel thesis against a current bioethics issue, namely, the problem of medical volunteerism. But first, I will provide a sketch of neo-Aristotelian virtue ethics, noting some theoretical features that may offer good reasons for how the other two major rival ethical theories, consequentialism and deontology, might agree with virtue ethics by adopting a given feature.

Separate VS Common Mechanisms in Simple Perceptual Decision-making

Heui Hye Park

Sponsor: Timothy Hanks, Ph.D.

MED: Neurology

Decision-making is a fundamental function of our conscious brain. Here, we study a simple decision-making paradigm, where subjects have to decide when they detect different types of changes in a stochastic ('noisy') stimulus, in order to investigate if there is a common or separate mechanism for detecting different types of changes. In our experimental design, human subjects listen to a train of auditory clicks, with a starting average click-rate that either increases or decreases in various degrees. Subjects have to detect when the average click-rate changes within a time period and report in what direction. Based on the subjects' change detection and direction reports, we examined the timecourse over which subjects varied their focus on detecting increases and detecting decreases. Our experiments will allow us to examine whether strategies for detecting increases or decreases are correlated or independent. The nature of the correlations provide insight into whether these two decisions are supported by shared or distinct neural mechanisms. By studying the neural mechanism of how various types of information are represented and factored into how we decide and act, we can expand our knowledge of the computational processing that underlies our complex interaction with the world.

The Effects of Acitretin on the Reactivation of Latent HIV

Caroline Park

Sponsor: Guochun Jiang, Ph.D.

MED: Medical Microbiology & Imm

The Human Immunodeficiency Virus-1 (HIV) is a RNA virus which can hide in the body's reservoirs and subsequently remain latent. Because of this, the HIV is undetectable by the immune system during antiretroviral therapy (ART). There are latency-reversing agents (LRAs) which induce HIV reactivation and could purge the reactivated viruses with an additional killing strategy. Consequently, it has been reported that Acitretin, a retinoic acid (RA) derivative, was not only able to reactivate latent HIV, but also able to induce apoptosis of reactivated cells by augmenting retinoic acid-inducible gene I (RIG-I) signaling. However, controversial results of its ability as a "Shock and Kill" agent were also reported. Here, I found that Acitretin acts as a potent latency reversal agent in J-Lat A1 cells of the HIV latency model, thus indicating that the ability of Acitretin to reactivate latent HIV may be different among different latency models both in vitro and ex vivo.

Validation of Enhancer Elements within Human-Specific Segmental Duplications

Eileen Pascual Gutierrez

Sponsor: Megan Dennis, Ph.D.

MED: Biochem & Molecular Med

Human-specific segmental duplications (HSDs) are DNA regions that share high sequence homology to each other (>98%) arising uniquely within the human lineage. Several genes are located within these regions. While considerable research has addressed the functions of the duplicated genes, enhancers have largely been ignored. Enhancers are regulatory sequences of DNA that activate transcription of genes when specific proteins, transcription factors, are bound. We hypothesize that duplicated enhancers will have activity, which may be differential to the ancestral enhancers, when paralogs (derived duplicated DNA within species) are compared. Previously, we analyzed published ChIP-seq datasets of lymphoblast cell lines in humans to identify histone marks that are associated with active enhancer activity across HSD regions. Using these datasets, putative enhancers within duplicate paralogs were discovered. We used Gateway cloning to validate these identified regions by generating luciferase reporter constructs. Experiments are ongoing to transfect plasmids into human HeLa cell lines. Functional enhancer constructs will show increased luciferase activity. To test our hypothesis, we will compare enhancer strength between putative enhancers from different paralogs testing for differential activity. Validation of these enhancers and their target genes can be used to further study the impact of duplications in gene regulation.

Do In-Class Distractions Associated with Cellphone Notifications Influence Recollection- or Familiarity-Based Memory?

Ilse Pastor

Sponsor: Andrew Yonelinas, Ph.D.

Psychology

Imagine you are attending lecture and suddenly, your cellphone musters a new notification. In what seems a split second, of receiving and attending to the notification, the lecture continued. But, what type of information from lecture are you most likely to forget? We previously conducted a study mimicking the classroom setting to examine the association between technology breaks (i.e., designated lecture breaks for students to check cellphones) and academic performance, when receiving text messages during lecture. We found that students who are aware of a designated break scored higher on average ($M = 76.67\%$) on lecture exams than students who were not aware of an undesignated break ($M = 69.06\%$). This study addresses what type of memory is most affected by cellphone distractions: recollection or familiarity. We expect that students in the tech break group will score higher on recollection than students in the non-tech break group, meaning that the tech break group will remember the lecture in greater detail than the non-tech break group. This research will further our understanding of the types of memory that are affected by cellphone notifications and will allow us to solidify understanding about the effectiveness of technology breaks to alleviate forgetfulness in class.

Nitrogen Footprint of UC Davis

Shona Paterson

Sponsor: Benjamin Houlton, Ph.D.
Land Air & Water Resources

Reactive nitrogen is an integral part of human life and ecosystems. An excess of this resource contributes to a wide range of environmental and human health problems including worldwide declines in biodiversity, climate change, and compromised air and drinking water quality. A nitrogen footprint provides a standardized measure for the amount of reactive nitrogen released by an entity, such as a university, thereby guiding opportunities for reductions in excess nitrogen emissions. The Sustainability Indicator Management and Analysis Platform (SIMAP) developed by the University of New Hampshire Sustainability Institute will calculate both the nitrogen footprint and carbon footprint of UC Davis. We present the nitrogen footprint results for major sectors at UC Davis: food, utilities, transportation, research, and wastewater. The updated results add new data that contributes to a more complete accounting of upstream and downstream losses of reactive nitrogen. This quantitative measurement, as well as the predictive scenarios and projections provided by SIMAP, will aid in the formation of future abatement targets and sustainable management actions for nitrogen at UC Davis.

BDNF Predicts Retreat-Related Increases in Telomere Length in Experienced Meditators on Retreat

Cavan Patterson

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

Brain-derived neurotrophic factor (BDNF) is a modulatory neuroprotein involved in learning, memory, and higher cognition. Low levels of BDNF are implicated in anxiety, depression, and emotional exhaustion. A recent, uncontrolled study by Cahn et al. (2018) found increased plasma BDNF during a 3-month retreat involving yoga and meditation. We extend this finding by examining plasma BDNF in participants before and after a 1-month Insight meditation retreat (n=28), compared to a control group (n=34), similar in age, gender, and meditation experience. We found a significant group difference such that retreat participants had lower levels of BDNF than controls, but no retreat-related changes in BDNF were found. These results suggest that the yoga component may have contributed to the BDNF increases observed by Cahn et al. Further work is needed to verify this hypothesis in a controlled and randomized study comparing a meditation-only retreat to a retreat with both meditation and yoga.

Nitrogen Footprint of UC Davis

Kami Peer

Sponsor: Benjamin Houlton, Ph.D.
Land Air & Water Resources

Reactive nitrogen is an integral part of human life and ecosystems. An excess of this resource contributes to a wide range of environmental and human health problems including worldwide declines in biodiversity, climate change, and compromised air and drinking water quality. A nitrogen footprint provides a standardized measure for the amount of reactive nitrogen released by an entity, such as a university, thereby guiding opportunities for reductions in excess nitrogen emissions. The Sustainability Indicator Management and Analysis Platform (SIMAP) developed by the University of New Hampshire Sustainability Institute will calculate both the nitrogen footprint and carbon footprint of UC Davis. We present the nitrogen footprint results for major sectors at UC Davis: food, utilities, transportation, research, and wastewater. The updated results add new data that contributes to a more complete accounting of upstream and downstream losses of reactive nitrogen. This quantitative measurement, as well as the predictive scenarios and projections provided by SIMAP, will aid in the formation of future abatement targets and sustainable management actions for nitrogen at UC Davis.

The Effects of Increased Prolactin on Glucose and Lipid Metabolism in Gestating and Lactating Gilts

Izabella Pendergast

Sponsor: Russell Hovey, Ph.D.
Animal Science

Pregnant mothers become partially insulin resistant to divert glucose as energy to the fetus. However, maternal insulin resistance can lead to gestational diabetes (GDM) and increased risk for fetal skeletal malformations and dystocia. The window of pregnancy also helps prepare for the subsequent lactation, which depends on the pituitary hormone prolactin (PRL). Prolactin also promotes β -cell proliferation in the pancreas and its secretion of insulin. Dopamine antagonists such as metoclopramide (MET) and domperidone (DOM) increase serum PRL, where our lab showed that DOM increased milk production by pigs receiving DOM during pregnancy. I hypothesize that pregnant pigs treated with MET will have increased insulin levels leading to glucose tolerance and lipolysis. Pregnant gilts were treated with either MET or control from d90-110 of pregnancy. A jugular catheter facilitated blood sampling over time. An oral glucose tolerance test allowed changes in circulating glucose to be monitored from -15 to +180 minutes after ingestion of corn sugar. Plasma was collected through pregnancy and lactation and are undergoing analysis. Fat mobilization will be measured through plasma glycerol using an absorbance assay. Understanding how PRL regulates insulin secretion in pregnant mammals, including humans, will help towards treatments for GDM.

Measuring Early-Age Cracking of Concrete Through a Restrained Ring Test

Chantal Peng

Sponsor: John Bolander, Ph.D.
Civil & Environmental Engr

Concrete is a widely used construction material in developing infrastructure. However, its lasting strength is often compromised by early-age shrinkage cracking. Factors such as the temperature in time of curing and the hydration of the mix cause such cracking. A Ring Test will be performed in order to determine the age at cracking and the induced tensile stress characteristics of the concrete. In the laboratory, concrete is compacted in between two ring molds in which the outer ring maintains the ring shape of the fresh mix and the inner steel ring provides shrinkage resistance. The outer ring is removed after initial curing occurs to allow the ring to be unrestrained from the outside. In order to simplify the concrete model, coarse aggregate will be replaced by soda lime glass spheres. Over time, the concrete is expected to shrink and crack, providing continuous strain data to enable the determination of the effects of shrinkage cracking on the concrete.

Boronic Acids as Hydrogen-Bonding Catalysts

Alma Perez

Sponsor: Annaliese Franz, Ph.D.
Chemistry

Catalysts based on organic molecules with hydrogen-bonding groups are important to investigate because these metal-free catalysts can accelerate the rate of a reaction using mild conditions and reduce the waste produced in a chemical process. The goal of my research is to evaluate boronic acids as hydrogen-bonding catalysts for organic synthesis and understand the binding interactions responsible for catalysis. Various aryl boronic acids have been determined to be effective catalysts to promote the addition of nucleophiles to trans-b-nitrostyrene. A comparison of the reactivity of several nucleophiles has been performed. To understand the interactions between the catalyst and the substrates, binding studies were conducted utilizing ^{11}B , ^1H , and ^{19}F NMR spectroscopy. The results from the binding studies have demonstrated evidence of H-bonding interactions and show that the boronic acid can interact with the nucleophile as well as the electrophile, and the interactions between the catalyst and substrate increase as the concentration of the boronic acid is increased. The knowledge gained from this research will promote the design of new hydrogen-bonding catalysts and supramolecular synthons with applications for the synthesis of organic molecules and polymers.

Characterizing Critical Highway Underpasses for Wildlife Conservation

Paola Perez

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

Impervious roads and structured highways pose obstacles for conserving the integrity of continuous natural habitats. The Visual and Noise Pollution (VAN) project investigates the effects of indirect road disturbances, such as light and noise, that threaten the likelihood of sensitive species to thrive among modern traffic structures. Sensitive species are wildlife particularly susceptible to population loss and distribution decrease due to habitat fragmentation. The VAN project recorded retreat behaviors at 19 underpasses along the 5, 280, 680 and 80 California highways. Statistical models concluded that sensitive species were unlikely to cross underpasses with high noise volume. We aim to support these findings by correlating percent land cover for a 100m radius buffer zone at the 19 sites to support predictions that noise and light attenuation are effected by vegetation proximity. Utilizing 16-class land cover data from the NLCD, spatial resolution of 30m², our GIS model criteria will narrow conservation efforts to "Critical Highway Underpasses", aka highways lacking vegetation cover. Management recommendations for noise and light barriers for specific bridges in the VAN project will be made to CalTrans. Further, findings will advance understanding of species movement in urban environments and aid in future road ecology research and wildlife management.

The Elastic Constants of Intercalated Bismuth Selenide as Determined by Brillouin Scattering

Russell Perry

Sponsor: Kristie Koski, Ph.D.
Chemistry

2D nanomaterials such as bismuth selenide are of rising interest in solid state physics due to their uniquely tunable electronic and physical properties. Bismuth and selenide form alternating layers in sets of five, with selenide at the outermost layers. The quintuple-layers then stack selenide-to-selenide, separated by a van der Waals gap, to form a nanoplate. The van der Waals gap is the source of 2D materials' tunable properties, as it can be intercalated with zero-valent heavy metals, semi-metals, and semiconductors to change the elastic and electronic properties of the material. To determine the elastic constants, we synthesized bismuth selenide nanoplates, then intercalated the plates either by tin chloride reduction or by decomposition of zero-valent coordination compounds. The unintercalated and intercalated bismuth selenide was then scanned in a custom Brillouin scattering spectroscopy apparatus at various excitation and collection angles to determine the phonon energies of the transversely isotropic material. From the phonon energies, the elastic constants, sound velocity, Poisson's ratio, and other bulk material properties were determined.

The Effects of Anxiety and Depressive Symptoms on Episodic Memory and Hippocampal Volume in Children

Rachel Petrie

Sponsor: Simona Ghetti, Ph.D.
Psychology

The present study was aimed at investigating the relation between anxiety and depressive symptoms in children and episodic memory and hippocampal volume. A sample of 170 children between the ages of 7 and 11 years were assessed three times over a five year period. Data analysis is ongoing and we predict that higher levels of anxiety and depressive symptoms will be associated with smaller hippocampal volumes and lower levels of episodic memory functioning. This prediction is supported by pre-existing literature on similar studies which generally focus on either the relation between anxiety or depressive symptoms and hippocampal volume or on the relation between these symptoms and episodic memory, but not the relationship between all three. Many related studies have been conducted on adult samples but because this study focuses on children, perhaps the results will increase motivation to improve mental healthcare for children which could indirectly impact their academic achievement.

Motor Development as it Relates to Mental Rotation During Infancy

Lindsey Phillips

Sponsor: Lisa Oakes, Ph.D.
Psychology

Independent sitting is an important milestone in infant development that affords infants the opportunity to grasp and manipulate toys, influencing their ability to explore the properties of objects in their environment. Mental rotation, or the ability to manipulate visual representations of objects, also develops during infancy. Since cognitive abilities do not emerge in isolation, we are interested in measuring the relationship between mental rotation and motor development across different age groups. To assess this, we are testing infants in a replication study of a mental rotation change detection task and measuring infants' motor development during a play session using the Alberta Infant Motor Scale (AIMS). We predict that infants who show a greater level of mental rotation in the task will also show more advanced motor development, reflected by the AIMS score. Knowing how sitting and crawling influences cognitive abilities will further our knowledge about the interplay between these two areas of development.

Personality-Dependent Agonistic Interactions and Web Theft in Black Widow Spiders

Sharon Pneh

Sponsor: Andrew Sih, Ph.D.
Environmental Science & Policy

An animal's behavior in response to habitat disturbance can determine its survival and fitness. Western black widow spiders (*Lactrodectus hesperus*) form unusually dense populations in suburban cities, likely due to the abundance of prey. In turn, these urban species experience high competition for living space, exacerbated by human activity that disturbs webs. Consistent differences in an individual's behavioral tendencies, otherwise known as its personality, may affect a web-less spider's decision to either rebuild or steal another's web. We hypothesize that differences in personality not only influence a spider's decisions to leave her web and to usurp another's, but also her likelihood of a successful web-theft attempt. After assessing 66 adult females for aggression towards a prey cue and for boldness in response to a predator cue, we observed the pairwise interactions between spiders following the destruction of the focal spider's web. Thus far, we found that bolder spiders are more likely to approach their neighbors after their webs are destroyed. In addition, if a spider is more aggressive than her opponent, she is more likely to usurp or defend a web successfully. Our study suggests that consistent urban disturbance may create selective pressures for more aggressive black widows.

Seeking Help for Mental Health Issues: The Relationship Between Individual Characteristics and Social Support in College Students

Stephanie Pomales

Sponsor: Heather Hether, Ph.D.
Communication

In recent years, mental health issues have become less stigmatized and talked about more often. There has also been an increase in the number of Americans who access mental health care services. Among college students, a population vulnerable to mental health issues, more than ever before have started to reach out for help from university health services, making the topic important and timely to address. Prior research has indicated that the availability of social support is associated with good mental health among college students. Although there have been previous studies on mental health and social support, this study will add to the literature by examining how individual characteristics of college students are associated with social support. More specifically, a survey of university students will examine how individual characteristics, such as health self-efficacy, motivation, and extroversion are associated with students' perceptions of availability of social support, and actual support received, for mental health issues. The findings for this study will contribute to research on mental health issues in college students. It will also help universities better understand which populations are particularly vulnerable to untreated mental health issues.

Investigating the Role of ATG8 Mediated Autophagy During Plant Immune Response

Ronni Ponek

Sponsor: Savithramma Dinesh-Kumar, Ph.D.
Plant Biology

Autophagy is one of the fundamental process for degrading and recycling cellular components in most eukaryotic cells. Cells can recycle their contents via sack-like vesicles; called autophagosomes, which can transport their components to the lysosome or vacuole for degradation. It is important in many aspects of cell life, including defense, reproduction, metabolism, and plant development. Autophagy is a bulk degradation process that can recycle damaged, aggregated proteins or organelles. It can also be highly selective in targeting specific cargo and protein complexes. Autophagy related genes (ATG) is a large family of proteins that play critical roles in the process of autophagy. ATG1 kinase is one of the main players that phosphorylates ATG13 and functions at multiple levels to mediate and adjust autophagic signaling. ATG8 functions in recruiting cargo and formation of autophagosomes, and is therefore central in the degradation pathway of autophagy. GFP tagged ATG8 has been used extensively to study mechanistic detail of autophagy function. Here I present my findings related to mechanistic details of autophagy and how it is manipulated during plant defense using ATG8-GFP transgenic plants.

Anemones or Enemies? Aggression and Range Shifts of Two Sea Anemones at Bodega Marine Laboratory

Maxine Pontius

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

Global climate change often leads to species' ranges shifting poleward as temperatures rise. The purpose of our project was to evaluate the increasing abundance of the southern sea anemone *Anthopleura sola* along the coast at Bodega Marine Laboratory and to examine its interaction with the more northern *Anthopleura xanthogrammica*. There is little understanding of individual-level interactions between these species and the consequences of these interactions for community structure. We performed several observational field studies in which we counted and measured anemones along a section of the shore, recorded temperature, and measured water flow. We also carried out laboratory experiments in which we measured the aggression between and within the two species. We found that the local abundance of *A. sola* has increased dramatically since 2013. Furthermore, *A. sola* was much more aggressive than *A. xanthogrammica* in laboratory trials. The effects of climate change on species' ranges can be exacerbated by agonistic behaviors, especially when two species compete for shared resources. Coupled with the increased abundance of *A. sola* in Northern California, agonistic behavior could force *A. xanthogrammica* further north or into less desirable habitat. This shift could have negative effects on the ecosystem and interactions with other species.

Differences in Ethnically Modulated Heritability of Systemic versus Inflammatory Markers in a Healthy, Family-Based Cohort

Nishant Prakash

Sponsor: Enkhmaa Byambaa, M.D., Ph.D.
MED: Div Of Internal Med

Inflammation is tightly correlated with atherosclerotic cardiovascular disease, a leading cause of death in the U.S. Presently, the genetic heritability of inflammatory biomarkers is poorly understood, especially considering ethnic variability. To differentiate between genetically heritable or environmentally-induced inflammation, we studied a family-based cohort of 82 Caucasian and African-American parent-offspring quartets for five systemic inflammatory biomarkers and three localized, vascular inflammatory biomarkers. Systemic inflammatory biomarkers included C-reactive protein (hsCRP), fibrinogen, serum amyloid A (SAA), haptoglobin and α -acid glycoprotein (AGP). Vascular inflammatory biomarkers included pentraxin-3 (PTX-3), sICAM-1 and sVCAM-1. Our results indicated that in Caucasian families, SAA, fibrinogen, AGP, haptoglobin, sICAM-1 and sVCAM-1 were heritable between parents and children, while in African-American families, hsCRP, SAA, AGP and sICAM-1 were heritable. These results show important differences in heritability of specific inflammatory biomarkers between Caucasian and African-American families. Furthermore, African-American families had an overall higher heritability for systemic and a lower heritability for vascular inflammatory biomarkers than Caucasian families. Therefore, consideration of ethnic variations in genetic heritability of systemic and vascular inflammatory biomarkers, contrary to environmentally-induced, may be important in clinical setting and needs further study.

Variation in Cortical Oxytocin Receptor Density in Voles With Differing Amounts of Parental Care

Allison Proffitt

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 and neuronal connections, and differences in 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. We know that oxytocin receptor (OXTR) expression in the prairie vole cortex--the part of the brain responsible for complex social behaviors--is highest in regions that are involved in multisensory integration. In this project, we use autoradiography to quantify and compare OXTR expression in the cortex of prairie voles that received different amounts of parental care. The results of this study will give us insight into how early experience can influence brain organization.

A Multi-Stressor Study: The Effects of Temperature and Feed Restriction on White Sturgeon (*Acipenser transmontanus*)

Bryan Puentes

Sponsor: Anne Todgham, Ph.D.
Animal Science

Like many aquatic ectotherms, white sturgeon (WS) have an optimal thermal range for growth (16-18°C); however, anthropogenic perturbations, such as cold-water (~11°C) releases from reservoirs, can reduce temperatures as a conservation effort to provide a suitable thermal environment for other species. This decrease in temperature together with foraging limitations experienced by sturgeon in nature may have detrimental effects on early-life growth. To investigate how simultaneous exposure to these stressors impact WS growth and stress tolerance, we measured specific growth rate and heat tolerance (critical thermal maximum, CT_{max}) of WS reared in four treatment groups for six weeks: 18°C (control temp), 100% optimal feed rate (OFR); 18°C, 40% OFR; 11°C, 100% OFR and 11°C, 40% OFR. There was a synergistic interaction between cold temperature exposure and food restriction on growth. Simultaneous exposure to these stressors resulted in an 80.6% reduction in growth rates, which translated into a 7-fold decrease in body size in treatment fish. Acclimation temperature affected CT_{max} (~2°C higher in 18°C acclimated larvae compared to 11°C acclimated larvae) but feed restriction had no effect. These findings highlight the unpredictability of stressor interactions and the importance to further examine multiple stressors for managers to minimize their threat on WS.

Numerical Solutions of Ordinary Differential Equations

Michael Puso

Sponsor: Mohamed Hafez, Ph.D.
Mechanical & Aerospace Engr

Many of the mathematical systems governing the world's greatest technical issues have no known exact solution. Numerical methods grant the ability to solve systems of differential equations which have no simple analytical solutions by creating precise approximate solutions. The simple, yet versatile nature of numerical methods allow them to be used in complex simulations of aerodynamic and heat flows, buckling and bending, chaos, and many other physical phenomena. This study focuses on the framework and theory of initial value (IVP), boundary value (BVP), and eigenvalue (EVP) problems pertaining to systems of linear and non-linear ordinary differential equations (ODE). We will solve the differential equations governing the elementary functions in order to test the relative stability, accuracy, and efficiency of finite difference and predictor-corrector schemes for IVP's. Next, the accurate schemes will be applied to more complex problems such as mass-spring-damper systems, resonance and beating phenomena, chaotic systems described by Duffing and Van der Pol equations, and Hopf bifurcation and hysteresis cycles. Finally, methods such as Gaussian elimination and Thomas tridiagonal algorithms will be applied to solve BVP and EVP applications such as catenaries, Poiseuille flows, viscous shock layer problems, and lastly, beam buckling problems.

Development of a Photocatalytic Titanium Dioxide Encapsulating Bacteriorhodopsin

Phung Quan

Sponsor: Marjorie Longo, Ph.D.
Chemical Engineering

Crystalline titanium dioxide (TiO₂) is a popular photocatalyst that is used to produce hydrogen when using UV irradiation to split water. However, since UV light consists only 5% of full solar spectrum, it restricts the direct use of TiO₂ as a photocatalyst. Therefore, by modifying the surface of TiO₂ using light-activated dyes, a sensitized amorphous TiO₂ that extends the absorption in the visible light spectrum is created. The dye molecules can inject electrons to conduction band and rise the overall photocatalytic efficiency, but inorganic dyes are not environment-friendly. Instead, Bacteriorhodopsin (BR) is entrapped in TiO₂ porous matrix. Bacteriorhodopsin (BR), acting as a proton pump across the membrane, in connection with TiO₂, increases the observed photocurrent density and hydrogen production. Therefore, a bio-friendly sol-gel amorphous TiO₂ is developed to maintain its photocatalytic activity. A final goal is to be able to produce hydrogen since hydrogen is potentially a new source of fuel.

Improved Methods for the Isolation of Thermotolerant Bacteria From Cheese

Zachary Quart

Sponsor: Maria Marco, Ph.D.
Food Science & Technology

Milk contains complex microbial populations that are essential for the production of fermented dairy products, but certain contaminant bacteria also result in costly defects. Current research shows that thermotolerant and endospore-forming bacteria in milk are correlated with spoilage development, a defect observed during cheddar cheese production. This study aims to develop a suitable method for isolating contaminant bacteria from milk and cheese, while also inactivating the abundant starter bacteria *Lactococcus lactis*. Because starter bacteria outnumber contaminant bacteria 1000:1, this presents a challenge to the enrichment of low-abundance contaminant bacteria. This was confirmed upon applying the standard protocol for contaminant isolation (12 min, 80°C) to inactivate *L. lactis* cells. In this study, we are testing variations of this protocol by increasing the length of time at 80°C and exposing cells to a cocktail of SDS, lysozyme, and NaOH to improve *L. lactis* killing. These methods are being validated by ensuring that *Bacillus subtilis* endospores are not inactivated. Outcomes of this research will be used to improve the isolation of contaminant bacteria from cheese and ultimately ensure better cheddar cheese quality.

Measuring Early-Age Cracking of Concrete through a Restrained Ring Test

Melissa Quintana

Sponsor: John Bolander, Ph.D.
Civil & Environmental Engr

Concrete is a widely used construction material in developing infrastructure. However, its lasting strength is often compromised by early-age shrinkage cracking. Factors such as the temperature in time of curing and the hydration of the mix cause such cracking. A Ring Test will be performed in order to determine the age at cracking and the induced tensile stress characteristics of the concrete. In the laboratory, concrete is compacted in between two ring molds in which the outer ring maintains the ring shape of the fresh mix and the inner steel ring provides shrinkage resistance. The outer ring is removed after initial curing occurs to allow the ring to be unrestrained from the outside. In order to simplify the concrete model coarse aggregate will be replaced by soda lime glass spheres. Over time, the concrete is expected to shrink and crack, providing continuous strain data to enable the determination of the effects of shrinkage cracking on the concrete.

Schizophrenia-Associated SNP variants in the CACNA1C Gene

Diana Quintero

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

Schizophrenia (SCZ) is a disorder that affects an individual's ability to think, feel, and behave. Genetics plays an important role in SCZ risk. There are many single nucleotide polymorphisms (SNPs), or one base-pair genetic variations commonly found across human population and some of these are associated with disorders. The SNPs we studied for SCZ are found in a single intronic region of CACNA1C, a gene that encodes a calcium channel subunit. Intronic regions were chosen as they are understudied compared to exonic regions even though the genome is only approximately 1-2% coding. The SNPs are contained in putative enhancers, a class of regulatory DNA elements that promote gene expression. Mutations in these regions can cause a change in the level of protein; we are interested as to whether the potential SCZ-associated sequence variants of the CACNA1C enhancers alter the ability of them to drive gene expression. To measure this we will be using a dual-luciferase reporter assay system to assess if the SNPs are within enhancer regions of DNA and compare their ability to drive reporter gene expression.

Influence of N-acetylglucosaminyltransferase V N-Linked Glycans on the Molecular Dynamics of Human Integrin $\beta 1$

Alejandra Quiroz Alonso

Sponsor: Fernando Fierro, Ph.D.
MED: Cell Biology & Human Anat

N-Linked glycosylation is a diverse post translational modification of extracellular proteins that adds highly structured carbohydrates to select amide nitrogens of asparagine—in the Asn-X-Ser/Thr consensus sequence, where X is not Pro. It has become evident that N-linked glycosylation is necessary for the dimerization of Human Integrin $\beta 1$ with other integrins. Aberrant N-glycosylation has been associated with reduced integrin clustering, increased cell migration, and more generally with a cancerous phenotype. Selective glycosylation of proteins is not yet feasible, which makes it difficult to study the effects of specific glycans. In this study we focus on the effects of N-acetylglucosaminyltransferase V (GnTV)- triantennary glycans on Human Integrin $\beta 1$ through molecular dynamics using AMBER16. We focus on both the protein and the glycan conformations by comparing a total of 1.5 microsecond trajectories of necessary glycan variants--biantennary and triantennary. Our results demonstrate that GnTV-triantennary glycans have a preferential conformation that is significantly different than that of biantennary glycans. Furthermore, these preferential conformations effect the conformation of Human Integrin $\beta 1$. This study suggests that the structure of N-glycans may result in the aberrant integrin clustering and cell migration through changes in the conformation of Human Integrin $\beta 1$.

Mesenchymal Stem Cells Over-Expressing IL-10 for the Treatment of Osteoarthritis

Brian Radut

Sponsor: Fernando Fierro, Ph.D.
MED: Cell Biology & Human Anat

Osteoarthritis (OA) is a debilitating disease currently without any effective treatment. It occurs in joints, like hip and knees, where cartilage breaks down leading to pain, stiffness and swelling. Mesenchymal stem cells (MSCs) have been used to treat conditions of other diseases due to their ability to replace damaged tissue and reduce inflammation. Complementing MSC treatment with gene therapy could allow for a multi-faceted solution through regenerating deteriorating tissue while inhibiting immune-inflammatory response to subdue pain and swelling. Both, Interleukin-1 Receptor Antagonist (IL-1RA) and Interleukin-10 (IL-10) are cytokines which primarily have an anti-inflammatory effect. FGF-2 is a well-known mitogen for MSC that promotes cell survival and inhibits cell deterioration. Our experimental approach is to compare the autocrine effects of over-expressing IL-1RA, IL-10, and FGF-2 in MSCs and their paracrine effects in-vitro on activated peripheral blood mononuclear cells (PBMC). We examined the autocrine effect at two levels, proliferation and tri-lineage differentiation. Over-expression of FGF-2 significantly affected all these parameters while over-expression of IL-1RA and IL-10 showed no autocrine effect. However, over-expression of IL-10 clearly increased the immune suppressive ability of MSCs. These results suggest that MSC and gene therapy approaches could be combined to exert a more potent treatment for OA.

Proteasome Activity in Akita Mouse Liver

Sahar Rahgozar

Sponsor: Aldrin Gomes, Ph.D.
Neuro Physio & Behavior

Ins2Akita mice are used as a mutant mouse model for type I diabetes. Type I diabetes is associated with high mortality rates, and no long term treatment currently exists. Due to the autosomal dominant mutation in the insulin 2 gene that results in misfolded proteins, Akita mice develop pancreatic β cell failure, and they exhibit symptoms such as hyperglycemia and hypoinsulinemia, which are substantially worse in the male mice than in the female mice. The proteasome is the main proteolytic enzyme in most cells, and the 26S proteasome is essential in regulating biochemical mechanisms such as DNA synthesis, repair, and cell signaling transduction. Consequently, impairment of the ubiquitin proteasome system contributes to the pathogenesis of disease. For this project, we purified the 26S proteasome from livers of male Akita and wild-type mice utilizing an affinity based method. The purified proteasomes were quantified and diluted to the same concentrations, and the proteolytic activity of the proteasomes is currently being measured.

Mating Preferences in Re-Pairing Leach's Storm Petrels

Ananya Rai

Sponsor: Gabrielle Nevitt, Ph.D.
Neuro Physio & Behavior

The Leach's storm-petrel (*Oceanodroma leucorhoa*) is a small, burrowing seabird that mates for life. Our lab has been investigating the mating system of this species on Bon Portage Island off the coast of Nova Scotia for the last decade. Our work focuses on how the MHC (Major Histocompatibility Complex) class IIB plays a role in mate-choice. We have previously established that this is a male-choice system, and that males tend to avoid females that are homozygous at a particular MHC class IIB locus (DAB-2). Although pairs mate for life, it is possible for a bird to lose a partner if that partner dies at sea, and we have a sufficiently large sample size (over 600 pairs) to examine questions related to re-pairing. I hypothesized that newly single adults choose to re-pair with mates that are more heterozygous than the partner that was lost. To test this hypothesis, I am using molecular techniques to sex and genotype targeted birds at the DAB-2 locus. I predict that males should re-pair with females to maximize heterozygosity. Results will increase our knowledge which could help in future preservation attempts for seabirds.

Amtrak Travel Research Podcast

Sharani Ramesh

Sponsor: Daniel Melzer, Ph.D.
University Writing Program

This research project explores the various benefits and protocols present while taking the Amtrak train from San Jose Diridon station to the Davis station. I have created a research-based podcast in order to explain the benefits of Amtrak travel for UC Davis students and others who commute to Davis from San Jose and other stops on the Capitol Corridor route. UC Davis student body contains a large number of students who live in places that this train route covers and therefore this podcast attempts to provide students with another option to reach their destination. During the course of this project I have engaged in participant-observer research, journeying on the Amtrak myself as well as taking notes in the process. From this podcast, one can learn about the different stops that this train picks up passengers from, what food is offered on the train, what sights can be seen, and finally how convenient and comfortable the train journey is overall as opposed to just driving from San Jose to Davis.

Film Optimization and Study of Charge Transfer in Copper Vanadate

Andrew Ramirez

Sponsor: Frank Osterloh, Ph.D.
Chemistry

The alpha form of copper vanadate (CVO) shows much promise for a water splitting catalyst. Because copper vanadate has a small band gap around 2 eV, it has the potential to be a good visible region photoanode. Copper vanadate's charge transfer properties have not been thoroughly studied nor maximized. Surface photovoltage spectroscopy (SPS) is one unique way in which we can learn about charge transfer in CVO as a photoanode. The goals of this project were to maximize absorption by optimizing film-making conditions and to observe charge transfer by measuring surface photovoltage. This study will provide the most efficient way to prepare a copper vanadate film via the drop casting method and observe the maximum contact potential difference. Copper vanadate's charge transfer is most effective when concentration is 5mg/mL, the film is annealed at 500°C, and the film thickness is 4100 nm. In future experiments, copper vanadate will be fully measured with techniques including SPS, Diffuse Reflectance Spectroscopy and profilometry. The results of our study of copper vanadate's electrochemical properties will demonstrate the material's suitability as part of a tandem photocatalyst.

Infant-Directed Speech and Adult-Directed Speech with Bilinguals and Monolinguals

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 further explore both infant-directed speech (IDS) and adult-directed speech (ADS) in bilinguals and monolinguals. Infants from 12-24 months and their parents will participate in several interactive tasks. These tasks will allow us to compare how parents talk to their own child using IDS compared to talk to another adult. We predict that there may be variations in pitch in IDS and ADS that will serve as cues for the infants to switch between languages. Moreover, we predict pitch differentiation will serve as an essential tool to understand more deeply the mechanisms involved in language acquisition of bilingual infants compared to monolinguals. It is important to better understand the role IDS plays in bilingual language acquisition and the ways that it might differ from monolingual acquisition.

Designing and Manufacturing a Simplified Dynamic Model of the Lung to Investigate the Effects of Respiratory Flow on Particle Deposition

Susana Ramirez Perez

Sponsor: Jean-pierre Delplanque, Ph.D.
Mechanical & Aerospace Engr

New engineering and biological technologies developed for drug delivery to the respiratory tract focus on particle inhalation and deposition. Developing an understanding of particle motion in a moving air stream within confined geometries is important to making improvements to current technologies. The focus of this research is to design and manufacture an experimental apparatus for the testing of particle deposition. Particle deposition in the lungs is affected by multiple parameters including breathing patterns, particle size and morphology, and anatomical parameters of the upper airways (ex. tracheal length). The experimental apparatus or simplified dynamic lung model was designed to account for human physiology, such as breathing rates and inspired volume. The key design feature for the apparatus is the pump which can drive the various breathing rates characteristic of normal human physiology. Experiments performed using the fabricated model will capture realistic particle deposition in the lungs and airways during breathing. The project integrates manufacturing, computation and electronic components. The findings provide insight on patient training for treatment, and enable improvements in treatment of animals and humans.

RNAseq Analysis Identification of Genes Down-Regulated in the Prefrontal Cortex of Depressed Women and a Rodent Model of Depression

Stephanie Ramos-Maciel

Sponsor: Brian Trainor, Ph.D.
Psychology

Stress is a risk factor for mood disorders such as depression. Prior studies using male California mice have shown decreased frontal activity following a chronic psychological stressor. However, the underlying mechanisms of these changes are poorly understood. Studies on depressed men have shown that immediate early genes (IEGs), indirect measures of neural activity, were suppressed in the prefrontal cortex (PFC). In this study, this observation was extended to a data set from women. Gene expression profiles in a human study of depression were compared with a mouse-model of depression to identify pathways that are affected similarly in human and mouse samples. RNAseq analysis was performed on brain tissue from female California mice that underwent chronic social defeat stress (SDS) and post-mortem brain tissue from depressed female patients to detect differentially expressed genes. As in previous studies on males, IEG expression decreased in the PFC of depressed women and stressed female mice. This suggests that lowered neural activity in the PFC is a robust response to depression in both sexes for human and mouse models. As a next step, I will perform qPCR analysis to determine if IEG expression patterns can be replicated on a different set of California mice.

Breaking Down Barriers: Exploring Tactile Technologies for a More Accessible Campus

Matthew Raytis

Sponsor: Susan Verba, M.F.A.
Design Program

Navigating our vast campus can be an everyday challenge, especially for visually impaired people. High numbers of bicyclists, pedestrians, buses, and more than 5,000 acres make UC Davis wayfinding particularly frustrating and difficult. California is among the states with the highest populations of visually impaired people, and statistics show that 57% of visually impaired youth pursue post-secondary education. Moreover, among college freshmen with any kind of disability, 13.3% report visual impairments. Yet limited resources are available to aid visually impaired people in finding their way around our campus. Through primary and secondary research, interviews, field trips, case studies, and iterative prototyping, this project will investigate standards and precedents for enhancing navigation via tactile (and other) technologies. The study aims to define tactile standards and to develop design interventions for breaking down navigational barriers, making UC Davis more accessible for visually impaired students and for faculty, staff, visitors, and the entire campus community.

Investigating the Life Cycle of a Microbial Fuel Cell Inoculated with *Shewanella oneidensis*

Ziqra Raza

Sponsor: Christina Cogdell, Ph.D.
Design Program

Microbial fuel cells, bio electrochemical devices, utilize the natural processes of bacteria, oxidizing organic and inorganic compounds, to convert chemical energy into electrical energy. Most conventional power generation methods convert chemical energy into mechanical energy and heat through combustion. This is then transformed into electrical energy, often releasing harmful gases in the process. Fuel cells on the other hand convert chemical energy directly into electrical energy with low environmental impact. *Shewanella oneidensis*, a bacterium found in deep sea anaerobic habitats as well as soil and sedentary habitats, converts available organic matter into electricity with its exoelectrogenic properties. This presents potential for wastewater treatment as well as wasteland treatment. The microbial fuel cell comprises of graphite felt electrodes and the bacterium, *shewanella oneidensis* used as the anolyte and catholyte in a growth medium with lactate and buffered ferricyanide solutions. Investigating the life cycle of the components of the microbial fuel cell inoculated with the bacterium *shewanella oneidensis*, the embodied energy involved, as well as the waste and emissions from its production and operations provides more insight into the sustainability of this green technology.

Targeting the Orphan Nuclear Receptor ROR- γ in Bladder Cancer

Shivani Reddy

Sponsor: Maria Mudryj, Ph.D.
MED: Medical Microbiology & Imm

Bladder cancer is the fourth most common type of cancer in men, accounting for 74,000 new cases in the US in 2017. However, standard of care for the disease has minimally changed in over 30 years. Oncomine perusal demonstrated that ROR- γ , a nuclear receptor family member and a drug target for human autoimmune diseases, is overexpressed in bladder malignancies. Recent research indicated success of a novel ROR- γ inhibitor, SR2211, in the treatment of castrate-resistant prostate cancer (CRPC). It is currently unknown if this ROR- γ antagonist has comparable results in bladder cancer cells. This study aims to further our understanding of the efficacy of SR2211 in limiting bladder tumor cell growth. Thus far, our findings from two bladder cancer cell lines have shown that this compound is equally effective in reducing bladder tumor cell growth as it is in lowering viability of CRPC cells. Further assessments of SR2211's efficacy will be performed using a total of 10 bladder tumor derived cell lines. Dose-dependent drug efficacy, alone and in combination with cisplatin, will be measured by viability assays. Upon its completion, this project will contribute to the identification of SR2211 as a potential bladder cancer therapeutic.

Investigating Student Problem-Solving Skills in Genetics

Vijay Reddy

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

The purpose of this study is to reform undergraduate-level STEM/biology education by identifying the aspects of problem-solving that students struggle with. To investigate this, we are exploring the differences in thought processes between high-performing students and low-performing students when solving open-ended genetics problems. During weeks 7 and 8 of the quarter, ten high-performing and ten low-performing students were invited to participate in one hour think-aloud interviews (TAInt) in which they solve genetic linkage problems while verbally demonstrating their thought processes. To evaluate students' knowledge retention, the same participants were invited to complete the same TAInts 8-9 weeks after the quarter ended. To analyze student performance, problems were subdivided and then codes were assigned using the previously established COSINE (Coding System for Investigating Sub-problems and the Network) method. Based on the students' performance, the COSINE method assigns a code to each sub-problem specific to the participant. These codes will then be analyzed to provide insights into where in the problem-solving process students struggle or succeed.

Ecology and Phenotype of *Plantago lanceolata* Across a Latitudinal Gradient

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. Our study uses the protocol of PlantPopNet, an international project which aims to develop theory about the spatial dynamics of plant populations using data from *P. lanceolata* from populations around the world. At our site in Davis, CA, we will measure traits including flower characteristics, phenology, and physical dimensions of plants along transects. We will also record density within square meter plots. We will then compare fitness-related traits of *P. lanceolata* between three locations along a latitudinal gradient (Davis, CA, Oregon, and British Columbia) and between the past three years of survey data. We will use statistical tests to analyze the differences between these data for each region and each survey year. Past years' results suggest that differences exist between phenotypic traits in each region, and we predict there will be variation among survey years. The results of this study can be used to demonstrate geographical variation in *P. lanceolata*, and baseline data allows us to ask questions in the future about the factors influencing these traits, including climate, herbivory pressure, and disease.

Clinical Significance of Ionized Magnesium in Critically Ill Burn Patients

Camerin Rencken

Sponsor: Nam Tran, Ph.D.
MED: Pathology & Lab Medicine

The objective was to determine the clinical significance of ionized magnesium (Mg⁺⁺) compared to total magnesium (tMg) levels in critically ill burn patients. Total Mg represents the sum of complexed and ionized forms. We evaluated an Mg⁺⁺ assay to determine its performance versus tMg in the critically ill population. Paired tMg measurements were compared against Mg⁺⁺ results. The results were stratified by percent total body surface area (TBSA) burned for the data analysis: Group 1 (<20%), Group 2 (21-50%), and Group 3 (>51%). 55 paired samples were tested. The patients had a mean (SD) age of 39.53 (12.79) years and burn size of 46.82 (21.75)% TBSA. Mean tMg was 1.85 (0.25) mg/dL and Mg⁺⁺ was 0.56 (0.08) mg/dL. Total Mg was significantly different between Group 1 vs. Group 2 ($P = 0.027$), and Group 2 vs. Group 3 ($P = 0.011$). Mg⁺⁺ among the three groups were similar ($P = 0.155$). The correlation coefficient between Mg⁺⁺ and tMg was $r=0.76$ ($p<0.0001$). 21.8% of patients had low tMg and none had low Mg⁺⁺. These data suggest the need for interventional studies comparing patient management by tMg vs. Mg⁺⁺.

Hepatocyte Growth Factor Modulates TGF- β Mediated Human Corneal Stromal Cell Differentiation on Substrates Mimicking Human Cornea

Eva Rewinski

Sponsor: Sara Thomasy, D.V.M., Ph.D.
VM: Surg/Rad Science

Upon a corneal injury, corneal keratocytes differentiate into fibroblasts and contractile myofibroblasts to close the wound. Fibroblast to myofibroblast transformation is promoted by transforming growth factor- β (TGF- β). However, prolonged persistence of myofibroblasts in wound space has been associated with corneal fibrosis. The purpose of this project is to analyze the effect of hepatocyte growth factor (HGF), which can counteract TGF- β , on the myofibroblast phenotype in human corneal stromal cells cultured on substrates mimicking the human cornea. Human corneal fibroblasts (HCFs) were seeded on different substrates (e.g. 25 kPa, 75 kPa, tissue culture plastic (TCP: >1 GPa)) mimicking human normal and fibrotic corneal stiffness as well as tissue culture plastic, and were treated with and without 5 ng/mL TGF- β 1 and 20 ng/mL HGF. After a 24-hour treatment, RNA and protein were harvested to quantify the expression of α -smooth muscle actin (α -SMA) as the marker of myofibroblasts by qPCR and Western blotting. HGF suppressed the expression of α -SMA in HCFs on substrates mimicking the human cornea, indicating that HGF could be used as a therapeutic to reduce risk of fibrosis after corneal wound healing.

Putah Creek Reserve Restoration

Docnary Reyes

Sponsor: Valerie Eviner, Ph.D.
Plant Sciences

During the 1940s, the U.S. Army Corps of Engineers built levees to prevent the Putah Creek from flooding Davis; as a result, the North Fork of Putah Creek dried up and ecosystems there were destroyed. Restoration ecology, a field that assists the recovery of natural or anthropogenically disturbed ecosystems, is expected to grow in the future as people realize the consequences of manipulating landscapes in an unsustainable manner. Now that the North Fork has a flowing stream, restoration of the site would be beneficial to attract wildlife, maintain a healthy creek, and allow native plant diversity. This project aims to restore a segment of the site by creating a riparian corridor that contains a upland valley oak savanna area. To carry out this concept various weed control methods will be used, along with the creation of a floodplain, and a localized irrigation system. Other aspects of the design will permit heterogeneity and feasible maintenance, to ensure that the plants and trees placed on the site survive to maturity. However, it will be years until the full effect of the restoration plan shows what design aspects worked and which did not.

Generation of CenH3 Mutations in *Arabidopsis thaliana* Using CRISPR/Cas9

Andres Reyes

Sponsor: Luca Comai, Ph.D.
Plant Biology

CenH3 is a conserved gene found in eukaryotes, this gene encodes a centromere-specific histone H3 variant which is essential for specifying centromeres. Centromeres act as the foundation for kinetochore complex assembly and aids in faithful segregation of chromosomes during meiosis and mitosis. Centromere location on a chromosome is specified, maintained and faithfully inherited across generations by epigenetic mechanisms. CenH3 functions by replacing the canonical histone H3 in a subset of nucleosomes occupying the centromeric chromatin which in turn determines the position of the centromere. By genetic manipulation, multiple studies in *Arabidopsis* had shown potential uses for CenH3 in designing efficient genetic tools for breeding crop plants. However, a majority of these studies were based on the one null allele of AtCenH3 (Atcenh3-1) generated in Col-0 ecotype of *A. thaliana*. The current project aims to create new null alleles in CenH3 gene using the CRISPR/Cas9 system in multiple ecotypes of *A. thaliana*. We are targeting three different regions of the CenH3 gene and designing strategies for screening null mutations. The new alleles identified from this study would be used to help further characterize epigenetic mechanisms of centromere specification in future studies.

Undocumented Students Experiences in Higher Education

Jocelin Reyes Valenzuela

Sponsor: Robert Irwin, Ph.D.

Spanish & Portuguese

Undocumented immigration has recently received great attention in countries around the world, especially in the United States of America; home to more than a million undocumented youth, where only 800,000 are temporarily protected under DACA (Deferred Action for Childhood Arrivals). Currently, undocumented and DACAmented youth in higher education deal with a plethora of issues such as: constant fear of deportation, higher levels of depression, isolation, structural barriers, lack of access to federal financial aid and in-state tuition, discrimination, social stigma, family responsibilities, stereotypes, uncertainty and poverty to name a few of the most prevalent. This thesis presents and analyzes the experiences of undocumented students in higher education in the United States and utilizes academic research articles, documentaries, testimonies (videos), newspaper articles with the goal of identifying some of the most difficult issues faced by this group. From there, I hope to publish my thesis to help raise cultural and public awareness.

Genetic Investigation of Idiopathic Hypocalcemia in Thoroughbred Foals

Victor Rivas Gutierrez

Sponsor: Carrie Finno, D.V.M., Ph.D.

VM: Population Hlth & Reprod

Horses with equine hypocalcemia have decreased calcium levels. It was reported that Thoroughbred foals displaying signs of hypocalcemic tetany, stiff gait, and hyperhidrosis, died while experiencing hypocalcemic episodes. A genetic variant in one of the genes homologous to human CASR, GNA11, or TRPM6 is hypothesized to be causative of idiopathic hypocalcemia in Thoroughbreds. Clinicopathologic data from affected and non-affected foals were collected to document the exclusion of other causes of hypocalcemia. Samples of three affected foals and their dams from the UC Davis Veterinary Teaching Hospital and from Hagyard's Equine Medical Institute (Lexington, Kentucky) were analyzed. DNA underwent next-generation sequencing on Illumina HiSeq2500. Reads were mapped to the EquCab2.0 equine-reference sequence using Burrows-Wheeler Aligner (BWA) for Illumina mapping program and mapping quality was assessed using flagstat. Variants (single nucleotide polymorphisms [SNPs] and insertions/deletions) were identified using freebayes and DELLY2 programs. SNPeff was used to characterize variants by phenotype. No segregating putative genetic variants in CASR, GNA11, or TRPM6 were found associated with idiopathic hypocalcemia. A whole-genome association analysis is currently being performed to identify potential variants in other genes.

Observed Mother-Child Interactions: Associations Between Preschoolers' Social Behaviors, Temperament, and Their Mothers' Cognitive Functioning

Stephanie Rivera

Sponsor: Daniel Choe, Ph.D.

Human Ecology

The way in which children react and interact with the world, or their temperament, impacts their social behaviors, particularly with their mothers during early childhood. However, few studies examine the relationship between mothers' cognitive functioning and young children's temperament-related behavior. This ongoing study examines associations between maternal self-regulatory and intellectual functioning, and preschool-age children's temperament and observed social behavior. A sample of 9 mother-child pairs (M=38 years, SD=1.3, 9 female; M=4.5 years, SD=4.428, 4 female, respectively) were video-recorded for two interaction tasks, Free-Play and Clean-Up, and later coded at individual and dyadic levels using the Parent-Child-Interaction-System. Mothers were administered an intelligence test to assess intellectual ability, computerized tasks to measure self-regulation, and parent-reports to measure child temperament. Preliminary findings suggest that maternal self-regulation is associated with several aspects of children's observed social behavior and temperament, with different associations seen across different tasks. Maternal intelligence, while showing correlations with child behavior, seems to be unrelated to temperament. Further explorations will clarify the direct effects of mothers' intelligence and self-regulation on children's behavior. These findings are important because children's positive social behaviors are crucial for their healthy development and positive future outcomes.

Using Primary Tracheal Cell Culture to Characterize the Innate Immune Response to Challenge with Infectious Bronchitis Virus in the Upper Respiratory System of Chickens

Alexander Robertson

Sponsor: Rodrigo Gallardo, D.V.M., Ph.D.

VM: Population Hlth & Reprod

The domesticated chicken is an extremely important protein source worldwide through egg and meat production. Avian viruses pose a serious threat to the poultry industry, both economically and to human health. In order to prevent and control respiratory diseases, more research must be done to better understand chicken immune response. Understanding how the innate immune system reacts to viral infections can help us develop immune boosting compounds to be used as vaccine adjuvants as well as develop more effective and targeted vaccines for viruses that replicate locally and don't stimulate an effective systemic humoral response. Cell culture is a commonly used tool in virology studies to determine basic cellular response to viral infection. In this study, we used primary tracheal cell cultures from embryonic chickens to determine a baseline count of viral replication and cytokine production in response to Infectious Bronchitis Virus (IBV). Besides minimizing the number of animals used, the in vitro setting allows us to better control variables present in in vivo experiments and facilitates the assessment of local immunity. This data will be used as a comparison in future studies to better understand the basic infection cycle of IBV in the upper respiratory system of chickens.

BRCA1/BARD1 Ubiquitin Ligase Activity Mediates DNA Repair in *Caenorhabditis elegans*

Foxy Robinson

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

Approximately three million women live with breast cancer in the United States. Germline mutations in the breast cancer 1 (brca-1) gene are a leading factor influencing familial breast and ovarian cancer. The RING domain within BRCA1 forms a heterodimer with BRCA1-associated RING domain protein 1 (BARD1) to serve as an E3 ubiquitin ligase, adding ubiquitin to protein substrates. The BRCA1/BARD1 complex supports homology-directed DNA repair (HDR) and suppresses tumor formation. Studies have shown that mutations within the BRCA1 RING domain are pathogenic, promoting tumor formation. I hypothesize that pathogenic BRCA1 RING domain variants compromise the integrity of homology-directed DNA repair. To test my hypothesis, I used *Caenorhabditis elegans*, a metazoan model, and conducted embryonic lethality assays of worms containing RING domain variants within BRC1, the *C. elegans* BRCA1 ortholog, as a measure of successful HDR. I exposed known pathogenic BRCA1 variants to DNA damage and meiotic stress. My preliminary results suggest that worms with BRCA1 RING domain variants experience elevated embryonic lethality in response to DNA damage, but not meiotic stress. Further research is needed to investigate how pathogenic BRCA1 RING domain variants disrupt HDR in the presence of DNA damage and meiotic stress.

Narrative Empowerment for Children of Immigrants

Jennifer Rodriguez

Sponsor: Monica Torreiro-Casal, Ph.D.
Chicano Studies

Telling one's narrative is empowering and validating. As a daughter of immigrants I was never asked about my own narrative until I came to college. I took my first Chicana/o studies course and learned about the history I was never taught about in school. I learned that my people have history and that it was slowly being erased. As I took more courses, I began learning more about myself. That was when I felt validated for my existence and my struggles. There are other children who share this experience. One of their main fears is that their parents could potentially be deported. Most of the studies done on immigrant children and their mental health are done using the objective approach. It does not capture their full experience. There is more to a human being's story than statistics will care to show. The purpose of this study is to empower children of undocumented parents by voicing their realities.

Student-Run Clinics: Preceptor Motivations

Natanael Rodriguez

Sponsor: Patrick Romano, M.D.
MED: Div Of Internal Med

UC Davis has served underserved patients in the surrounding Sacramento region through student-run clinics (SRC's) for more than 35 years. A mix of undergraduates, medical and other health professions students, and physicians provide primary health care services at no cost. Since the Affordable Care Act (ACA) and California's Medicaid program, the uninsured population in California has dropped to 6.8%, but patients continue to seek care at SRCs, while physicians are still volunteering their time. SRC's operate on weekends in suboptimal facilities, are limited in resources and scope, and rely heavily upon bright but inexperienced medical students and undergraduates. There is a paucity of information available about what motivates preceptors, their challenges, and what improvements they suggest. This research explores these questions and how preceptors' lived experiences in SRCs relate to students' and patients' experiences. Approximately 20 interviews will be conducted with physicians at ten SRC's to explore preceptor motivations, challenges, and suggestions for improvement. Some preliminary findings show that many preceptors value the teaching aspect and being able to care for patients in need without the burden of tedious paperwork. Findings from this study will inform efforts to recruit and retain high-quality preceptors and improve the operations of student-run clinics.

Testosterone Supplementation Increases Skeletal Muscle Growth When Undergoing Functional Overload in Female Mice

Eric Roman

Sponsor: Keith Baar, Ph.D.
Neuro Physio & Behavior

The loss of skeletal muscle mass and function occurs in all aging adults. Aging is also associated with a decline in anabolic hormones such as testosterone (T), and this is believed to contribute to the loss of muscle mass. We sought to determine the effects of T on skeletal muscle hypertrophy and illuminate the pathways responsible. Five-month-old male and female C57Bl6 mice were subjected to 21 days of slow-release T pellets to determine the effects on the gastrocnemius muscle mass. No significant effects were found from T supplementation on adult muscle mass. We decided to utilize functional overload (FO) to determine whether T affects actively growing muscle. Western blotting was performed to assess overall protein synthesis, and immunohistochemistry was used to analyze fiber type distribution and cross-sectional area. Female mice that underwent FO and T supplementation for two weeks showed 76% greater growth in the plantaris compared to those without supplementation. However, male mice that underwent FO and T supplementation failed to increase plantaris mass more than those who only underwent FO. These data suggest that T preferentially affects growing muscle where native T is low.

Fluorescent Imaging of *E. coli* Attachment to Microbial Fuel Cell Anode Substrates

Katerina Roth

Sponsor: Christopher Simmons, Ph.D.
Food Science & Technology

Microbial fuel cells (MFC) utilize exoelectrogenic bacteria to generate electricity. As part of their metabolic activity, these bacteria deposit electrons onto an anode that is connected to an external load and cathode, like a battery connected to a circuit. The formation of a biofilm on the anode is integral to this process, so understanding biofilm formation in MFCs is important for future optimization. This project investigated growth and adherence of bacteria to planar anode materials that are compatible with MFCs and readily scanned via microscopy to facilitate biofilm imaging. *E. coli* was used as a model bacterium to compare the growth of bacteria on different substrates. The bacteria were grown on pieces of carbon, glass, oxidized copper, and unoxidized copper. Fluorescent microscopy was used to enumerate cells on the surface of each material. ANOVA showed that the cell growth on the carbon paper samples was significantly higher than the two copper treatments. However, the two kinds of copper substrate, the glass and unoxidized copper, and the carbon and glass were shown to be statistically similar to each other. The data indicate that carbon paper anodes are best suited for future MFC microscopy research to link biofilm structure to MFC performance.

Investigating General Chemistry Students' Knowledge Retention and Success in Problem Solving

Nicholas Rothbart

Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Stoichiometry is one of the most challenging topics of general chemistry due to its reliance on problem solving skills and its inclusion of many different chemistry concepts. Using the Coding System for Investigating Subproblems and Network (COSINE) method, our study examines students' success with each subproblem, allowing the discovery of the exact place a student makes a mistake instead of focusing on the final answer. These subproblems were categorized based on chemistry concepts, such as limiting reactant and mole concept. This helped to identify the most challenging concepts that students face in a general chemistry course. This study also focused on students' knowledge retention between quarters. Students were tested both fall and winter quarters on stoichiometric topics to see if they could achieve the same level of success. Our preliminary results showed that in winter quarter, students had higher success rates than in the fall quarter, meaning that student understanding improved over time. Instructors should give their students more time to learn and process the material they teach. Among all the concepts studied, stoichiometric ratio was the most difficult topic for the students in the fall quarter, yet it had the highest success rate in the winter quarter.

Nuclear Magnetic Resonance (NMR) Spectroscopic Analysis of Polyphenol Oxidase Activity During Bacterial Blight Disease of Walnut

Sucharita Roy

Sponsor: Abhaya Dandekar, Ph.D.
Plant Sciences

Polyphenol Oxidases (PPOs) are copper-containing enzymes ubiquitously present in a diverse group of organisms. In plants, the activity of PPOs are closely associated with the attack of pests and/or pathogens yet their role in disease resistance/development is still unknown. Enzymatic activities associated with PPOs includes hydroxylation of monophenols into ortho-diphenols followed by oxidation and formation of quinones and melanins. Accumulation of these dark-colored phytomelanin results into pigmentation in plant tissues. This is a salient visual phenotype also observed during walnut blight disease that significantly affects walnut production in California. Hence, we are interested in defining the physiological role of PPOs during this disease development. In this study we will analyze the kinetics of the two PPO activities, expressed from two PPO genes (JrPPO1 and JrPPO2) found in the walnut genome, to understand their regulation during infection using NMR spectroscopy. A sensitive 800 MHz NMR equipment was used for the real time monitoring of activity and to determine Vmax and Km values. A comparison of the kinetics of these reactions will provide insights into the relationship of these two enzymes and disease progression leading to symptom development that could explain plant susceptibility to this important disease.

Body Elongation as a Major Feature of Diversification in Eupercarian Fishes

Xylina Rusit

Sponsor: Peter Wainwright, Ph.D.
Evolution & Ecology

The extraordinarily diverse series Eupercaria contains fishes that live in a range of habitats. These fishes have adapted to their environments in countless ways that are evident in their body morphologies. Previous studies have shown that body elongation is the dominant mode of shape variation in reef fishes. This trend is driven by a number of factors, like feeding performance and defense against gape-limited predators, not all of which are unique to reefs. Our research focused on whether elongation is the dominant form of diversification across all marine Eupercarians in different types of habitats. We utilized an assemblage of linear body measurements collected at the National Museum of Natural History, spanning the four orders in the series (Perciformes, Gasterosteiformes, Scorpaeniformes, Lophiiformes). Using habitat data collected from the online database 'FishBase,' we performed comparative analyses of the aforementioned body measurements for species in these orders. We predicted that head depth, maximum body depth, and caudal peduncle depth, relative to standard length, would show the greatest trend in shape diversity. This study will have major implications for our understanding of morphological variation of fishes and the adaptive significance of body elongation.

Synthesis of Iron Oxide Microspheres for Targeted Drug Delivery

Florence Rusly

Sponsor: Ricardo Castro, Ph.D.
Materials Science&engineering

With good drug loading capacity and dispersion in aqueous media, porous magnetic microspheres become promising drug carriers which allow targeted drug deliveries to specific body parts. The production of non-toxic porous magnetic microspheres, however, still remains a challenge. In order to investigate the prospect of porous iron oxide microspheres (PIOMs) as drug delivery carriers, I attempted to synthesize PIOMs from mixtures of iron(III) nitrate and tin(IV) acetate with varying concentrations via the ultrasonic spray pyrolysis technique at 800°C. Initial findings from X-ray Powder Diffraction and Transmission Electron Microscopy confirm the presence of PIOMs in the powder synthesized from the mixture with 5% tin concentrations. The mixtures with 2%, 3%, and 7% tin concentrations do not form perfect PIOMs. Nevertheless, with increasing tin concentration, the magnetite phase in the powder becomes more apparent which is consistent with the increasing attraction to a magnet observed. To confirm the phases of the PIOMs, the magnetic properties of the powders synthesized are currently being analyzed further.

Using SNAP Tag Technology to Study the Trophocytosis Mechanism in *Entamoeba histolytica*

Natalie Sahabandu

Sponsor: Katherine Ralston, Ph.D.
Microbiology & Molec Genetics

Entamoeba histolytica is a eukaryotic, parasitic pathogen that causes the diarrheal disease amoebiasis. *E. histolytica* is capable of causing profound tissue destruction during infection, including intestinal ulcers and fatal abscesses in other tissues. It was recently discovered by our lab that the amoeba kills human cells by ingesting bites off the human cell, a process known as trophocytosis (trogo-: nibble). The aim of our lab is to investigate the molecular mechanism behind this unusual cell-killing process, in order to understand the cause of profound tissue damage during infection. My overall hypothesis is that *E. histolytica* requires unique, previously uncharacterized genes in trophocytosis. To test this and characterize putative essential genes that are involved in trophocytosis I will be utilizing SNAP tag technology. I will be modifying the SNAP vector by inserting C2PK and AGCK1 genes using Gibson cloning methods. This will allow me to study protein localization of candidate genes that are predicted to be involved in trophocytosis. Since trophocytosis is likely to underlie the tissue damage that occurs during infection in humans, in the long run, my studies will help improve understanding of how *E. histolytica* causes disease.

The Effects of Groundwater Banking on Soil Microbial Denitrification Potential in Almond Orchards

Carlotta Sainato

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

Groundwater contributes about 40% of California's total annual water supply and plays a crucial role in agriculture. Flood irrigation in dormant almond orchards may replenish groundwater aquifers and prevent the impacts of overdraft. However, this high-volume irrigation may result in the mobilization of soil nitrate from previous fertilizer application and could lead to nitrate leaching into groundwater, which can cause adverse human health consequences when untreated. Water saturation from flood irrigation can create an anoxic soil environment where microbial denitrification can occur, which may help remove soil nitrate before it reaches groundwater. This study characterizes how soil microbes affect denitrification in almond orchard soils undergoing flood irrigation. Three marker genes encoding for key steps of microbial denitrification, which characterize distinct denitrifying microbial groups, have been observed at varying depths in mesocosm samples representing environmental conditions before and after flood irrigation, suggesting denitrification activity in both conditions. The abundance of these genes are quantified through real-time qPCR to examine possible changes in denitrification potential after flood irrigation. Due to anoxic conditions in irrigation-flooded soils, the results are expected to reveal an increase in denitrification genes, and therefore a decreased threat of nitrate leaching.

Investigating the Effects of Minimizing Urea Consumption in Microbially Induced Calcite Precipitation (MICP) Treatments for Ground Improvement

Alexandra Camil San Pablo

Sponsor: Jason Dejong, Ph.D.
Civil & Environmental Engr

Microbially Induced Calcite Precipitation (MICP) can increase the strength and stiffness of sandy soils, making it an environmentally-conscious alternative to conventional ground improvement techniques such as permeation grouting. Efforts are being made to lower the usage of urea to minimize cost and carbon footprint since a life-cycle assessment performed on MICP showed that urea is one of the main contributors to greenhouse gas emissions. Optimizing treatment solution formulations may enable comparable engineering performance with lower environmental impact. The formula developed will be used in future large-scale testing. A series of eight soil columns containing sand were treated to investigate formulas to minimize urea consumption and improve precipitation efficiency during both stimulation and cementation phases. Four columns studied the effects of varying urea during stimulation and the other four varied the urea to calcium chloride ratio during cementation. pH and urea analysis were performed on daily samples. Shear wave velocity (V_s) measurements were also measured to assess shear stiffness improvement over time. Calcite content and unconfined compressive strengths were also obtained. The results of this experimental program may enable identification of a more optimal solution formula that achieves similar engineering performance while minimizing process costs and carbon footprint.

Characterization of a Black Bear Microsatellite Multiplex in California Optimized for Noninvasively Collected Samples

Camilo Sanchez

Sponsor: Benjamin Sacks, Ph.D.
Veterinary Genetics Lab

California black bear management lacks a noninvasive genetic abundance monitoring program for sustainable harvest and population control. To that end, we aimed to test and optimize a microsatellite multiplex genotyping assay for individual identification and sex determination of black bears from DNA extracted from scat. We used 66 field-collected and 28 zoo-collected bear scat samples to assess error in fecal DNA analysis, specifically, allelic dropout and false allele rates. Primers for 15 autosomal loci and a sex marker were combined into multiplex assays of 8 loci each by maximizing the distance between allele size ranges of different loci labeled with the same fluorescent dye and avoiding primer conflicts. Additionally, we analyzed 108 hunter collected tissue samples to more thoroughly characterize alleles and genetic diversity of the marker set in the present population. We anticipate this study will result in a high-resolution genetic assay for individual identification and sex determination in California black bears that can be used for estimating abundance and population structure.

Child Body Mass Index and Diet Behaviors Associated with Parent Restrictive Feeding Practices

Alma Sanchez

Sponsor: Lenna Ontai, Ph.D.
Human Ecology

The prevalence of childhood obesity has been increasing over the last thirty years (Ogden et al., 2010). The home environment is a major concern because parent feeding practices, such as restriction, can have a vital impact on a child's development to self-regulate their food intake (Johnson & Birch, 1994) and influence food preference (Wardle, et al., 2005). Restriction is defined as restricting a child's access to junk food and restricting the total amount of food consumed (Birch, L, et al., 2001). Birch and colleagues found that higher child weight status was associated with greater parent use of restrictive feeding practices (Fisher & Birch, 1999b). The purpose of this study is to expand these results by assessing the association between parent restrictive feeding and child dietary energy density in relation to changes in BMI percentiles with data from the UC Davis Healthy Kids project (N = 60 parent-child dyads). BMI was calculated using the child's measured height and weight. Eating behaviors were captured in dietary logs that recorded energy density and restrictive feeding was observed from a videotaped mealtime. We hypothesize that child BMI will be associated with higher consumption of energy dense foods and parental use of restrictive feeding behaviors.

Incorporating a Socio-Scientific Issue Into the General Chemistry Curriculum to Improve Student Engagement

Jose Sandoval

Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

This study attempts to improve the relevance of chemical education as perceived by students through the introduction of controversial topics into chemistry curriculum, with a focus placed on socio-scientific issues (SSI). Considering its political and economic relevance, Hydraulic Fracturing was selected as a suitable SSI. A lesson plan was developed and designed to stimulate self-directed learning by allowing students to contrast and defend different viewpoints on hydraulic fracturing. A group of General Chemistry students were first given an extensive Prezi on Hydraulic Fracturing to provide a base knowledge on the issue. The students were split into groups of four, with each member representing the views of a Politician, a Scientist, an Environmentalist, or an Oil Company Representative. Hydraulic Fracturing was analyzed through each perspective. Pre and post-discussion quizzes as well as a survey were administered to gauge how much was learned from this activity as well as student perception of the activity. The findings elucidate that most of the students who participated viewed the lesson plan as relevant and interesting. These results indicate that by contextualizing the chemistry curriculum through a socio-scientific issue, students are able to view the relevance of chemistry beyond the classroom environment.

Development of Optimism Across the Lifespan

Priyanka Sanghavi

Sponsor: Richard Robins, Ph.D.
Psychology

In this research, we examine the developmental trajectory of optimism from 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.

Regulation of Plant Immunity by Phytohormones

Nathaniel Ryan Sanjaya

Sponsor: Savithramma Dinesh-Kumar, Ph.D.
Plant Biology

In the environment, plants are constantly in contact with an array of pathogenic microbes with various means of infection. To protect themselves against such biotic stress, plants have evolved a mechanism of defense that could recognize common pathogenic molecules and trigger responses to deter the pathogens, much like the innate immunity in human. However, they lack any dynamic adaptive immunity against different specific pathogens. Instead, plants utilize phytohormones to warn other tissues of an eminent threat. Phytohormones play a pivotal role by adding a layer of regulation and finely tuning the plants' immune response to deal with specific pathogens. Salicylic Acid, Jasmonic Acid, and Ethylene are the major phytohormones that tightly regulate the plant immune responses. These phytohormones work in synergy or antagonistically to each other (cross-talking) to trigger different responses in the most effective and cost-efficient manner. Here I present my work related to the mechanism underlying hormone-mediated regulation of plant immunity to gain deeper understanding about it using various biochemical, and cellular biology approaches.

Break The Cycle: A Documentary about Sustainable Cycles, a Menstrual Activist Cyclist Group

Sinead Santich

Sponsor: Julie Wyman, M.F.A.
Cinema & Digital Media

Every person in the world is born from someone who menstruates, yet the topic of menstruation is widely considered a cultural taboo, and a shameful weakness of the body. Menstruation represents a burden managed by the use of discrete disposable products, instead of an indicator of health or wellness. My documentary, entitled *Break The Cycle*, chronicles Sustainable Cycles, a group of women who attempt to break this stigma by promoting the use of reusable menstrual products. Every two years, the group bikes thousands of miles across the U.S.A. to the Society for Menstrual Cycle Research Conference. Along the way, Sustainable Cycles hosts community workshops, where they unite cycling activism with menstrual health activism in order to empower and educate menstruators to make informed choices about their bodies. My documentary follows the group for the last 150 miles of their bike tour, from Birmingham, Alabama to Atlanta, Georgia. The film's goal is to provide Sustainable Cycles a wider audience and to cultivate a space where people can talk freely about their menstrual health. At the Undergraduate Research Conference, I will screen clips from the film, and host a discussion about the process of bringing their story to the screen.

Evaluating the Association Between Language Exposure and Language Outcomes

Diana Santoyo

Sponsor: Yuuko Tonkovich, Ph.D.
Education

With an exponential increase in dual immersion programs (DI), variability among students' English language proficiency has been long debated with respect to various academic performances. The aim of this study is to examine the association between language exposure and language outcomes. Data was collected from a total of 100 students from the same school district (18 students in a Cantonese DI Program, 45 students in a Spanish DI Program, and 37 students in a General Education Program). Language outcomes were measured with the Peabody Picture Vocabulary Test (PPVT) and the Woodcock Johnson Picture Vocabulary Test. Correlations and statistical significances between the three groups and vocabulary outcomes were analyzed. For children in general education and dual immersion programs, English exposure is positively correlated with English vocabulary. For children in dual immersion programs, other language (i.e. Spanish/Cantonese) exposure is positively correlated with other language vocabulary. Furthermore, children in both programs performed similarly on English vocabulary. On average, this indicates that the more exposure of a specific language, the higher the child's vocabulary is for that language.

Biochemical Characterization of RNF212 and RNF212B: Two SUMO E3 Ligases That Promote Chromosome Crossing Over During Meiosis.

Samuel Sara

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

Meiotic crossing-over is essential for proper chromosome segregation. Successful segregation requires that chromosomes associate into homologs and become connected by crossover recombination. Defects in crossing-over cause aneuploidy or apoptosis. Alleles of human Rnf212 cause heritable variation in crossover rate. We previously showed that RNF212 is an E3-ligase that promotes protein modification by the ubiquitin-like molecule SUMO, and functions in a dosage-dependent manner to promote crossing-over. We purified human RNF212 and a paralog RNF212B and reconstituted SUMO conjugation reactions in vitro. SUMO conjugation is mediated by an enzymatic cascade comprising E1, E2 and E3 enzymes. RNF212 physically interacts with both SUMO and UBC9 (E2), and stimulates SUMO conjugation, both chain-formation and transfer of SUMO to model substrates. While RNF212B also shows SUMO E3 ligase activity, the rate of conjugation is slower compared to RNF212. Immunostaining of surface-spread spermatocyte chromosomes reveals a punctate pattern of RNF212B localization with dynamics similar to those previously described for RNF212. The interaction of RNF212B with the SUMO machinery and its relationship with RNF212 are currently being evaluated. Together, our biochemical studies will help elucidate how RNF212 and RNF212B function to promote the essential process of meiotic crossing over.

A Search for the Rotational Spectrum of the β -cyanovinyl Radical

Haley Scolati

Sponsor: Kyle Crabtree, Ph.D.
Chemistry

Nitrogen-containing molecules are a fundamental component in the formation of life and in particular N-heterocycles are important components of many biological structures. The detection of this class of compounds on meteorites has sparked added interest in determining whether they are formed from chemical reactions on the meteorite surface itself or if they are synthesized via gas phase chemistry in the interstellar medium and subsequently deposited.. Although no N-heterocycle has yet been detected in space, recent research has suggested that a new reaction for the formation of pyridine, one of the simplest N-heterocycles, from vinyl cyanide and the β -cyanovinyl radical may be feasible in the interstellar medium. We have undertaken a search for the rotational spectrum of the β -cyanovinyl radical using a combination of chirped-pulse and cavity Fourier transform microwave spectroscopy. In this talk, I will discuss our initial results from a series of experiments at the Harvard Smithsonian Center for Astrophysics, as well as our current work on the construction of a new broadband microwave spectrometer to expand upon our initial data.

Empowering Desert Rats: Social and Environmental Well-Being of Youth in Victorville, CA

Grace Serrato

Sponsor: Jonathan London, Ph.D.
Human Ecology

Since the early 2000s, the high desert region of Victorville, California has been undergoing a large demographic shift. As the Chicanx/Latinx and African American population has increased, the number of Caucasian residents has decreased. One of the causes that have brought more marginalized communities to Victorville is the availability of affordable housing. The families who moved to Victorville faced displacement, lack of community support and health problems when they arrived. These factors have created negative effects in the community, including crime rates increasing, and the quality of education and public health deteriorating. All of these effects have impacted the social and environmental well-being of youth in the community. My research will use social constructivism and critical race theory as framework and include demographic data analysis, mapping and interviews with youth, long-time residents, health education and law professionals to show the relationships between crime, high school dropouts, environmental hazards and the demographic changes and displacement youth in the community face. I will also investigate the vital role that youth play in the region because their perspectives and ideas to help the community need to be heard in order to create a better environment for themselves and the community.

Mechanism of Punctate Human CTP Synthetase Mobility in MCF10A Cells

Bitu Shahrivini

Sponsor: Enoch Baldwin, Ph.D.
Molecular & Cellular Bio

CTP synthetases (CTPSs) are ubiquitous enzymes that produce the essential nucleotide CTP from UTP. CTP is a precursor for DNA, RNA, phospholipid and saccharide biosynthesis. Since these are necessary for cell proliferation, CTPS is a therapeutic target for anticancer, antiparasite, and antiviral drugs. As part of their complex regulation, CTPSs undergo dynamic changes in localization and aggregation. Upon live imaging of fluorescently-tagged CTPSs in MCF10A human breast cells, hCTPS aggregates to form filaments, particularly under glutamine deprivation. Under normal growth conditions, however, we observe mobile hCTPS puncta localizing at cell-cell contacts. We hypothesize that localization delivers concentrated CTPS activity to locales of high metabolic need, for example, during membrane restructuring. We used high resolution and confocal microscopy to provide baseline characterization of puncta trajectories, speed, and localization. We then tested the role of microtubules in puncta motion. We used the drug Nocodazole to disrupt microtubules, and Taxol to stabilize microtubules, and then compared the subsequent puncta movement to our baseline data to determine the role microtubule dynamics play in puncta motion. Demystifying CTPS's localization mechanism and the signals that control it may explain the roles of biosynthetic enzyme localization in cellular homeostasis, and in increasing biosynthetic efficiency.

Use of Iron Supplements by Women During Pregnancy in Cameroon: A Cross-Sectional Study

Anran Shao

Sponsor: Reina Engle-Stone, Ph.D.
Nutrition

Iron supplement use during pregnancy reduces maternal anemia and infant low birth weight. Our aim is to identify factors associated with use of iron supplements among Cameroonian women during pregnancy. The cross-sectional survey of 559 women of age 14-55 y was conducted by cluster sampling from 12 sites in Cameroon. Data included women's iron supplement use during pregnancy, age, education, occupation, role in households, health center use in the past year, and household food insecurity. The Chi-Square test was used to determine the association between the use of iron supplement and maternal characteristics. The results showed that 84.4% women reportedly took iron supplements during pregnancy. Among iron supplement users, 18.3% had no formal education, whereas 45.4% non-iron users had no formal education ($P < 0.001$); 64.4% iron supplements users visited a health center in the past year, but 52.3% non-iron supplement users went to a health center ($P < 0.05$). However, the use of iron supplements was not associated with household location or food insecurity, or maternal age or occupation. Overall, iron supplement use during pregnancy is common in Cameroon, but less common among women with no education and infrequent health center use.

Frugal Science: Digitally Controlled Open-Source Syringe Pump

Shonit Sharma

Sponsor: Eduardo Silva, Ph.D.
Biomedical Engineering

The cost of performing modern biomedical research includes the initial acquisition and subsequent maintenance of equipment, salaries of post-doctoral researchers, and intermittent purchases of consumable materials such as glassware or chemicals. In an effort to save money and/or direct funds elsewhere, one may look for cheaper alternatives to laboratory equipment, a major expenditure yet necessary component of the research. The advent of new additive manufacturing technologies has made it increasingly popular to design, 3D print, and construct devices for personal use. In this work, we undertook a project to build, program, and test an open-source syringe pump as evidence that it is possible to make a commercially available piece of laboratory equipment significantly more affordable. We hypothesize that this Digitally Controlled Open-Source Syringe Pump is as accurate as its commercially available counterpart for our research purposes, droplet microfluidics. Our findings from comparison tests between the open-source and commercial syringe pumps confirm that the accuracy of dispelling fluid of various viscosities and at different temperatures is retained. The significant price difference between the two devices suggests that creating open-source laboratory equipment is a viable method of procuring basic equipment in the pursuit of frugal science.

A Deep Learning Approach to Sustainable Waste Management

Andrew Shephard

Sponsor: Ilias Tagkopoulos, Ph.D.
Engr Computer Science

According to the Environmental Protection Agency's (EPA) report, USA generated 254.1 million tons of trash in 2013. Compared to 1960 when USA generated only 88.1 million tons, the municipal solid waste generation has increased by a staggering 188.4%. Despite our best efforts to recycle and compost, we are lagging behind as we were only able to achieve a 34.3% recycling rate in 2013. Here, we propose to address the problem at the source by building an inexpensive smart trash can that takes trash images, processes them and then automatically segregates it into Compost, Recyclable & Landfill bins. We do this by implementing Convolutional Neural Networks (CNNs) and Computer Vision algorithms on a Raspberry Pi 3 to correctly identify the images of trash. Our dataset includes the 2527 labelled TrashNet images coupled with an increasing set of images acquired by our smart trash can. Preliminary results show a performance of 60% in trash classification, with further refinement under way. This project paves the way for intelligent, inexpensive and sustainable waste management across a wide spectrum of commercial and residential facilities.

Interaction Between CLC-1 and FKBP8 Studied by Fluorescence Resonance Energy Transfer

Ting-Jung Sheu

Sponsor: Tsung-yu Chen, M.D., Ph.D.
MED: Neurology

CLC-1 is a voltage gated chloride channel that regulates the excitability of skeletal muscles. Mutations in CLC-1 has been known to cause myotonia congenita, a genetic disorder characterized by muscle rigidity. It has been reported that Fujimycin binding protein 8 (FKBP8), which is a chaperone protein involved in protein trafficking mechanism, may help the functional expression of CLC-1. This effect may result from a direct interaction between CLC-1 and FKBP8 based on co-immunoprecipitation studies. To further examine the interaction between FKBP8 and CLC-1, I plan to use Fluorescence Resonance Energy Transfer (FRET) approach to quantify the transfer of energy from a donor molecule to an acceptor molecule. CLC-1 and FKBP8 will be tagged with Cyan and Yellow fluorescent proteins (CFP and YFP), respectively, and will be transiently expressed in Human Embryonic Kidney 293 cells. I expect to learn how close is FKBP8 to CLC-1, and reveal the possible role of FKBP8 in enhancing trafficking of the CLC-1 to the cell membrane.

Crystal Age and Magma Storage Conditions Beneath the Katmai-Novarupta Volcanic System Based on ^{238}U - ^{230}Th Dating

Samuel Shipman

Sponsor: Kari Cooper, Ph.D.
Earth And Planetary Sciences

Studying magmatic processes is important for both expanding our knowledge of large-scale earth processes and potential forecasting of volcanic events on human timescales. Magma bodies beneath volcanoes undergo dynamic physical and chemical processes throughout their lifetimes, which affect their ability to evolve and erupt. The extent and timescales of these processes, although impossible to observe directly, are recorded in the crystals that reside within magma reservoirs. Geologists can combine dating and microscopic analyses of chemical composition of volcanic crystals to reveal a history of chemical changes within a magma reservoir prior to eruption.

This study uses ^{238}U - ^{230}Th radiometric dating to investigate the magmatic processes that occurred beneath the Katmai-Novarupta system prior to eruption. The 1912 eruption of the Katmai-Novarupta volcanic system in southern Alaska was the largest eruption of the 20th century. Although relatively well studied, the magmatic conditions leading up to this eruption remain unresolved and debated. Uranium-series analysis of the rocks and crystals produced by the eruption will be used to determine the ages of the crystals and the conditions under which they were stored, ultimately leading to a better understanding of magma storage and volcanic hazards at Katmai-Novarupta.

Creating Clean Water Through Organic Filtration

Yordanos Shita

Sponsor: Bassam Younis, Ph.D.
Civil & Environmental Engr

The removal of hazardous metals is an essential part of water treatment. Regrettably, common industrial scale chemicals used for this process, such as aluminum sulfate and ion exchange resin, can be both expensive and create long-term hazardous waste. Therefore, the use of biodegradable, locally sourced, plant based treatment options are a necessary alternative to expand clean water resources in developing countries. This study is a preliminary investigation into the use of *Moringa oleifera* and *Luffa cylindrica* as adsorbents for the removal of arsenic from drinking water. The objective of this research is to determine the treatment efficacy of these two plants using adsorption isotherms and rapid small scale column testing (RSSCT). The adsorption isotherms will assess the capacity of the plants to adsorb arsenic and the RSSCT study will examine the best operating conditions for using these plants in a depth filter. Along with the removal of these chemicals, the column testing will also investigate the effective lifetime of the column due to the degradation of the plants in the column, (i.e. the time to fouling). This information will also be used to determine the economic feasibility of using these plants for water treatment in the real world.

CENH3-Mediated Haploid Induction in Model Plant *Arabidopsis thaliana*

Mohamed Hisham Siddeek

Sponsor: Anne Britt, Ph.D.
Plant Biology

The CENH3 gene is centromeric histone 3 variant that epigenetically defines the centromeric region of the chromosome. It was shown by Ravi & Chan, that mutations in the CENH3 gene can give rise to haploid induction in plants. The purpose of our project was to identify a non-transgenic approach for haploid induction(HI). We used Ethyl Methanesulfonate (EMS) inducible point mutations that result in single amino acid substitution in the CENH3 protein to test the HI effect. The effects of these point mutants were studied in endogenous cenH3 - / - background. Because the CENH3 gene is highly conserved in most organisms, we believe that this haploid inducing technology could be transferred to crop plants, thereby giving us the ability to produce true-breeding lines in a single generation as opposed to 7-8 generations of back-crossing using classical approaches.

A Longitudinal Review of Breastfeeding Smartphone Apps Using Social Cognitive Theory

Suhail Sidhu

Sponsor: Kristin Lagattuta, Ph.D.
Psychology

Exclusive breastfeeding is recommended for six months, but only 22% of US parents reach that goal. Smartphone apps can be used to educate patients to improve health outcomes. Breastfeeding apps are typically used to track breastfeeding progress and provide education. Breastfeeding apps have never been reviewed. The primary aim of this project is to review and assess educational content, features, technological capabilities, and design characteristics of breastfeeding apps based on their alignment with principles of the Social Cognitive Theory (SCT). Breastfeeding apps were identified, downloaded onto a smartphone, and used for fifteen minutes. Features of apps were scored using a rubric grounded in SCT. Apps will be stratified by payment method (free, freemium, not free) and business model (for-profit, non-profit, government, private individual, other) for analysis. Design characteristics will be quantified using Nielsen's heuristics, and all apps will be re-evaluated. Data presented at the California Breastfeeding Coalition Summit showed that when apps were evaluated and stratified by payment method, there were no differences in the average scores of an application's features or technological capabilities. I expect to find that for-profit entities are more likely to create breastfeeding apps with engaging educational content, interactive features, advanced technological capabilities, and user-friendly design.

Differences in Reported Perceived Parental Support and Control by Oxytocin Gene SNP Allelic Pairings

Andre Sillas

Sponsor: Paul Hastings, Ph.D.
Psychology

Studies have investigated genetic associations between parental support and parental control with progeny development. Specifically, the oxytocin (OXTR) receptor gene, SNP rs53576, has been associated with expression of sensitive parenting (e.g., G/G allele pairing). However, less is known whether OXTR gene rs53576 allele pair-type differences exist in progeny's self-reported perceived parental support and parental control. First, we hypothesized that individuals with a GG allele pairing would report higher parental support and lower parental control when compared to individuals with a AG/AA allele pairing. Participants (N =202) between the ages of 18-29 (M=23.5 years) completed a series of questionnaires and provided a saliva sample via passive drool collection for a genetic assay. A t-test showed that participants with GG allelic pairing perceived more parental support (M=3.34, SD=0.70) and less parental control (M=1.35, SD=0.46) when compared to individuals with AG/AA allele pairing (M=2.98, SD=.82; M=1.65, SD=.76, respectively), $t(152)=-2.86, p<0.05$. These findings suggest that individuals with an OXTR G/G allele pairing may perceive interactions with their parents as more supportive and less controlling. Whether these findings remain robust across varying social contexts and for different social groups (e.g., ethnic, racial, and sexual minority populations) is an open question.

Algorithms, Platforms, and Bias: An Integrative Literature Review

Selena Silva

Sponsor: Martin Kenney, Ph.D.
Human Ecology

Algorithms and digital platforms utilizing rich datasets, or “Big Data,” are increasingly used decision-making tools in a variety of fields and industries. This presentation explores the current understanding of algorithmic decision making, digital platforms, and potentially resulting racial or ethnic bias. After a thorough literature review, 125 sources including academic, legal, and popular press articles were identified. Each article was examined and nine unique loci where ethnic bias might arise were inductively identified: (1) training data bias (2) algorithmic focus bias (3) algorithmic processing bias (4) transfer context bias (5) misinterpretation bias (6) automation bias (7) non-transparency bias (8) consumer bias (9) feedback loop bias. The articles keywords, sector, and methodology were identified. The paper considers both the possible harms of growing algorithmic integration and potential benefits that may include increased objectivity and standardization. With the increasing use of artificial intelligence and software-based platforms to channel and regulate social life, algorithms are becoming ever more pervasive in a wide variety of social decision making processes. For this reason, a rigorous evaluation of the current state of knowledge and the development of a taxonomy of the types of bias is an important academic and societal contribution.

Impact of Qualitative Research Experience on Pre-Health Undergraduate Students

Madeleine Silverstein

Sponsor: Patrick Romano, M.D.
MED: Div Of Internal Med

Every year, thousands of pre-health students seek research experiences to bolster their applications to professional health schools and demonstrate their commitment to the field. Due to lack of exposure, qualitative research forms a tiny minority of these experiences in comparison to other forms of research. Recently, a qualitative study at the UC Davis School of Medicine, in conjunction with 41 pre-health students at the undergraduate campus, examined the role of student-run clinics in providing patient access to healthcare. The UC Davis School of Medicine operates seven student-run clinics and several affiliated clinics, each serving a different high-risk patient population. By engaging in qualitative research, students gained exposure to public health concepts, engaged in extended interviews with patients, and also learned interviewing and coding techniques. We designed a survey intended to gain insight into the students' experience of engaging in qualitative research, with hopes of learning how or if the process affected the students' perceptions of professional healthcare roles. Our findings could demonstrate the significance of such experiences in preparing pre-health students for future career goals.

Reliability of Two Indirect Measures of Tendon Stiffness

Alexander Simileysky

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

Tendon stiffness affects physical performance and changes in tendon stiffness can be indicative of injury. Thus, there is a desire to measure tendon stiffness in-vivo. Directly measuring stiffness in-vivo is difficult, but indirect methods are possible. Two such methods are Electromechanical Delay (EMD) (time delay between onset of muscle activation and external force detection) and the Rate of Muscle Force/Torque Development (RFD/RTD). The viability of using these techniques to track physiological changes in tendon stiffness depends on the reliability of these measurements, which have not been reported. The goals of this project are to quantify the reliability of EMD and RTD measurements and assess the viability of EMD and RTD for tracking tendon stiffness changes. In a preliminary study, three participants performed isometric knee extensions while knee extension torque and muscle activation were recorded. Custom software calculated EMD and RTD. Variances of each measurement were compared across trials to determine reliability. The reliability of EMD and RTD were 7 ms (15 % of mean) and 201 Nm/s (10% of mean) respectively, suggesting that these approaches are viable for detecting tendon stiffness changes resulting in EMD and RTD changes greater than these values.

Control of 3D Robotics Solo Quadcopter for Augmented Reality Video Game

Gabriel Simmons

Sponsor: Nelson Max, Ph.D.
Engr Computer Science

Control of quadcopters in indoor environments lacking GPS availability is integral to making quadcopter-based indoor games accessible to novice pilots. Solutions to this problem could also provide benefit to the fields of package delivery, personal robotics, and the military. This research aims to investigate the indoor control of the commercially-available 3D Robotics Solo quadcopter using fiducial marker-based localization data, in the context of an augmented reality (AR) video game. Robot Operating System (ROS) software is used as a framework for developing the control algorithm. The success of the control algorithm will be reflected in the quadcopter's ability to maintain an arbitrary position specified by the user. The algorithm will be applied to the problem of collision avoidance in the context of the AR video game, and success will be evaluated by the quadcopter's ability to avoid collision with the real-world game enclosure and other quadcopters. If successful, this experiment would serve as a proof of concept for a simple, cost-effective method of control of a popular, commercially available quadcopter platform.

Perception of Landscape in Literature

Steffi Sin

Sponsor: Elizabeth Boults, M.L.A.
Human Ecology

The history of San Francisco has shaped Chinese communities. This is especially evident in Chinese-American literature because authors' interpretations of their reality and the environment are exaggerated using literary devices. Because identity is fundamentally linked with the sense of belonging, how does the landscape impact the "Sense of Place" to which literary characters are subjected? How can an analysis of literature written by Chinese-American authors reveal the perception of "Sense of Place" in San Francisco's Chinese communities, and how can this analysis influence design recommendations in urban planning and landscape architecture? Selected literary works include: *The Woman Warrior* by Maxine Hong Kingston, *The Joy Luck Club* by Amy Tan, *Bone* by Fae Myenne Ng, and *Fifth Chinese Daughter* by Jade Snow Wong. Christopher Alexander's *A Pattern Language* will be used to guide the development of themes and analysis of literature. Data collection consists of selecting passages based on their descriptions of the landscape and by using "Sense of Place" as a literary lens. Quantitative and qualitative data analysis will explore linguistic, formal, contextual, and personal meaning, along with signatures of landscape. Findings will then be used in the composition of design recommendations and the creation of a pattern book.

Seasonal and Regional Variations in Nonapeptide Receptor Distributions in House Sparrows (*Passer domesticus*)

Alexis Singh

Sponsor: Karen Bales, Ph.D.
Psychology

Many neuroendocrine investigations of social behavior have focused on the relationship between nonapeptides and social bonding. In mammals, the nonapeptides oxytocin and vasopressin modulate a variety of affiliative behaviors, such as mother-offspring interactions and pair bonding between mates. In birds, mesotocin and vasotocin—the avian homologues—modulate similar behaviors. However, far less is known about the role of nonapeptides in nonreproductive social behaviors, such as avian flocking. The purpose of our study was to determine the relationship between nonapeptides and grouping behavior using house sparrows as our animal model. In particular, we compared differences in nonapeptide receptor distribution during the breeding and winter seasons and examined the extent to which winter severity influenced this difference. To test these effects, we sampled adult male and female house sparrows from three locations of varying latitude during the breeding and winter seasons. We collected weather data; observed behavior; assessed reproductive status, physical measures, and hormone levels; and determined nonapeptide receptor distributions using autoradiography. We hypothesize that increasingly severe winter weather conditions—occurring with increasing latitude or transition from summer to winter—promotes aggregative behavior by modulating nonapeptide receptors. Our findings will elucidate how environmental and neuroendocrine factors influence grouping in wild birds.

Testing a Novel Compound for the Reduction in Airway Inflammation in a Murine Model of Asthma

Jasmine Singh

Sponsor: Kent Pinkerton, Ph.D.
MED: General Pediatrics

Asthma affects more than 300 million children in the world today. Therapeutic approaches for the treatment of this malady is of critical importance. Use of inhibitors of soluble epoxide hydrolase (sEH) have been shown to reduce inflammation under a variety of settings. In my study I tested the efficacy of TPPU, a specific sEH, to alleviate airway inflammation in a murine model of pulmonary asthma. Male BALB/c mice were sensitized by ovalbumin (OVA) via inhalation over a period of 2 weeks. A total of 6 groups were examined: 1) control, 2) OVA, 3) OVA+TPPU (2 hr), 4) OVA+TPPU (6 hr), 5) OVA+TPPU (sc) and 6) OVA+ 21i. To measure the effect of TPPU, I quantitatively scored the amount of inflammation for four distinct regions of the lung in the controls and each of the treatment groups. Significant differences were noted in the bronchiolar region between control and OVA-treated mice, demonstrating the ability to create a reproducible model of asthma-like inflammation. Treatment with OVA+TPPU for 2 or 6 hr, as well as treatment with OVA+21i significantly reduced bronchiolar inflammation as a result of sEH inhalation.

Towards Self-Driving Car: Lane Line Detection

Sarvagya Singh

Sponsor: Chen-nee Chuah, Ph.D.
Elect & Comp Engr

With the recent re-emergence of Deep Learning, many computationally expensive applications can be performed in real-time. In particular, autonomous vehicles features such as Lane Line Detection can be implemented using Computer Vision. Through our independent senior design project, conducted during Fall and Winter Quarters of 2018, we were able to perform real-time lane line detection at 99 fps. Therefore, we would like to present this work for the reference of future development. We have tested lane line detection model on a custom track; the demo car model was able to navigate and stay within the lane lines using this computer vision algorithm.

EMSY - A Possible Repressor of Homologous Recombination

Kartik Singhal

Sponsor: Wolf Heyer, Ph.D.
Microbiology & Molec Genetics

DNA repair mechanisms are processes used by the cell to rectify DNA damage that it has incurred due to exogenous mutagens or endogenous sources. DNA double stranded breaks (DSBs) are a complex form of DNA damage that affect both strands of the double helix. The cell can repair DSBs using several pathways, and Homologous Recombination (HR) repairs such damage with the highest fidelity. BRCA2 and RAD51 are two important proteins required for HR and are recruited to the DSB site by PALB2. Variants of BRCA2, PALB2, and other HR genes have been associated with increased susceptibility to cancer. However, in the majority of cancer cases, none of the known HR pathway genes are mutated. EMSY is found amplified in a fraction of breast cancers and was suggested to act as a negative regulator of HR by inhibiting BRCA2. Therefore, we aim to establish the function of EMSY in HR. To this end, we are purifying the EMSY protein to determine its structure and function. In particular, we will determine its biochemical properties alone, and in reconstituted recombination reactions containing BRCA2.

Enrichment Preference in Mature Boars, and the Impact of Enrichment Exposure on Boar Welfare

Lara Sirovica

Sponsor: Kristina Horback, Ph.D.
Animal Science

An increasing public concern over the welfare of livestock species is motivating more producers to consider changes to production practices. Providing environmental enrichment for intensively housed animals is one such potentially welfare-enhancing change. The goal of environmental enrichment is to provide biologically relevant environmental stimuli to allow an animal to perform highly-motivated, species-specific behaviors. To date, there is no research specific to the applicability of environmental enrichment for adult boars, nor on commercial boar welfare in general. This study aims to assess individually-housed boars' preferences for, and their behavioral responses to, two different enrichment items (rubber chew sticks and cotton rope). Additionally, this study will investigate differences in the proportion of time boars spend performing the abnormal behaviors of sham chewing and bar-manipulation without enrichment (control) versus with enrichment (treatment). Any reductions in amount of time spent performing abnormal behaviors may indicate that animals' behavioral needs are being met. The results of this novel study should help provide producers with more objective, research-based suggestions concerning the applicability and efficacy of different enrichment choices for individually-housed boars.

Investigating Student Problem-Solving Skills in Genetics

Evelyn Sjaflii

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

The purpose of this study is to reform undergraduate-level STEM/biology education by identifying the aspects of problem-solving that students struggle with. To investigate this, we are exploring the differences in thought processes between high-performing students and low-performing students when solving open-ended genetics problems. During weeks 7 and 8 of the quarter, ten high-performing and ten low-performing students were invited to participate in one hour think-aloud interviews (TAInt) in which they solve genetic linkage problems while verbally demonstrating their thought processes. To evaluate students' knowledge retention, the same participants were invited to complete the same TAInts 8-9 weeks after the quarter ended. To analyze student performance, problems were subdivided and then codes were assigned using the previously established COSINE (Coding System for Investigating Sub-problems and the Network) method. Based on the students' performance, the COSINE method assigns a code to each sub-problem specific to the participant. These codes will then be analyzed to provide insights into where in the problem-solving process students struggle or succeed.

The Impact of Gender Quotas on Female Labor Market Indicators

Christina Skandalis

Sponsor: Giovanni Peri, Ph.D.
Economics

An unfortunate but common occurrence on both political and corporate decision-making boards is a lack of female representation. However, research has found explicit and implicit benefits of having increased female leadership; from better operational company control, to higher net profit margins, to increased career aspirations in young women. To address this discrepancy, gender quotas have served as the primary policy mechanism to increase female representation. Political quotas have been found to produce better female and family friendly policies, and corporate quotas tend to benefit women already at the top of the corporate ladder. But what about the average woman in the labor force? Using panel data of EU countries from 1990-2015 and their passage of political and corporate quotas, I will use a fixed effects regression to analyze how the implementation and trends associated with quotas impact female labor market indicators. With this, while we find positive results at initial implementation of quotas, over time, quotas have negligible impacts on women in the labor force.

Investigating the Effects of Prebiotics and Their Potential for Improving Human Health Using an *in vitro* Gut System

Kyra Smart

Sponsor: Matthias Hess, Ph.D.
Animal Science

There are trillions of microorganisms inside the gastrointestinal (GI) tract of mammals, which perform key health roles in the host. Prebiotics are non-digestible carbohydrates which improve the overall function of this microbial community associated with the GI tract. The pig gut represents an excellent opportunity to study processes in the human gut since the human gut and the pig gut share similar morphology. Previous studies with rodents suggest that a variety of compounds containing large-chain polysaccharides or polyphenolic compounds can act as prebiotics. Plant-derived compounds such as berberine, γ -oryzanol, and powdered cactus cladode are popular commercial prebiotic sources; in this project I will be investigating the effect of these compounds on the microbial community associated with the pig gut using an *in vitro* system. I hypothesize that the tested compounds will increase the microbiome's fermentation potential, volatile fatty acid production, and result in changes to the microbial community akin to what is seen in healthy adult humans. The obtained results will provide an enhanced understanding of the molecular function of these compounds and will allow me to determine if the *in vitro* platform can be used to identify new prebiotic candidates for improving gut health.

Maximizing the Production of Therapeutically Active Lipids in Microalgae

Jeanelle Smoot

Sponsor: Annaliese Franz, Ph.D.
Chemistry

Many microalgae produce significant amounts of polyunsaturated fatty acids (PUFAs). Metabolites of PUFAs are involved in the regulation of inflammation, cell proliferation, apoptosis, angiogenesis, and other biological processes in humans. These therapeutically active lipids are currently expensive to synthesize or bioengineer, so the long-term aim of this project is to optimize alternative methods to produce target lipids in oleaginous microalgae. This research will also lead to an increased understanding of the biosynthesis of target lipids in microalgae. The specific goals of this research are focused on investigating three methods to increase target lipid production: fatty acid feeding, temperature regulation, and chemical treatment. Algae have been previously shown to absorb two precursor PUFAs—eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). After optimizing EPA or DHA content with fatty acid supplementation, we will investigate whether there is a synergistic response with low temperature conditions and oxidative stress on target lipid formation. These results will be used to identify a combination of PUFA supplementation, low temperature, and chemical treatment conditions effective for an alternative method of production of therapeutically active lipids in microalgae.

DNA Damage Repair at Oocyte Prophase is Disrupted by Atrazine

Christina So

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

Atrazine is a widely used herbicide, making it a common contaminant of ground water. Acting as an endocrine disruptor, atrazine has been shown to cause feminization of male gonads across lower classes of vertebrates, and induce meiotic defects during spermatogenesis. However, the effects of atrazine exposure on female reproduction are poorly characterized. In this study, we exposed fetal mice to atrazine throughout pregnancy and then analyzed DNA damage repair in fetal oocytes and the development of ovarian follicles in juveniles. Immunostaining of fetal ovary chromosome spreads for the DNA damage markers Replication Protein A (RPA) and Phospho-Histone H2A.X (gH2AX) shows increased levels of DNA double strand breaks in the oocytes of atrazine-exposed mice. Immunohistochemistry of ovary sections reveals significantly increased numbers of multi-oocyte follicles in the ovaries in the animals exposed to atrazine. Our data demonstrates that atrazine exposure during fetal development negatively affects the meiotic process, resulting in elevated DNA damage and increased incidence of multi-oocyte follicles. These defect could have long-term effects on female reproduction.

Encountering the Alien: Exploitation, Appropriation, and Subversion in Postcolonial Science Fiction and Fantasy

Samantha Solomon

Sponsor: Michael Subialka, Ph.D.
Comparative Literature

Set in galaxies with more sophisticated technologies and more pristine natural settings than we know today, science fiction and fantasy analyze past and present to construct a future physical reality not so far removed from our own. However, what of the politics of these imagined future worlds? Despite the negatives of colonialism in human history, most sci-fi and fantasy works have folded imperial discourses into their narratives while failing to include critiques of colonialism. Postcolonial science fiction and fantasy address this gap by reconsidering the prevalent colonization narrative of mainstream sci-fi and fantasy; they examine the relationship between colonizer and colonized through the perspective of the subaltern. These works follow historical postcolonial theory by addressing the ways colonizers exploit language, nature and technology in a colonial context. In this paper, I will perform close readings of texts in an effort to examine how postcolonial thought functions in a sci-fi/fantasy environment. I will argue that authors of the genre address the roles of language, technology and nature as tools of colonization while simultaneously promoting the appropriation and cultivation of these systems by the subaltern. As a result of this subversion, I argue that these works advocate for a decolonized future.

The Therapeutic Potential of Ayahuasca in Treating Neuropsychiatric Disorders

Sina Soltanzadeh Zarandi

Sponsor: David Olson, Ph.D.
Chemistry

It is known from brain imaging and post mortem brain studies that neuropsychiatric diseases such as depression, anxiety, and post-traumatic stress disorder, are characterized by the atrophy of pre-frontal cortex. Therefore, compounds that rectify this structural change by promoting neurite outgrowth, possess enormous therapeutic potential. Possible candidates include compounds found in ayahuasca, a traditional spiritual medicine of indigenous Amazonian tribes, as this brew has demonstrated anxiolytic and antidepressant properties in both humans and rodents with chronic consumption being associated with cognitive enhancements. Ayahuasca primarily contains N, N-dimethyltryptamine (DMT), harmine, and harmaline. DMT, a classical psychedelic, promotes neuroplasticity in cortical regions of the brain characterized by spinogenesis, synaptogenesis, and dendritogenesis. β -carboline alkaloids harmine and harmaline function as monoamine oxidase (MAO) inhibitors and therefore, increase the oral bioavailability of DMT. While there has been a number studies on the effects of harmine and harmaline in the animal models of neuropsychiatric disorders, there is a lack of research on the possible synergistic effects of harmine, harmaline, and DMT in treating neuropsychiatric disorders. Herein, we deduce that ayahuasca possesses an enormous therapeutic potential due to its unique composition, leading to dendritogenesis, spinogenesis, synaptogenesis, while simultaneously preventing DMT degradation.

Effect of Ibuprofen on Mouse Kidney Protein Concentration

Sai Sahitha Somepalle

Sponsor: Aldrin Gomes, Ph.D.
Neuro Physio & Behavior

Ibuprofen, a non-steroidal anti-inflammatory drug, is commonly used to treat pain, fever, and inflammation by blocking the production of prostaglandins, substances that contribute to the inflammatory response. Prostaglandins, such as PGE2 and prostacyclin, affect both glomerular filtration rate and renal blood flow among other renal processes. Previous research indicates that consumption of Ibuprofen affects prostaglandin levels which in turn lead to decreased renal function as a result of decreased renal perfusion. NSAIDs, such as Ibuprofen, have been known to affect renal function especially in patients who are at-risk or in kidneys which are under constant stress. In these experiments, through the use of protein concentration determination and western blots, total protein concentrations and kidney proteasome subunits were determined between mice treated with Ibuprofen and mice given a vehicle. The results show that mice treated with Ibuprofen have a higher protein concentration compared to control mice. This occurred in both male and female mice, indicating that this trend was not gender specific.

The Hegemonic Institution of Violence in Slave Societies vs Societies with Slaves

Clifton Sorrell

Sponsor: Justin Leroy, Ph.D.
History

The 17th-19th century violence of slavery within the colonial Atlantic world has received a great amount of attention from scholars within the studies of slavery in the Americas. Much work has been done examining the role violence played in slavery meant to reinforce domination and preeminent authority over slaved bodies which is illustrated through the intimacies between the slave and the slave owner. Consequently, this normalizes a constructed narrative of violence in which articulates it within the privatized space of the slave owner as an exercise of his autonomy. This project cross-examines the colonies of New England, Jamaica, and Louisiana to explicate the violence of slavery beyond the autonomous acts of slave owners, expanded further as an established institution of hegemony within the boundaries of slave societies and societies with slaves. I will be analyzing primary sources of archival documents to examine the firsthand accounts and possible connections towards explicating violence as an established hegemonic system beyond the autonomous power of slave owners. The significance of this project will allow for the expanded question of violence and its designed function within the institution of slavery.

The Effect of Beta-Glucosidase on the Phenolic Profile of Olive Oil and Waste Products

Chelsey Souza

Sponsor: Selina Wang, Ph.D.
Food Science & Technology

California has emerged as a major world producer of olive oil in recent years. Olives are abundant in phenolic compounds which have antioxidant properties. However, during olive oil production, the majority of phenolics end up in the waste streams (water & olive pomace). The wastewater has a high organic content & cannot be recycled back into processing. There is great interest in recovering these high-value phenolics from waste streams; however, current strategies like filtration & biodigestion are energy-intensive & not feasible on a large scale. The goal of this study was to increase the amount of phenolics in olive oil using an enzymatic method, thereby decreasing the amount that ends up in the by-products. This was done in two different experiments using our lab-scale olive oil processor. In the first, varying concentrations of beta-glucosidase were added during processing to break down large water-soluble phenolics into smaller, more lipophilic compounds. The second trial explored the synergism of beta-glucosidase with other common enzymes like pectinases & cellulases, which are already used to increase oil yield. Phenolic content of the fruit, oil, wastewater & pomace are currently being analyzed to determine if the enzyme affects the phenolic profile.

Quantifying Pinnacle Morphology Using 3-Dimensional Reconstructions of Microbial Mats in Lake Vanda, Antarctica

Natasha Sramek

Sponsor: Dawn Sumner, Ph.D.
Earth And Planetary Sciences

Benthic pinnacles grow in ice-covered Lake Vanda, McMurdo Dry Valley, Antarctica and extend from the base of the ice to more than 50 m depth. Three-dimensional reconstructions of these pinnacles are created using underwater videos and Agisoft Photoscan. Reconstructions are analyzed in UCD KeckCAVES (<http://keckcaves.org>), where interactive exploration and analysis of three-dimensional data are used to measure pinnacle heights and locations. Results are compared to nutrient diffusion model predictions to study constraints on the growth of microbial communities in Lake Vanda and the resulting pinnacle morphology. Mats were reconstructed at 27.1 m, 23.6 m, and 21.8 m water depths. Pinnacle height measurements show that at 27.1 m depth pinnacle heights are up to 1.8 cm; whereas, at 21.76 m, the heights are overwhelmingly between 0.1 cm and 0.3 cm. Results suggest an inverse correlation between heights of pinnacles and water depth. The youngest and shortest pinnacles are at 21.8 m depth, where slight velocity flows may induce nutrient transport by convection. At 27.1 m depth, there is negligible movement in the water column, therefore, nutrient delivery occurs through diffusion. Differences in pinnacle morphology may be affected by the water depth, nutrient delivery mode, and age of the microbial mats.

Comparing Evolutionary Histories of Pathogen *Anaplasma phagocytophilum* in Ungulate and Non-Ungulate Species

Samvardhini Sridharan

Sponsor: Janet Foley, D.V.M., Ph.D.
VM: Medicine & Epidemiology

Anaplasma phagocytophilum (previously known as *Ehrlichia phagocytophilum* or *Ehrlichia equi*) is a bacterial pathogen found mainly in the northern hemisphere. When transmitted by ticks, it can cause granulocytic anaplasmosis in wildlife, domestic animals, and humans. This disease can cause fever, severe head and muscle pain, and rarely immunosuppression or acute respiratory distress, lower limb edema, and death. However, once properly diagnosed and treated, the prognosis is very good. The number of diagnosed cases in humans and animals has steadily increased over the last decade. It is thought that the species may actually comprise multiple different variants, each with its own ecology. To understand more about the evolution of this bacterium, the 16S gene of NIH's GenBank database and in-house samples were analyzed in diverse host species from around the world. PCR and gel electrophoresis, among other techniques, were used to acquire DNA from procured samples. Afterward, analysis techniques, including Molecular Evolutionary Genetic Analysis (MEGA), were employed to analyze the samples. Using this software, phylogenetic trees were created using maximum likelihood, and are currently being explored to determine the if *A. phagocytophilum* was originally an ungulate pathogen or a rodent one, as well as the location of the bacterium's origin.

Came From a Woman, Got Our Name From a Woman: Female Bodies as Sites of Identity, History, and Narrative in *Absalom, Absalom!*

Emily Stack

Sponsor: Elizabeth Freeman, Ph.D.
English

Many critics read Faulkner's *Absalom, Absalom!* through a distinctly male-centric lens, as the story of a man and his sons, the rise and fall of a patriarchal dynasty, a microcosm for the rise and fall of the antebellum American South. Though the novel ostensibly suggests patrilineage as its guiding ethos, I suggest instead that it is female names, bodies, and narratives which are the foundation of the narrative and form. Examining the ways family heritage and racial identity within the story are created and controlled by women as well as the ways in which the formal structure is dependent on and given meaning by its relationship to women, I argue that the female body, identity, and consciousness are the mechanisms through which identities are formed, stories transmitted, and histories given meaning. Rather than understanding the outsized significance assigned to the female body as misogynistic, I suggest that if Faulkner's project in *Absalom, Absalom!* is to untangle and pass on the story of the Old South, then the positioning of women's bodies as the mechanism through which selfhood, identity, history, and meaning are produced, reproduced, and transmitted is not a position of subjugation but a manifestation of power.

Relationships Between Head Morphology and Body Depth in Labrid Fishes

Anya Stajner

Sponsor: Peter Wainwright, Ph.D.
Evolution & Ecology

Dwelling in habitats from coral reefs to the sandy sea floor, the aesthetically captivating Labridae are widely regarded as one of the most speciose and morphologically diverse groups of marine fishes. The vast morphological diversity found in labrids is related to their ability to diversify across extensive ranges of environmental and ecological niches. It is possible, however, that this may also constrain the relationship between body depth and head morphology as seen in other adaptive radiations. Here, we examine the dynamics of the relationship between body depth and head depth, lower jaw length, and mouth width diversity in labrids. This study uses the largest data set of its type, with data collected from the National Museum of Natural History, and includes measurements of nearly 600 specimens within Labridae, across over 200 species. To quantify the strength of the relationship between head morphology and body shape we used a phylogenetic framework and linear morphometric data to estimate and compare head shape diversity in shallow and deep bodied fishes. We hypothesize a strong connection between these two regions. This research sheds light on the interaction between body and head shape evolution and provides novel insight into an incredibly diverse radiation of fishes.

Mutation R4496C Causes Leaky RyR2 Independent of Zipping/Unzipping Mechanism

George Stavropoulos

Sponsor: Donald Bers, Ph.D.

MED: Pharmacology

Catecholaminergic polymorphic ventricular tachycardia (CPVT) is a condition characterized by arrhythmia triggered by physical exertion or emotional distress. CPVT affects 1 in 10,000 individuals with 50-55% of cases caused by Ryanodine Receptor 2 (RyR2) mutations. Under physiologic conditions, the N-terminal domain and the central domain of RyR2 zip together. The zipped state of RyR2 allows for the binding of calmodulin (CaM), which stabilizes RyR2. Unzipping of the N-terminal and central domains, which is caused by oxidation, phosphorylation by CaMKII, and central domain mutations, leads to leaky RyR2, which breaks down the RyR2-CaM interaction, leading to arrhythmogenesis. In this project, we investigated whether R4496C, a transmembrane domain mutation of RyR2, affects zipping/unzipping of RyR2. We used DPc10, a central domain peptide, to probe the structural states of RyR2. We found that compared to wild-type (WT) RyR2, R4496C-RyR2 was more active at baseline and after protein kinase A (PKA) activation. However, DPc10 and CaM affinities for binding RyR2 are unaltered. We conclude that R4496C mutation causes a leaky RyR2 independent of zipping/unzipping mechanism.

Anemones or Enemies? Aggression and Range Shifts of Two Sea Anemones at Bodega Marine Laboratory

Seth Strumwasser

Sponsor: Eric Sanford, Ph.D.

Evolution & Ecology

Global climate change often leads to species' ranges shifting poleward as temperatures rise. The purpose of our project was to evaluate the increasing abundance of the southern sea anemone *Anthopleura sola* along the coast at Bodega Marine Laboratory and to examine its interaction with the more northern *Anthopleura xanthogrammica*. There is little understanding of individual-level interactions between these species and the consequences of these interactions for community structure. We performed several observational field studies in which we counted and measured anemones along a section of the shore, recorded temperature, and measured water flow. We also carried out laboratory experiments in which we measured the aggression between and within the two species. We found that the local abundance of *A. sola* has increased dramatically since 2013. Furthermore, *A. sola* was much more aggressive than *A. xanthogrammica* in laboratory trials. The effects of climate change on species' ranges can be exacerbated by agonistic behaviors, especially when two species compete for shared resources. Coupled with the increased abundance of *A. sola* in Northern California, agonistic behavior could force *A. xanthogrammica* further north or into less desirable habitat. This shift could have negative effects on the ecosystem and interactions with other species.

Exploring Student 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 TA's and the ES's, 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 TA's or ES's and how the teaching styles may vary between the two lab instructors. Student inquiries and TA/ES 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. The results will also be used to assess the overall success of the Emerging Scholars program and suggest improvements to enhance the role of ES's in the labs.

The Home Stretch: Body Elongation in Pelagic Fishes

Victoria Susman

Sponsor: Peter Wainwright, Ph.D.

Evolution & Ecology

Among marine environments, the pelagic zone has the largest volume, nearly 1.4 billion cubic kilometers, and the greatest vertical range, 11,000 meters. Throughout this area, body shape is specialized to an incredible degree to overcome the open ocean – yet there is still great morphological diversity. While biodiversity can manifest in many forms, body elongation is the dominant mode of shape variation in reef fishes. To expand beyond reefs, we evaluated morphological diversity across a different habitat – the pelagic zone. Reefs possess limited space but high complexity, which contrasts the expansive yet structurally simple pelagic environment. We used linear body shape measurements from the National Museum of Natural History that span all spiny-rayed fishes and gathered habitat data from the literature. In order to analyze this dataset, we used a phylogenetic framework for comparative analyses. We predicted that certain morphological measurements, including head depth, maximum body depth, and caudal peduncle depth relative to standard length will yield the greatest diversity – and therefore that body elongation is the primary form of shape variation across pelagic fishes. Such findings would align with current thinking that body elongation diversity is a key manifestation of ecological differences across habitats.

The Impact of Acculturation and Enculturation on the Mental Health of Ethnic Minorities

Alice Tang

Sponsor: Nolan Zane, Ph.D.
Psychology

The United States is home to various racial and ethnic groups, and this heterogeneity is expected to increase in the future. Acculturation to mainstream culture and enculturation to one's heritage culture become increasingly relevant as both have implications for mental health. This study assessed the relationships between acculturation, enculturation, and mental health. Participants included 60 ethnic minority college students ranging in age from 18 to 42. Enculturation to one's heritage culture was negatively associated with both depression and anxiety, but not related to perceived stress. Acculturation was also negatively correlated with depression, but was not significantly related to anxiety or perceived stress. When acculturation and enculturation were included in the same regression model, only enculturation to one's heritage culture emerged as a significant predictor of anxiety. Neither acculturation nor enculturation emerged as a significant predictor of depression when both were accounted for in the same model. Findings suggest that enculturation to one's heritage culture may act as a protective factor with respect to mental health, specifically anxiety. Based on these results, health care professionals and practitioners should consider incorporating ways to maintain or preserve one's heritage culture as a protective factor against emotional distress and stress among ethnic minority populations.

Exploring Hydrogen Bonding of Silica Surface Interactions Using a Soluble Organosilicon Model Compound

Karina Targos

Sponsor: Annaliese Franz, Ph.D.
Chemistry

Silicon and oxygen are the two most abundant elements in the Earth's crust. These elements are incorporated into many materials such as glass, ceramics, and computer chips. One important configuration of these two elements is a siloxanol (ROSiOH), a motif capable of hydrogen bonding that is found in various materials including the surface of silica gel. Investigating the hydrogen-bonding behavior of siloxanols can lead to a better understanding of their role in the applications of silica gel in separations, material science, heterogeneous catalysis, and drug delivery. In this study, a series of polyhedral oligomeric silsesquioxane (POSS) triols, $R_7Si_7O_9(OH)_3$, an inorganic-organic hybrid structure containing siloxanol groups, are used as soluble model compounds to study their hydrogen-bonding interactions. Nuclear magnetic resonance (NMR) spectroscopy was used to probe solution-phase molecular hydrogen-bonding interactions of these POSS triols with neutral and anionic Lewis bases. Various POSS siloxanol derivatives have been designed and synthesized to compare binding interactions and catalytic activity. These results indicate which siloxanol arrangements can provide effective hydrogen-bonding activation and be applicable as models of silica surface.

Body Shape as a Constraint on Head Diversity in Atherinomorph Fishes

Tahmina Tasmim

Sponsor: Peter Wainwright, Ph.D.
Evolution & Ecology

Atherinomorphs are a diverse clade of fishes that include groups like flyingfishes and medaka fishes. These fishes have evolved unusual structures such as needle-like mouths, extreme asymmetry in upper and lower jaw lengths (so-called "half-beaks"), reproductive organs on the chin, and a particularly wide range of body depths. The question as to which factors are the primary drivers of morphological diversity in these fishes remains of interest. To examine relationships between different regions of the body plan, we compared measurements of the head and body depth. We hypothesized that changes in body depth will constrain head and jaw diversity. Given that we generally observe an array of mouth structures among slender-bodied fishes in this lineage, we predicted that deepening events lead to more constraint compared to shallowing events. We utilized data from the National Museum of Natural History, which included linear morphological measurements of body shape across Atherinomorpha. We evaluated relationships between head and body shapes in a phylogenetic context to identify instances of mouth diversity constraint relative to body depth. Our work provides important insight on morphological tradeoffs and diversification in fish body plans.

Is Adipocyte Viability Affected By Temperature During Lipoaspirate Centrifugation?

Vasiliki Tasouli-Drakou

Sponsor: David Sahar, M.D.
MED: Surgery

Centrifugation is utilized to concentrate adipocytes from a lipoaspirate during fat grafting, which can cause mechanical damage to the cells. Low temperatures can increase the integrity of the cell membranes and possibly reduce the resistance to mechanical force. This study aims to explore the effect of various temperatures during lipoaspirate centrifugation to the viability of adipocytes. Institutional Review Board approval was obtained prior to commencement of this study. Lipoaspirates from six healthy women were harvested and each sample was divided into three groups at different temperatures, i.e. Group 1, at 4°; Group 2 at 25°; Group 3 at 37°. Hematoxylin and eosin staining, immunofluorescence, glycerol-3-phosphate dehydrogenase (G3PDH) activity and MTS assays were utilized to evaluate function and viability. Group 1 retained fewer intact adipocytes significantly ($p < 0.05$) compared to Group 2 and 3, which did not differ significantly. The level of glycerol-3-phosphatase dehydrogenase absorbance value was significantly higher in group 2 compared to the others. There was no significant difference among three groups by MTS assay. Thus, 4° and 37° did not protect the viability or integrity of adipocytes during centrifugation. The group that underwent centrifugation at 25° had the best viability.

DysUtopia: A Screenplay

Jake Taylor

Sponsor: Kristopher Fallon, Ph.D.
Cinema & Digital Media

When surrounded by constant streams of digital entertainment, “fake news,” and other mediated glimpses into the world, how can one discover what is objectively true? By writing a feature-length screenplay in the standard industry format, we seek to creatively explore these concepts. Ultimately, the aim of our project is twofold. For ourselves, we hope to learn about the process of writing a feature-length screenplay. For readers, we hope to encourage critical thought about the nature of truth, the role of cinema, as well as other pressing present-day global issues, and equally as important, experience something that is both entertaining and engaging. The screenplay is set in a slightly-futuristic dystopian world, where the corruption of government and corporate figures plagues everyday life from the most menial matters to sweeping global issues. Written in the style of a mockumentary, and using different forms of comedy such as sketch humor, dry humor, and dark humor, the screenplay attempts to show the absurdity of bureaucratic behavior and the development of a kyriarchy through illogical policies and the consumption and acceptance of a toxic world by the general public.

Sex-Specific Behavior Modulation of OT in the Anterior BNST

Christopher Taylor

Sponsor: Brian Trainor, Ph.D.
Psychology

Oxytocin (OT) is highly involved in the modulation of social behaviors, and has therefore been investigated as a possible therapeutic for psychiatric illnesses involving social deficits. Using the California mouse model, our lab has previously shown that in females, but not males, social defeat stress induces social avoidance and is accompanied by increases in OT neuronal activity in the bed nucleus of the stria terminalis (BNST). Further, we found that blocking OT receptors in anterior portions of the BNST rapidly reverses stress-induced social avoidance in females. In these studies we wanted to investigate whether OT in the anterior BNST was sufficient to induce social avoidance in individuals naïve to stress. 20 minutes before behavior testing, randomly assigned animals were given one of three treatments aimed at the anterior BNST: high OT (1ng), low OT (0.2ng), or vehicle (control). We found that high, but not low, OT in the BNST reduces social interaction and increases vigilance in females, while preliminary data suggest that high OT also reduces social interaction but does not induce vigilance in males. Future studies will investigate possible sex differences in downstream effects of OT receptor activation in BNST that may account for these sex-specific results.

Muscle Strength Improvement and ColQ Rescue in Endplate Acetylcholinesterase Deficient Mice Through Allographic Mesenchymal Stem Cell Therapy

John Tenorio

Sponsor: Ricardo Maselli, M.D.
MED: Neurology

Congenital endplate acetylcholinesterase deficiency (CEAD) is an autosomal recessive human disease characterized by severe muscle weakness and fatigability. CEAD results from mutations in COLQ, a gene that encodes the collagen tail of the enzyme acetylcholinesterase (AChE). Mutations in COLQ result in defective ColQ proteins that are unable to anchor acetylcholinesterase at the motor endplate. This causes an excess of acetylcholine, endplate depolarization, and acetylcholine receptor desensitization, thus leading to neuromuscular transmission failure. Conventional treatments of myasthenia based on acetylcholinesterase inhibition are ineffective because patients with CEAD have insufficient acetylcholinesterase. We examined the effectiveness of genetically engineered allographic mesenchymal stem cell therapy to rescue ColQ function in colq knockout mice. Through behavioral testing, fluorescent microscopy, and repetitive nerve stimulation (RNS), we observe improvement in muscle strength and motor performance. Furthermore, we demonstrate the effectiveness of mesenchymal stem cells in secreting ColQ and restoring the enzyme acetylcholinesterase at the neuromuscular junction. Thus, genetically programmed stem cells are capable of ameliorating muscle weakness caused by defective ColQ proteins. This study provides compelling evidence in favor of the use of allographic mesenchymal stem cell therapy as treatment for human CEAD.

An Agent-Based Modeling Investigation of the Role of Social Grooming in the Evolution of Blood Meal Sharing in Vampire Bats

Alery Tenorio

Sponsor: Jeffrey Schank, Ph.D.
Psychology

The social nature of vampire bats has been documented from their behavior to their brain structure. In particular, social grooming (the biting, licking or nibbling on the fur of a groupmate) and food sharing (the regurgitation of blood meals to aid a groupmate) were found to be correlated behaviors. The proposed computer simulation studies will elucidate the role that social grooming plays in the evolution of social groups and particularly in its functional relationship to food sharing. Two agent-based models of vampire bat behavior will be developed. Agent-based models allow us to simulate large populations of agents (e.g., vampire bats) from which large-scale patterns of behavior emerge. The first model will model the emergence of social grooming in a type of prisoner's dilemma scenario, a dilemma between benefits of cooperation or defection. The next model will incorporate the findings of the first model and the functional relationship of social grooming and food sharing. The second model will determine whether social grooming networks play a role in the evolution of food sharing. Based on previous simulation work, the experiment may support multi-level selection as the evolutionary mechanism.

Spectroscopic Determination of the Chemical Structure and Elastic Properties of Marine Sponge Spicules

Samantha Teshima

Sponsor: Kristie Koski, Ph.D.
Chemistry

A common trend in material science involves the identification and replication of beneficial properties in natural structures. In biological contexts these properties can be of particular interest due to their potential medical applications. Marine sponge spicules have remarkable elastic properties, are able to withstand oceanic forces, and have interesting optical properties, such as the ability to transport light like an optical fiber. We investigated the interplay of structure and elastic properties in a silicate marine sponge, *Microciona prolifera* – the “Red Beard Sponge.” Raman scattering was used to determine the molecular structure of the sponge, while Brillouin scattering was used to measure the elastic properties including the elastic anisotropy, sound velocity, Young’s moduli, and bulk moduli. Understanding the structure-property relationships of *M. prolifera* can help us understand the biological interplay of silicate to construct similar synthetic materials in the future. Through comparison to other sponges, we will be able to form a generalized correlation and conclusion of the properties of other sponge spicules.

2’-Fucosyllactose, a Human Milk Oligosaccharide, Induced Intestinal and Systemic Anti-Inflammatory Effects in a Mouse Model

James Thach

Sponsor: Helen Raybould, Ph.D.
VM: Anat Physio & Cell Biology

Chronic inflammation accompanies many diseases. One potential source of chronic inflammation is impaired intestinal barrier function, resulting in harmful bacterial components, such as lipopolysaccharide (LPS), to enter the body. Improvement of barrier function may be a useful therapeutic approach. 2’-Fucosyllactose (2FI) is an oligosaccharide found abundantly in human breast milk and is beneficial in reducing inflammation. Our hypothesis is that 2FL reduces systemic inflammation by supporting growth of beneficial gut microbes and via changes in expression of anti- and pro-inflammatory markers. To recapitulate chronic systemic inflammation, LPS was administered to mice via intraperitoneal injection and 2FI administered in drinking water. Severity of the inflammatory response was assessed by measuring expression of inflammatory markers in liver and intestine tissues using RNA extraction and amplification using real-time polymerase chain reaction (qPCR). Gut microbiota composition was measured using qPCR of 16S DNA. 2FL treatment attenuates expression of pro-inflammatory cytokines and elevates some anti-inflammatory proteins, and decreased liver and spleen weights suggesting an attenuated inflammatory response. In addition, there was a significant increase in the population of beneficial bacteria, such as *Bifidobacteria*. This data suggests that 2FL can induce an anti-inflammatory response both in the intestine and systemically.

Analysis of the Howiesons Poort Lithic Assemblage from Montagu Cave, South Africa

Zoya Thomas

Sponsor: Nicolas Zwyns, Ph.D.
Anthropology

In this study, I will examine the Howiesons Poort lithic (stone artifact) assemblage from Montagu Cave in South Africa. My primary focus is on the variations observed between tool types in the assemblage and how they relate to the economy and technology of hunter-gatherer groups during the Middle Stone Age. The intensity of the tool management (e.g. sharpening) and the distance of raw material sources can provide insights into the mobility and settlement patterns of the occupants of the cave. I am collecting primary data on the lithic assemblage, which is curated at the Phoebe A. Hearst Museum of Anthropology (UC Berkeley), and I will conduct an attribute analysis of the assemblage. I will test whether the intensity of retouch observed on flakes and blades predicts the distance from the raw material source. To do so, I will quantify how much tools have been re-sharpened using methods such as Kuhn’s Geometric Index of Unifacial Stone Tool Reduction, and integrate previously published research on the raw material sources, the site and on the Howiesons Poort technocomplex. Understanding the process of tool manufacturing has the potential to further our awareness of the subsistence pattern and social network of the cave’s inhabitants.

UC Davis Student-Run Clinics: Improving Patient Care to an Underserved Community

Derek Tjeerdema

Sponsor: Lorena Garcia, Ph.D.
MED: Public Health Sciences

UC Davis is unique in that it is home to the most student-run clinics (SRCs) of any institution in the country. These clinics, which are primarily managed by undergraduate student volunteers, provide culturally-sensitive primary care to uninsured and underserved communities in Sacramento. Currently, there is limited information concerning patient demographics at each of the SRCs. The purpose of our study was to identify patient needs and demographic data to improve healthcare practices and foster interclinic collaboration. From 2014-2015, we administered over 1000 surveys to patients during clinic hours, using an 18-question survey that collected patient feedback and demographic information. Drawing from these responses, in addition to interviews with SRC leaders, has allowed our team to establish relationships between social and economic factors influencing an individual’s experience within the healthcare system. We aim to use our research to identify SRC strengths and deficiencies to best tailor patient care within target populations.

Statistical Behavior of Random Plane Partitions

Alec Todd

Sponsor: Dan Romik, Ph.D.
Mathematics

A plane partition may be viewed as a collection of cubes arranged in multiple stacks against the corner of a room, where stacks decrease in height away from the corner. Totally symmetric self-complementary plane partitions (TSSCPP's) are plane partitions that exhibit several particular symmetries, including reflective and rotational symmetries. We consider the set of such plane partitions fitting in a cubic room with side length $2n$. In 1994, G. Andrews proved a simple formula for the number of such plane partitions, first conjectured by several mathematicians in the 1980s; and in 1993, W. F. Doran identified a one-to-one correspondence between these objects and certain families of lattice paths with endpoints on the line $y=x$. We consider such a plane partition selected uniformly at random, which defines a random set of endpoints in the corresponding lattice-path family. We show that this random point process belongs to a class of processes with useful algebraic properties known as Pfaffian point processes, and we study the probabilities of various events associated with this process using experimental methods.

Examining the Effects of Child Sexual Behavior Problems on the Quality of the Parent-Child Relationship

Eori Tokunaga

Sponsor: Susan goff Timmer, Ph.D.
School Of Med - Aps

Research has shown that children who have experienced maltreatment often demonstrate disruptive behaviors such as aggression and defiance (Kim & Cicchetti, 2003; Shonk & Cicchetti, 2001), and reflect problems in the parent-child relationship (DuPaul et al., 2001). Children who have experienced maltreatment may also present co-occurring problems such as sexualized behaviors (Merrick et al., 2008). Pithers et al. (1998) found that caregivers of children with sexualized behaviors thought parenting their children was more difficult and less rewarding. The present study aims to add to current research by examining the effects of child sexual behavior problems on the already challenged relationships between parents and their maltreated children. The quality of the parent-child relationship was evaluated using an observational measure: the Emotional Availability Scales (Biringen et al., 2014). Sexual concerns were measured using the Trauma Symptom Checklist for Young Children (TSCYC; Briere, 2005). The sample consists of 214 maltreated, clinic-referred young children and their biological mothers. Of these, 48 (22%) were rated as having high levels of sexual behavior problems. Preliminary results showed that parents of children exhibiting sexual behavior problems demonstrated greater hostility toward their children than other parents, particularly in situations requiring child compliance. Findings will be discussed.

Respiratory Sinus Arrhythmia Predicts Young Children's Self-Regulation

Liliana Torres

Sponsor: Daniel Choe, Ph.D.
Human Ecology

Self-regulation is the ability to modulate one's reactions and responses, and serves as an important indicator of young children's development. Respiratory sinus arrhythmia (RSA) measures variability in heart rate and respiration, serving as a physiological marker of behavioral and emotional self-regulation. In a preliminary sample of nine children (M age = 53 months; SD = 4.18, 5 girls), we measured children's RSA values during a sitting baseline and as they completed eight self-regulation tasks, including Day-Night, Happy-Sad, Bird-Dragon, Reverse Bird-Dragon, Tongue Task, Dinky Toys, Gift Wrap, and Gift Delay. We calculated the difference in RSA between each task and the baseline to represent changes in RSA during self-regulation tasks, which we then compared to children's performance. Preliminary analyses suggest that higher RSA values during Gift Wrap is associated with high self-regulation and larger differences between baseline and task RSA predict poorer self-regulation in Bird-Dragon. This ongoing research quantifies children's self-regulation behaviorally and physiologically to help us understand how children adapt to different environments and respond to challenges. By observing self-regulation early in children's lives, steps can be taken to improve children's behavioral and emotional responses to stress.

Human-Swarm Interaction: Multi-Robot Operation Using Gesture Control Armband

Tomas Torres - Garcia

Sponsor: Sonia Martinez Diaz, Ph.D.
UCSD: Mechanical and Aerospace Engineering

Interacting with swarms of robots is challenging, however, using gestures is a simple and productive way of accomplishing this task. A gesture control armband, MYO Armband, will be used to simulate formations that robots can follow by simply drawing shapes using forearm motion. The armband modifies the way humans interact with technology. It enables the user to control various types of technology wirelessly by using an accelerometer, a gyroscope and a magnetometer to detect linear acceleration, angular velocity and angular orientation along a three dimensional coordinate system using inertial measurement unit (IMU) sensors. The first research aim is to collect data from the MYO Armband to produce the correct correlations between the IMU sensors and the movements of the arm, such as the left/right, up/down and any combinations of the four motions. The second aim is to apply a Kalman Filter to decrease the noise of the IMU sensors, to increase the accuracy. Finally, the final product will be implemented to a swarm of robots, Turtlebots, to display its functionality using an interactive interface.

Understanding Optical Properties of Liquid Argon for Future Dark Matter Detectors

Sebastian Torres-Lara

Sponsor: Emilija Pantic, Ph.D.
Physics

The elusive cosmic substance known as dark matter holds our universe's galaxies together; however, the fundamental properties of dark matter remain a mystery. The Darkside program, located at the Gran Sasso National Laboratory in Italy, aims to detect the collisions between dark matter particles and liquid argon (LAr) atoms. Measuring the light released from the interaction is a key component of dark matter detection. In order to maximize light collection, it is critical to understand the optical properties of LAr and the detector surfaces. The reflectivity of the detector surfaces, absorption length, and Rayleigh scattering of LAr all factor into determining the detection capabilities of Darkside. We developed a simulation to understand the effects of varying these three optical parameters on the detection of scintillation photons in a LAr chamber. These results will be presented, and will aid in further development of an optical simulation for a LAr detector and support a planned experimental study at UC Davis to determine the reflectance of detector surfaces.

Body Shape as a Constraint on Head Diversity in Atherinomorph Fishes

Angelly Tovar

Sponsor: Peter Wainwright, Ph.D.
Evolution & Ecology

Atherinomorphs are a diverse clade of fishes that include groups like flyingfishes and medaka fishes. These fishes have evolved unusual structures such as needle-like mouths, extreme asymmetry in upper and lower jaw lengths (so-called "half-beaks"), reproductive organs on the chin, and a particularly wide range of body depths. The question as to which factors are the primary drivers of morphological diversity in these fishes remains of interest. To examine relationships between different regions of the body plan, we compared measurements of the head and body depth. We hypothesized that changes in body depth will constrain head and jaw diversity. Given that we generally observe an array of mouth structures among slender-bodied fishes in this lineage, we predicted that deepening events lead to more constraint compared to shallowing events. We utilized data from the National Museum of Natural History, which included linear morphological measurements of body shape across Atherinomorpha. We evaluated relationships between head and body shapes in a phylogenetic context to identify instances of mouth diversity constraint relative to body depth. Our work provides important insight on morphological tradeoffs and diversification in fish body plans.

Exploring Student 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 TA's and the ES's, 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 TA's or ES's and how the teaching styles may vary between the two lab instructors. Student inquiries and TA/ES 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. The results will also be used to assess the overall success of the Emerging Scholars program and suggest improvements to enhance the role of ES's in the labs.

The Role of Oxytocin Neurons in the Bed Nucleus of the Stria Terminalis on Stress-Induced Social Avoidance in Female California Mice

Amy Tran

Sponsor: Brian Trainor, Ph.D.
Psychology

Oxytocin (OT) is usually thought to promote social behavior and decrease anxiety. However, recent research has shown that the effects of OT are context-dependent, which has led to the hypothesis that OT intensifies the perception of both positive and negative social stimuli. Our lab found that social defeat stress together with intranasal administration of OT induces social avoidance behavior in female but not male California mice. Furthermore, stressed females have increased activity in OT neurons located in the medioventral bed nucleus of the stria terminalis (BNSTmv), a brain area that mediates anxiety. Our project aims to test the hypothesis that hyperactivity of OT neurons in the BNSTmv contributes to social avoidance behavior in stressed female California mice. Using Vivo-Morpholino oligos, we reduced the expression of OT specifically in the BNSTmv in both control and stressed females and found that OT knockdown prevents stress-induced social avoidance without affecting behaviors in non-social contexts or social behavior in control females. These findings together with our previous results suggest that hyperactivity of OT neurons in the BNSTmv contributes to stress-induced social avoidance behavior in females.

Mass Spectrometry-Based Carbohydrate Characterization of Common Weaning Foods From Different Cultures

Monica Tran

Sponsor: Carlito Lebrilla, Ph.D.
Chemistry

Foods contain different glycan and monosaccharide compositions. When infants are weaned from an exclusive milk diet to one consisting of solid food, they are exposed to different carbohydrates that may influence their future development, intestinal bacteria composition, and immune system. Different cultures wean infants in distinctive ways that we believe will be prominent in the monosaccharide composition. Analyzing the carbohydrates in weaning foods to this level has not yet been done and will provide a basis for proper weaning practices. Weaning foods samples underwent lyophilization and grinding. Hard acid hydrolysis with trifluoroacetic acid was used to depolymerize the carbohydrates. Chemical derivatization was conducted with 3-methyl-1-phenyl-2-pyrazoline-5-one before being analyzed with an ultra high performance liquid chromatograph coupled to a triple quadrupole mass spectrometer. Characterizing and quantifying the monosaccharide composition of different weaning foods will offer further knowledge for the best weaning practices that can be catered towards specific cultural groups and provide insight on the developmental and health implications of weaning foods on infants.

Enhancing Purification of Systolic Heart Failure Exosomes From Peripheral Blood for Clinical Prognostic Use

Darlene Tran

Sponsor: Anne Knowlton, M.D.
MED: Div Of Internal Med

In the United States, heart failure is a major cause of morbidity and mortality. However, there have been no major breakthroughs in the field for the last two decades. As patients with heart failure get worse, there are no sources of information regarding disease progression other than BNP levels, cardiac imaging to assess function, and creatinine levels to evaluate kidney perfusion/function. Thus, our goal is to identify exosome surface markers on heart failure cardiac myocytes derived exosomes in order to enable isolation of heart failure derived exosomes from serum samples. Exosomes are extracellular, cell-derived vesicles that carry proteins, mRNA, miRNA, and DNA between cells for cell-to-cell communication. Since these exosomes come from the cell membrane and contents of cardiac cells, they essentially give us a noninvasive, "liquid" cardiac biopsy. The endpoint for analysis will be protein and RNA content of the cardiac specific exosomes, particularly microRNA. We hypothesize that there is a correlation between change in exosome content and disease progression of heart failure, and that the content of heart failure derived exosomes can provide novel insights into the progression of this serious disease.

Chronic, Negative Cardiometabolic Consequence of Rosiglitazone Through PPAR-G Activation in the Brain

Edwin Tran

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

Continued and recurrent exposure to psychological stress responses may lead to organ breakdown and increase susceptibility to cardiovascular disease, such as myocardial ischemia. Psychological stress escalates blood cortisol through the hypothalamic-pituitary adrenal (HPA) axis. In previous studies, activation of peroxisome proliferator-activated receptor gamma (PPAR-G) with rosiglitazone has shown to reduce acute stress by blunting the HPA axis. While RSG alleviates acute stress, we previously found that systemic administration of RSG in chronically stressed rats is associated with negative cardiometabolic consequences such as increased pulse pressure and worse aortic morphology. Because PPAR-G is found in peripheral tissues and the brain, it's unknown whether PPAR-G in the brain or periphery is responsible for these negative outcomes. In this study, we investigated the relationship between PPAR-G activation in the brain and cardiometabolic health. Rats were separated into CVS and non-stressed control groups, in which rosiglitazone and saline was administered intracerebroventricularly to both groups. Vascular thickness, aortic tunica media to luminal area ratio, was analyzed as a measure of cardiovascular damage. CVS rats administered rosiglitazone displayed higher ratios than saline controls. This suggests that negative cardiovascular outcomes from rosiglitazone is due to PPAR-G activation in the brain.

Bioengineering of an RNA Molecule to Introduce MicroRNA-328 in Cancer Cells

Michelle Tran

Sponsor: Aiming Yu, Ph.D.
MED: Biochem & Molecular Med

MicroRNAs (miRNA) are a type of noncoding RNAs that silence mRNA and target gene expression through transcriptional regulation. In past studies, microRNAs have been identified as major regulators in cancer metabolism and proliferation. MicroRNA-328 for example has been shown to target and degrade GLUT1 and cause a metabolic shift during oncogenesis, making miRNA-328 a candidate for cancer therapy studies. Therefore, to study the miRNA's function, Escherichia coli was transformed with a bioengineered plasmid to over express a ncRNA (noncoding RNA) that contains the sequence for microRNA-328 attached to either a serine or leucine tRNA in an tRNA/pre-miR-34a molecule. An anion exchange fast protein liquid chromatography (FPLC) method was finally used to purify the two chimeras from bacterial RNA. We were able to produce 15-20 mg of pure chimeric miRNA agents from 1litre of bacterial culture using this novel method. Purity was confirmed by a high-performance liquid chromatography (HPLC) assay and urea gels. In the future, more assays will be done to the ncRNA to study the effect of miRNA-328 on cancer cell proliferation and as a potential cancer therapy.

Investigating General Chemistry Students' Knowledge Retention and Success in Problem Solving

Emma Tribble

Sponsor: Ozcan Gulacar, Ph.D.
Chemistry

Stoichiometry is one of the most challenging topics of general chemistry due to its reliance on problem solving skills and its inclusion of many different chemistry concepts. Using the Coding System for Investigating Subproblems and Network (COSINE) method, our study examines students' success with each subproblem, allowing the discovery of the exact place a student makes a mistake instead of focusing on the final answer. These subproblems were categorized based on chemistry concepts, such as limiting reactant and mole concept. This helped to identify the most challenging concepts that students face in a general chemistry course. This study also focused on students' knowledge retention between quarters. Students were tested both fall and winter quarters on stoichiometric topics to see if they could achieve the same level of success. Our preliminary results showed that in winter quarter, students had higher success rates than in the fall quarter, meaning that student understanding improved over time. Instructors should give their students more time to learn and process the material they teach. Among all the concepts studied, stoichiometric ratio was the most difficult topic for the students in the fall quarter, yet it had the highest success rate in the winter quarter.

Development of a Semi-Preparative Multi-Platform LC-MS/MS-Based Approach to Structurally Characterize Polysaccharides

Gina Ann Trinidad

Sponsor: Carlito Lebrilla, Ph.D.
Chemistry

The correlation between food polysaccharides and their role towards regulation of digestive health, immune system development, and gut microbiota modulation remains largely understudied. One of the critical steps in understanding the function of food polysaccharides requires their complete structural characterization. However, difficulties arise as polysaccharide structures can be highly complicated due to unique composition of monosaccharide sequence and glycosidic linkages. In this research, a semi-preparative multi-platform LC-MS/MS technique, using sophorose, maltotriose, maltopentaose, and maltohexaose oligosaccharide standards, was developed to isolate and structurally characterize polysaccharide-derived food oligosaccharides to determine the overall polysaccharide structures. For semi-preparative separation, oligosaccharide structures were separated and analyzed for their monomeric sequence using HPLC/quadrupole time-of-flight mass spectrometry. Isolated structures were collected using in-line 96-well plate automated fraction collector. Next, in-house developed methods for monosaccharide and glycosidic linkage composition analysis using ultra-high performance/triple quadrupole mass spectrometry were performed on individual fractions to fully characterize isolated structures. The overall work flow was validated using oligosaccharides generated from raw rice polysaccharides. Through use of this multi-platform approach, we can better understand carbohydrate structures present within foods and aid in the determination of potential bioactivities.

Detecting the Presence of *Felis catus* Gammaherpesvirus 1 (FcaGHV1) in Oropharyngeal and Nasal Swabs of Domestic Cats

Tiffany Tse

Sponsor: Patricia Pesavento, D.V.M., Ph.D.
VM: Pathology, Micro, & Immun

Felis catus gammaherpes virus (FcaGHV1) has recently been identified as a persistent infection of domestic cats across the globe. FcaGHV1 is phylogenetically related to Epstein Barr Virus, a common infection of humans and the causative agent of mononucleosis and, rarely, either lymphoma or nasopharyngeal carcinoma. Clinical sequelae of FcaGHV1 infection in cats is unknown, but infection prevalence rates are high. FcaGHV1 is likely transmitted horizontally, but target tissues of infection and shedding sites are unknown. We hypothesize that the nose and/or oropharynx are tissue sites of persistence for FcaGHV1. This project aims to investigate whether FcaGHV1 is transmitted via nasal and/or oropharyngeal secretions. Nasal and oropharyngeal swabs were collected from shelter cats at the San Jose Animal Care Center. Using a combination of polymerase chain reaction and gel electrophoresis, DNA extracted from the swab samples were independently analyzed for the presence of FcaGHV1. Results so far demonstrate that FcaGHV1 is present in oropharyngeal secretions. Analysis of nasal swabs is pending. Detection of FcaGHV1 DNA in respiratory secretions will provide evidence that cat to cat transmission can occur via the respiratory route, and will be the foundation for further studies to determine whether FcaGHV1 infection is pathogenic in domestic felines.

Synthesis of Pyrazole Rings Through Intramolecular 1,3-Dipolar Cycloadditions of Propargylic Ether Hydrazones and Subsequent Thermal Rearrangements

Nolan Turman

Sponsor: Jared Shaw, Ph.D.
Chemistry

Heterocyclic ring systems, such as nitrogen containing pyrazoles, are found in a variety of natural products which display biological activity. The scaffolds of substituted pyrazole rings have been incorporated into many marketed drugs being used today as anti-inflammatory, anti-bacterial, or analgesic agents. With this activity in consideration, there is an apparent need to develop additional routes of synthesis for these types of structures. Our group has been investigating the synthesis of substituted pyrazole rings through the application of intramolecular 1,3-dipolar cycloadditions of propargylic ether hydrazones and subsequent thermal, [1s, 5s] sigmatropic rearrangements. This method provides an efficient tool for generating stereogenic centers not previously seen in nature and can produce a library of compounds for drug design. In addition, the electronic effects on these structures have been assessed through the application of various electron donating and withdrawing groups. Once optimization has been achieved, these substituted pyrazole ring intermediates can be developed into more complex structures.

Placenta Stem Cell Therapy for Spinal Cord Injury

Erica Tutuwan

Sponsor: Aijun Wang, Ph.D.
MED: Surgery

Spinal Cord Injury (SCI) can result in life long disabilities with varying severity, ranging from sensory deficits to irreversible paralysis. Approximately 1.5 million Americans live with some form of Spinal Cord Injury (SCI), most often following an injury to the neck. While there is no cure for SCI, experimental treatments utilizing stem cells have been investigated with variable success. Stem cells isolated from placenta have been shown to improve functional outcomes in a congenital model of SCI. Using an established rodent model, we sought to determine if these stem cells could improve functional recovery after an acquired SCI. Stem cells were applied 3 days after a contusion injury to the neck, followed by weekly motor and behavioral tests. Over 8 weeks post-injury, animals that received stem cells (n=5) showed significant improvement in forelimb fine motor skill recovery when compared to untreated controls (n=2). These preliminary results suggest that placenta stem cells may represent a potential therapeutic option for patients with recent SCI. Additional studies to verify these findings and determine the ideal treatment regimen are underway.

Analyzing Amygdalae Intranuclear Inclusions in an Inducible Mouse Model of Fragile X-Associated Tremor/Ataxia Syndrome (FXTAS)

Shrishti Tyagi

Sponsor: Robert Berman, Ph.D.
MED: Neurological Surgery

Fragile X-associated tremor/ataxia syndrome (FXTAS) is a neurodegenerative disease that results from expanded CGG trinucleotide repeats in the 5' untranslated region of the fragile X mental retardation 1 (FMR1) gene. A pathological hallmark of FXTAS is the presence of ubiquitin-positive intranuclear inclusions in neurons and astrocytes found in many brain regions, including the hippocampus. Patients with FXTAS display symptoms of cognitive dysfunction and anxiety disorders which have been linked to the activation of the amygdala by norepinephrine. Using a doxycycline-inducible mouse model of FXTAS with 8 and 20 weeks of exposure, the amygdala is being analyzed for the presence of these hallmark inclusions. The brains were sectioned and stained for ubiquitin using immunohistochemistry. Inclusion density and size in the basolateral amygdalar (BLA) nucleus and the basomedial amygdalar nucleus were quantified via stereological techniques as the BLA plays an important role in processing information about fear and anxiety. The piriform area, located near the amygdala, was analyzed for inclusions for comparison. Preliminary results show that 20 week mice have more inclusions in the amygdala than 8 week mice. Results from this study will provide a deeper understanding of how inclusions in the amygdala contribute to FXTAS pathophysiology.

Towards Self-Driving Car: Pedestrian and Traffic Sign Classification

Christopher Uy

Sponsor: Chen-nee Chuah, Ph.D.
Elect & Comp Engr

With the recent re-emergence of Deep Learning, many applications that otherwise computationally expensive were made possible. In particular, autonomous vehicles features such as Pedestrian and Traffic Sign detection/classification can be further improved with Deep Learning. Through our Independent Senior Design Project, conducted during Fall and Winter Quarters of 2018, we have been able to develop initial results on such application. Not only were we able to detect pedestrian and classify traffic sign in real-time, but also to identify bottlenecks and difficulties. Therefore, we would like to present our work for the reference of future development. In a nutshell, we used a modified version of YOLOv2 detection/classification to achieve our goal. We were able to run the algorithm in 30 fps. Our bottleneck is the communication between the algorithm processor and the car.

Investigating the Dependence of Oxytocin on Divalent Metals

Kylie Uyeda

Sponsor: Marie anne Heffern, Ph.D.
Chemistry

Oxytocin is a powerful peptide hormone that is known to regulate a number of biological processes such as contractions during childbirth, sexual reproduction, and social interactions. Previous research has suggested that the presence of divalent metal ions is essential for the interaction of oxytocin with its extracellular cell receptor. In fact, there are a handful of peptide hormones, including insulin, have been shown to require the presence of certain metal ions for proper function. The metal ions and their exact effects on oxytocin structure and function remain unclear. We are working to uncover the interactions between oxytocin and metal micronutrients. We hope to determine metal-dependent structural and conformational effects on the hormone, as well as the influence of metal ions on receptor binding and downstream biological signaling. By understanding these factors, our research can provide insight to normal oxytocin function as well as the design of synthetic analogues for clinical applications.

Designing Cell Delivery Vehicles with Programmable Degradation

Lauren Uyesaka

Sponsor: Eduardo Silva, Ph.D.
Biomedical Engineering

Vascular progenitor cells are capable of promoting the formation of new blood vessels (i.e. angiogenesis) to treat a variety of ischemic diseases, yet clinical application has proven difficult due to delivery challenges. To bypass this, we are working on developing a polymeric delivery vehicle that displays on demand degradation for the local delivery of vascular progenitor cells at specific times and doses. Alginate is a naturally occurring polymer derived from algae and is biocompatible, elicits a low immune response, and does not interfere with the functional survival of the cells. However, alginate is not enzymatically digested by mammals and will degrade in an uncontrolled and unpredictable manner. An alternative approach to achieving a controlled degradation of these alginate hydrogels is based on the enzymatic degradation by alginate lyase (AL). We will modify vascular progenitor cells with a lentivector expressing AL upon doxycycline (dox) induction. We hypothesize that the dox will induce the AL expression by vascular progenitor cells and the hydrogel will be degraded on demand. This study will demonstrate the capability of controlling the delivery and release of cells for therapeutic applications, specifically regarding angiogenesis.

The Role of Urocortin3 in Maintaining Delta Cell Identity Within Pancreatic Islets

Richard Van

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

Over 30 million people in the U.S. have diabetes, which is characterized by the lack of proper regulation of blood glucose levels due to dysfunction or loss of insulin-producing beta cells found within pancreatic islets. The regeneration of beta cells thus provide a therapeutic approach for diabetes treatment. Recent studies focus on exploiting the plasticity of other islet endocrine cell types, such as glucagon-producing alpha cells and somatostatin-producing delta cells, to reprogram them to generate new beta cells. Under certain circumstances, delta cells can convert, or transdifferentiate, into beta cells, but the signals that promote this process remain unknown. My project investigates the role of Urocortin-3 (Ucn3), a peptide hormone secreted from beta cells that specifically activates delta cells, in maintaining delta cell identity. To elucidate the role of Ucn3, I will compare the population of delta cells that have transdifferentiated into beta cells in wild type and Ucn3 knockout mice at 3-months and 9-months of age. My preliminary data on the 3 month cohort suggests a slightly greater ratio of transdifferentiated cells in Ucn3 knockout mice compared to controls. This implies that the absence of activation of delta cells by Ucn3 may induce their reprogramming into beta cells.

The Efficacy of Cupping and Dry Needling in Treating Sports Injuries and Their Symptoms: A Literature Review

Tanner Van Es

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

Cupping (creating negative pressure on skin with cups) and dry needling (DN) (inserting a needle into a myofascial-trigger-point) have been proposed to promote healing and reduce pain following exercise, but the efficacy of these methods are not well documented. The goals of this study were to determine: (1) ailments cupping and DN are used to treat, (2) effects these methods have on anatomical structure and physiological function, and (3) their efficacy. A literature search was conducted (electronic search engines - Science Direct and Google Scholar, with key words –“dry needling” “cupping” “trigger point” “myofascial pain syndrome” “cupping effects on muscles, ligaments, and tendons” “dry needling effects on muscles, ligaments, and tendons”) resulting in 3 cupping articles and 4 DN articles that appeared relevant to the goals of this study. Ailments treated include skeletal muscle pain and swelling. Cupping was shown to induce metabolic changes that can reduce pain and swelling. DN was shown to produce local twitch responses (LTRs), but inconsistently. LTRs can reduce pain and swelling. Thus, cupping and DN can effectively reduce local pain and swelling if performed properly. However, each technique induces micro-trauma, the effects of which have not been well studied.

Axial Elongation of Benthic Fishes and its Contribution to Morphological Diversity

Kazoua Vang

Sponsor: Peter Wainwright, Ph.D.
Evolution & Ecology

Marine fishes display an incredibly high level of morphological diversity, with adaptations for life in a range of habitats. For this study, our primary interests surround the dominant mode of morphological diversity in the benthos. The benthic zone, or sea floor, houses a large diversity of species, ranging from flatfishes to predatory anglerfish, that all interact closely with the bottom substrate. Previous work has shown that body elongation is the primary feature of morphological variation in reef fishes, yet it has not been determined if this trend is applicable to all benthic fishes. We predict that elongation is the largest axis of morphological diversity among benthic fishes, relating to advantages such as maneuverability through crevices and increased ability to bury within the substrate. We used linear morphological measurements collected at the National Museum of Natural History to describe overall body shape and analyzed these data in a phylogenetic framework to estimate and compare shape variation in fishes in the series Ovalentaria and Eupercaria. Through this study, we attempt to validate that interaction with the bottom substrate is the major driver of elongation in benthic fishes and provide a foundation for further research on the evolution of fish morphology.

Development of a Rapid High-Throughput Glycosidic Linkage Analysis Method to Characterize the Carbohydrates in Foods

Daniela Vasquez

Sponsor: Carlito Lebrilla, Ph.D.
Chemistry

Although carbohydrates are the predominant biomolecule found in nature, their complete structures in food is minimally understood. Carbohydrates not only serve as a source of energy but hold an important role in nutrition absorption and modulating the gut microbiome. A thorough understanding of carbohydrates in food is necessary to understand the possible bioactive properties. This project aims to optimize a method capable of semi-quantifying glycosidic linkages of polysaccharides in food. To prepare the samples for mass spectrometry analysis, the sample is first permethylated with iodomethane and dimethyl sulfoxide (DMSO) under basic conditions in a 96-well plate. However, DMSO is not suitable for mass spectrometry analysis during electrospray ionization and must be removed by liquid-liquid extraction using water and dichloromethane. In this work, we have optimized the minimum amount of water washes required to remove DMSO to preserve time and materials. The samples then undergo hydrolysis with trifluoroacetic acid (TFA) before being labelled with 3-methyl-1-phenyl-2-pyrazoline-5-one (PMP) prior to analysis by ultra-high performance/triple quadrupole mass spectrometry (UHPLC-QqQ-MS) operated in multiple reaction monitoring (MRM) mode. As a result, this method allows for accurate glycosidic linkage analysis of 200 samples within 4 days, which may aid in determining the bioactivities of carbohydrates.

Meiotic Recombination Defects in Mice Lacking Breast Cancer Associated Gene BRCA2

Srishti Vats

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

Homologous recombination (HR) is an error-free mode of DNA repair, in which the damaged strand copies information from intact chromosome to repair damage. BRCA2 plays an essential role in regulating HR by recruiting RAD51 to breaks, thus enabling homology search. This mode of DNA repair is also required in germ cells undergoing meiosis to promote chromosome pairing, which is essential for formation of eggs and sperms. Understanding of BRCA2's role in regulating HR during meiosis is still in its infancy. This study aims to determine BRCA2's role in meiotic recombination, specifically focusing on strand exchange proteins RAD51 and DMC1. To ablate BRCA2 protein in meiotic cells we used a Brca2 conditional mouse model, which is inactivated specifically in meiotic cells using Cre recombinase expressed from a meiosis-specific promoter (Spo11-Cre). To analyze recombination defects, mouse spermatocytes from control and Brca2 mutant mice were immunolabelled for RAD51, DMC1 and SYCP3. We observed a significant decrease in total number of RAD51 and DMC1 in Brca2 mutants compared to wild type, indicating that BRCA2 plays a vital role in meiotic recombination. However, this defect is only partial suggesting that other factors facilitate assembly of RAD51 and DMC1 during meiosis.

Investigation of the Reactivity of Gallium and Aluminum Tetrarlys with Hydrogen, Olefins, and Carbon Monoxide

Juan Antonio Vazquez Marquez

Sponsor: Philip Power, Ph.D.
Chemistry

Aluminum is the second most abundant metal in the Earth's crust, making its use as a catalyst an area of high interest. The ability of main group metal compounds to react with small molecules such as hydrogen, mimicking the reactivity of transition metals, potentially allows for the replacement of expensive catalysts like iridium and platinum with aluminum compounds. The lowest unoccupied molecular orbital (LUMO) of compound $\text{Trip}_2\text{AlAlTrip}_2$ (Trip = 2,4,6-triisopropylphenyl) is a π -type orbital formed by the p-orbitals of the Al atoms. The π -type orbital is the correct symmetry to react with the highest occupied molecular orbital (HOMO) of hydrogen, olefins, etc.; so a reaction between the $\text{Trip}_2\text{AlAlTrip}_2$ and small molecules is likely. The heavier congener $\text{Trip}_2\text{GaGaTrip}_2$ is expected to react in a similar manner, so it is used as a model system due to its ease of synthesis. This project will expand the known reactivity of main group metal compounds with small molecules.

Complicated Interactions Between Substrate and Product Inhibition in *E. coli* CTP Synthetase

Marysol Velazquez

Sponsor: Enoch Baldwin, Ph.D.
Molecular & Cellular Bio

Cytidine triphosphate synthetases (CTPS) catalyze CTP formation from UTP, ATP and glutamine via an active enzyme tetramer. Due to the central role CTP plays in cellular metabolism, CTPSs have elaborate regulatory mechanisms. My work is directed at characterizing the interaction between two *E. coli* CTPS regulatory mechanisms: UTP substrate inhibition and CTP product feedback inhibition. CTP competes with UTP for the catalytic site, diminishing enzyme activity and exhibiting "product inhibition". As expected for a substrate, reaction velocity increases with increasing UTP concentration from 0-1 mM ($S_{0.5} \sim 60 \mu\text{M}$), but decreases significantly at higher concentrations ($\text{IC}_{50} = 2.5 \text{ mM}$). Previously, I determined CTP concentration-dependent inhibition at different UTP concentrations. Surprisingly, at inhibitory UTP concentrations, CTP inhibition was also enhanced. To further describe this unusual phenomenon, I am quantifying UTP concentration dependence of activity as a function of CTP concentration. I predict that CTP and UTP are inhibiting by binding to the same inhibited conformation, which would lead to enhancement of UTP inhibition as CTP concentration increases. This behavior would require that either CTP and UTP bind to the active sites of different monomers within the same tetramer, or UTP binds to a separate allosteric inhibitory site.

A Survey of Healthcare Resources Available to Undocumented Workers in Fresno County, California

Monica Velazquez

Sponsor: Monica Torreiro-Casal, Ph.D.
Chicano Studies

The purpose of this study is to understand the limited number of healthcare resources available to the undocumented population in Fresno County, California. They are in California's agricultural San Joaquin Valley and have been historically known for attracting undocumented people to the area due to the demand of fieldwork. Currently, Fresno County has a population of almost 100,000 people and there is no complete information on number of the undocumented population. Over the course of winter quarter 2018, I designed and implemented a survey in order to collect information on healthcare services for undocumented people. I do so to understand more on the realities of this community. The study specifically focuses on current healthcare laws affecting the range of services available to the undocumented population. More specifically, the survey consisted of asking Fresno County healthcare providers of the healthcare services they offered and what proportion of them was available to the undocumented people. Furthermore a deeper focus on the limited resources helped to understand the distribution and access in healthcare services offered to this population in Fresno County. The study hopes to show detailed information on how current policies have impacted the access to health services for undocumented people.

Point-of-Care Needs and Availability for Diagnosis and Monitoring of Diabetes Mellitus in Central Vietnam

Irene Ventura Curiel

Sponsor: Gerald Kost, M.D., Ph.D.
MED: Pathology & Lab Medicine

My goal is to describe the needs and availability of point-of-care testing (POCT) and capabilities for diagnosis and monitoring of diabetes mellitus in Central Vietnam. POCT is diagnostic testing at or near the site of care. In summer 2017, we performed a field survey of a provincial (Level 2), district hospitals (L3, n=7) and community health centers (L4, n=7) in Hue Province. Results show that glucose testing was performed using predominantly capillary blood specimens. We found no HbA1c testing. POCT was limited at most L3 and L4. Diabetes and prediabetes glucose screening cutoffs varied across groups, possibly underdiagnosing or over-diagnosing. A screening program was not reported at L2 and availability varied in L3 and L4. Self-monitoring of blood glucose (SMBG) is utilized. However, glucose meters must be purchased at patients' expense. Microvascular and macrovascular complications, such as kidney failure and retinopathy are treated at the central and provincial hospitals. In conclusion, we found that a) approaches to diagnosis must be improved; b) instrumentation, including equipment for HbA1c testing, must be supplied throughout the region; and c) SMBG should be enabled by including funds for meters and test strips in public health budgets.

Protein Kinase D Modulation of Cardiac Protein Phosphatases

Marie Verberckmoes

Sponsor: Julie Bossuyt, D.V.M., Ph.D.
MED: Pharmacology

Protein Kinase D1 (PKD1) is an important stress stimuli transducer affecting myriad cellular functions. Despite a crucial role in pathological cardiac remodeling, few cardiac PKD1 targets are identified. Recent studies suggest PKD1 could target protein phosphatases (PP) other than the substrate slingshot. We test this by measuring phosphatase activity and expression in ventricular homogenates from cardiac-specific PKD1 knockout mice (cKO) vs their wildtype (WT) littermates. Using the EnzChek phosphatase assay kit with DiFMUP substrate, PP1, PP2a, PP2b and PP2c phosphatase activity was measured as tautomycin-, LB100-, calcineurin- and sanguinarine chloride-sensitive DiFMUP fluorescence respectively. PP1 activity was slightly higher in cKO vs. WT homogenates at baseline. Inhibition of the other PKD isoforms with 25 nM CRT0066101 reduced PP1 activity in both WT and cKO. PP2a activity was slightly reduced in cKO homogenates at baseline, and strongly reduced with CRT treatment in WT and cKO. PP2b activity was unaltered in WT vs. cKO homogenates but CRT strongly reduced PP2b activity. PP2c activity was also similar at baseline and decreased following CRT inhibition. Interestingly PP2A and MYPT1 protein expression was reduced in cKO vs. WT. This is a first step in defining PKD isoforms as regulators of cardiac protein phosphatase activity.

Packaging Electronics for DUNE's Sanford Far Detector

Carlos Verdoza

Sponsor: Michael Mulhearn, Ph.D.
Physics

The Deep Underground Neutrino Experiment (DUNE) will soon build its Far Detector at the Sanford Lab in North Dakota to detect neutrinos originating from Fermilab in Illinois. A proposed design for the the detector uses an Application Specific Integrated Circuit (ASIC) for data acquisition, which will be connected to a custom printed circuit board (PCB) and placed under cryogenic conditions for up to thirty years. In order for these circuits to function reliably, the adhesives which bind ASIC's to the PCB must be able to withstand change of temperatures from subzero environments to room temperature without breaking the physical bonds or electrical connections. Suitable adhesives must maintain structural rigidity and possess an optimal thermal expansion rate and appropriate thermal and electrical conductivity. Dummy ASIC's are bonded to dummy printed circuit boards using candidate adhesives and placed under cryogenic conditions. The performance of each candidate adhesive is evaluated by measuring the strain experienced by the ASIC and visual inspection for catastrophic failure.

The Effectiveness of the Social Belonging Intervention for Incoming Freshmen and Transfer Students at UC Davis

Laurie Victor

Sponsor: Susan Ebeler, Ph.D.
Viticulture & Enology

In the United States, there is still a large achievement gap between racial, ethnic, and socioeconomic groups. Many students, especially from disadvantaged groups, encounter significant challenges during their transition to college, which decreases their retention rate. However, previous studies have shown that implementing a social-belonging intervention that allowed first-year students to become aware of the fact that it is common to experience challenges in their transition to college led to positive outcomes. These positive outcomes included increased sense of belonging and retention rate, greater academic persistence and achievement, and greater social integration among minority students. Therefore, a social-belonging intervention was implemented at UC Davis for first-year freshman and transfer students in 2017. In this study, we will examine the effectiveness of the social-belonging intervention for UC Davis students and compare the transition experiences between freshmen and transfer students through focus groups. We hypothesize that the intervention was effective and that freshman and transfer students will show some similarity between transition experiences, but also vary due to differences in age, living situations, and life experiences.

Queerness and Non-Able Bodies: A New Narrative of the American Family

Nicholas Villarreal

Sponsor: Rana Jaleel, J.D.
Gendersexuality Womensstudies

This project critiques the American nuclear family using a multi-lensed, feminist approach to analyze how the intersections of identity, sexuality, race, able-bodiedness, etc. affect family belonging. My research looks at the Marriage Equality movement and the eventual ruling that "Same-Sex Marriage" is a constitutional right. In it, I critique how main stream support of the gay liberation movement reinforces the desirability of the able-bodied nuclear family and essentially calls for the assimilation of the queer community. Furthermore, within this critique of the nuclear family I will be looking at the film, "I love you, Phillip Morris," and how it portrays the correct way for gay couples to be a family: as the picturesque version of the American dream. In this analysis, I investigate how the hyper masculine or feminine, white, able-body is used as the master narrative of the queer community. Throughout my project, I argue that assimilation is not liberation and call attention to the exclusion of Queer and Non-Able bodies from the social-construction that is the American family.

The Effects of Disruptive Stimulation of the Ventral Hippocampus on Activity in the Amygdala

Nina Vishwakarma

Sponsor: Brian Wiltgen, Ph.D.
Psychology

The hippocampus is a structure in the brain known to be necessary for contextual fear memory retrieval and spatial learning. Several recent studies suggest that the ventral portion of the hippocampus (VHC) is necessary for contextual fear memory retrieval because it projects to another region of the brain involved in fear, the amygdala (AMY). We previously replicated these studies by disrupting the projection from the VHC to the AMY using optogenetic stimulation in mice and observed impaired fear memory retrieval. Ninety minutes after stimulating the VHC-AMY neurons, we sacrificed the mice and used immunohistochemistry to stain for c-fos, which is correlated with strong neural activity. In order to see what the downstream effects of stimulating this VHC-AMY projection are, I will compare c-fos expression in the AMY of animals that received optogenetic stimulation to those of the controls. This ongoing analysis will quantify the amount of activation in several AMY nuclei to confirm that we functionally activated the VHC-AMY projection.

Towards Self-Driving Car: Lane Line Detection

Vidush Vishwanath

Sponsor: Chen-nee Chuah, Ph.D.
Elect & Comp Engr

With the recent re-emergence of Deep Learning, many computationally expensive applications can be performed in real-time. In particular, autonomous vehicles features such as Lane Line Detection can be implemented using Computer Vision. Through our independent senior design project, conducted during Fall and Winter Quarters of 2018, we were able to perform real-time lane line detection at 99 fps. Therefore, we would like to present this work for the reference of future development. We have tested lane line detection model on a custom track; the demo car model was able to navigate and stay within the lane lines using this computer vision algorithm.

Development of a Rapid High-Throughput Mass Spectrometry-Based Method for the Quantification of Monosaccharides in Food

Thai-Thanh Vo

Sponsor: Carlito Lebrilla, Ph.D.
Chemistry

As the predominant biomolecule in food, carbohydrates hold an important role in nutrition and immune development through a symbiotic relationship with the gut microbiota. However, carbohydrate profiles of common foods still remain largely uncharacterized despite its well-known significance as the primary source of energy. Therefore, a complete determination of carbohydrate composition and structure can impact a diverse range of fields such as food science, material science, and microbiology. Currently, due to the large size of polysaccharides and their inherent complexity, there are no methods that can easily characterize food glycome both rapidly and accurately. This project aims to develop a robust and high-throughput method that can overcome tedious derivatization and long instrumental run times to quantify and characterize the 12 monosaccharides commonly found in foods. Foods such as rice, flour, fruits, and vegetables were lyophilized, pre-cooked, and depolymerized to their monosaccharide components via hard acid hydrolysis with trifluoroacetic acid. Samples then underwent derivatization with 3-methyl-1-phenyl-2-pyrazoline-5-one. Analysis was carried out using ultra-high-performance liquid chromatography paired with triple quadrupole mass spectrometry. This will further our knowledge of each food's unique carbohydrate profile and aid in the development of modified foods that can target specific health problems.

Classifying Sonographic Structures of Rat Pup Ultrasonic Vocalizations in Autoantibody Model of Autism

Malin Von Knorring

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

Ultrasonic Vocalizations (USVs) have long been used as a tool to measure communicative behaviors in laboratory rats including rat pups. A high degree of variation has been found in pup calls, especially relating to the rate of calls made and range of sound frequencies emitted; however, very few studies have attempted to classify USV calls based on their sonographic structures. The goal of this project is to examine sonographic patterns of rat pup USVs and determine how they may be altered in rat pups prenatally exposed to maternal autoantibodies associated with autism. I hypothesize that rat offspring from dams injected with these autism-associated autoantibodies will produce fewer USVs and will demonstrate different patterns of sonographic call structures compared to control groups. USV data was collected by placing rat pups individually in a sound attenuated chamber and recording their USVs for three minutes using Avisoft recording and analysis equipment. After classification of these USVs into eight call structure categories, the frequency of each pattern of call was quantified and comparisons were made between experimental and control groups. The USV protocol established in this study will provide a novel classification system to better understand communicative behavior in rats.

Enhancing Understanding of the Molecular Toolkit Employed by Anaerobic Fungi to Degrade Plant Material

Derek Wadsworth

Sponsor: Matthias Hess, Ph.D.
Animal Science

The discovery of novel biomass degrading cellulase enzymes could improve the efficiency of feed additives. Anaerobic fungi found in the cow rumen represent an underexplored source of novel cellulases. The rumen contains a complex mixture of microbes and that enables the host to extract sufficient energy from cellulose material at an efficiency that is one of the highest that has been reported in nature. Previous work in the Hess Lab has focused on the isolation and amplification of putative glycoside hydrolase gene candidates from a rumen fungal metatranscriptome. To complement this work, putative novel glycoside hydrolases will be heterologously expressed and their enzymatic potential will be characterized. Enzyme function will be compared to in silico predictions. These data will help elucidate the unique role anaerobic fungi play in the biomass degradation process, and determine whether anaerobic fungi found in the cow rumen provide a viable source of efficient biomass degrading cellulases.

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. 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.

Fototestimonios: Campus Climate in Davis

Michelle Wang

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

How can we foster diversity and inclusive spaces for all current and incoming students? What are the spaces students find most safe and how can we work with campus administration to create more of these across campus? Conversely, how can we also fix the unsafe, harmful spaces that subject students, particularly underrepresented minority respondents, people of color, women, LGBTQIA folks to discrimination, marginalization, sexual assaults, alienation, microaggressions, and crimes? By leading a community-based participatory research with UC Davis students we are co-creating a UC Davis map that highlights where students feel safe or not. Students are using fototestimonios (photos and accompanying narratives). The photos and narrative allowed us to investigate what makes a space safe or unsafe for students, and what will it take to make to make spaces safer on campus and thus improve campus climate and the well-being of students. This project is creating awareness of campus climate problems, as well as a call to action for students who can no longer condone a toxic climate or general passivity.

Do Differences in Myofilament Concentrations Exist Between Wild-Type Mice and Long-Lived Ames Dwarf Mice?

Colin Wang

Sponsor: Aldrin Gomes, Ph.D.
Neuro Physio & Behavior

Ames dwarf (df/df) mice live 50% longer than wild-type mice due to a mutation leading to signaling deficiencies within their growth hormone (GH)/insulin-like growth factor-1 (IGF-1) pathway. Previous studies have observed that this mutation leads to smaller relative nuclear-to-cell ratios, smaller cardiomyocyte cell size and reduced collagen accumulation with age for df/df mice. However, df/df mice demonstrate longer durations and diminished velocity of contraction and relaxation. We investigated whether these contractile differences result from variation in ratio of cardiac proteins within the heart, including tropomyosin, troponin (I, T, and C), and myosin heavy chains (MHC). We compared heart lysates of one-year old female wild-type and df/df mice using advanced western blotting techniques. We found no significant difference in the relative ratios of tropomyosin, troponin (I, T, and C), and myosin heavy chains between the hearts of the two groups. These findings suggest that: 1) although df/df mice have smaller cardiomyocytes, they contain similar ratios of key myofilament proteins as wild-type mouse hearts, 2) altered contraction may be due to differences in post-translational modifications of myofilament proteins or other external extracellular factors.

Characterizing Growth of *Botrytis cinerea* in Soil

Melissa Wang

Sponsor: Daniel Kliebenstein, Ph.D.
Plant Sciences

Botrytis cinerea (*Botrytis*) is a common fungal species found on a variety of crops. Current models assume that *Botrytis* can germinate and infect plants through the soil, but this has never been formally tested. Our procedure for characterizing the natural ecology of this fungal plant pathogen has yielded surprising results. Spore isolates were plated on soil to test if *Botrytis* can be obtained from bulk soil samples. *Botrytis* was recovered from sterilized soil but not from non-sterile soil, defying current assumptions about the growth model for *Botrytis*. However, we could not determine if the isolates underwent a full life cycle or were killed by the soil from these results. The soil microbiome is complex and could contain organisms impeding *Botrytis* growth. To clarify if *Botrytis* can germinate on soil, isolates were plated on cellophane on soil. Placing *Botrytis* on cellophane allows the fungus to be separated from the soil for visualization, while still allowing it to utilize nutrients in the soil to grow. The results will help to elucidate the *Botrytis* life cycle and potentially aid in biocontrol of *Botrytis* on agriculture. Further studies are required to define how *Botrytis* interacts with plants and other species within the soil.

Recent Changes in the Autumn Migration Phenology of Two North American Raptor Species

Olivia Wang

Sponsor: Joshua Hull, Ph.D.
Animal Science

Raptors serve as important biological indicators of ecosystem health in various habitats around the globe. Despite this, raptors are an underrepresented group in studies of avian migration phenology. Changes in migration timing can stem from a variety of factors such as migratory short-stopping or bottom-up effects of climate change. This project looks at long-term changes in the autumn migration timing of two North American raptor species, Sharp-shinned Hawks and Cooper's Hawks. Due to differences in their breeding ground latitudes, we expect to see differential migration shifts between these two species. We will look at migration data collected from 1983 to 2016 and quantify the timing of migration for each of these species for every year. We will then analyze these dates for directional changes over the duration of the entire study and compare shifts in timing between Sharp-shinned and Cooper's Hawks. We anticipate that the mean passage date of Sharp-shinned Hawks will advance over time, while the mean passage date of Cooper's Hawks will be delayed. The magnitude of the timing shifts is also expected to be greater in Sharp-shinned Hawks than Cooper's Hawks.

Testing the Importance of Volatile Cues in Host Location by the Parasitic Fly *Thelaira americana*

Jia Wang

Sponsor: Richard Karban, Ph.D.
Entomology/Nematology

Tachinidae, commonly called tachinid, is one of the most diverse fly families with around 10,000 described species. All tachinids are parasitic and consequently function as a natural enemy to many groups of insects. This has led to the use of many tachinids for pest management, especially of butterflies and moths. Tachinids have two major egg laying (oviposition) strategies: direct oviposition, laying of eggs directly on the host, and indirect oviposition, laying of eggs away from the host, generally on the foliage of its host's host plant. The project aims to understand the cues used by a tachinid fly (*Thelaira americana*) that employs the indirect oviposition strategy to parasitize its moth host (*Platyrepia virginalis*). By quantifying and comparing *T. americana*'s preference for volatiles from its host's feces and leaves from its host's host plant (*Lupinus arboreus*), we conclude that the main cues are feces. The result can be applied to help increase the efficiency of future regulatory projects using indirectly-ovipositing tachinids to control insect pest populations.

Callus: A Black Experience

Jasmine Washington

Sponsor: Jon Rossini, Ph.D.
Theatre And Dance

Callus is a full length play that explores the life of a young Black woman and her family experiencing systemic oppression in the form of inadequate health care. A health crisis forces the family to adapt their relationships, lifestyles, and mentalities in order to deal with the dilemma. A callus is formed when friction between skin and an external force cause the formation of hard, rough barrier. Thus, the callus is a metaphor for the emotional barrier that Black people often form to survive. The alternate meaning of the word (spelled callous) is defined as the lack of emotion or sympathy. The purpose of a callus is being brought into question here. Does a callus serve as a tool for self-preservation or does it simply distance a person from the world? Callus uses both realistic and abstract aesthetics to explore issues of power and privilege, with narrative scenes often being structured in realism while scenes at hospitals or in health care offices utilize abstract techniques to tell the story. An example of this is the disembodied voices of health care employees, including doctors and case workers, used to criticize the cold, bureaucratic health care system.

Comparative Analysis of Body Elongation as a Major Trend in Demersal Fishes

Justin Waskowiak

Sponsor: Peter Wainwright, Ph.D.
Evolution & Ecology

Demersal fishes are a unique group to study because they share ecological qualities of both pelagic and benthic dwellers, and could exhibit morphological trends associated with either habitat. They may be found traversing the open water column or just above the seafloor, two habitats that contain different degrees of structural complexity. While body elongation has been shown to be the dominant axis of variation in reef fishes, it is unclear whether the ecological drivers for body elongation diversity are unique to reef habitats, or if this trend persists across a broader range of benthopelagic environments. We test whether elongation is the dominant form of shape diversity across demersal teleost fishes. We collected morphometric data from the National Museum of Natural History and used linear measurements of depth and length to quantify body elongation. We evaluated our data within a phylogenetic framework for teleosts to estimate the dominance of elongation across fish shape diversity. Fishbase and various literatures were used to validate the demersal habitats of our study species. We predicted that body depths relative to standard length show the greatest trend in diversity across demersal fishes, providing evidence that the importance of elongation is not limited to reef environments.

Stable Isotope Insights into Cooperation, Diet, and Life History at Sii Túupentak (CA-ALA-565) in Sunol, CA.

Davis Watkins

Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

Archaeologists are often interested in how humans adapt to particular landscapes and environments. This study examines the diets of pre-contact hunter-gatherers living at a site given the name "Sii Túupentak" (CA-ALA-565). An urban development project resulted in the unexpected discovery of this ancient village, located in modern-day Sunol, CA. The site was occupied between 500 years ago and 200 years ago, spanning the time of settlement by European immigrants. Through a partnership between the Muwekma Ohlone tribal leadership, Far Western Anthropological Research Group (in Davis), and the Archaeometry lab at UC Davis, we present carbon and nitrogen isotopes results from samples of human bone and teeth isotopic data. The data suggest that inhabitants had very little access to aquatic foods from San Francisco Bay, but focused instead on terrestrial resources in the surrounding river valley and hills. The study compares the diets of males vs. females, and young vs. old, and wealthy vs. non-wealthy, as insight into food sharing and social organization within the community.

How Can We Apply Bioremediation to Landscape Architecture Practice to Rebuild Communities?

Kennedy Wells

Sponsor: Elizabeth Boults, M.L.A.
Human Ecology

The purpose of my project is to create a community development plan and restoration timeline for Treasure Island in San Francisco. Treasure Island suffers from many complex environmental problems due its prior use as a military facility. Many of the sites on the island are plagued with nuclear radioactive material, petroleum, heavy metals and chloroethenes. The project is motivated by my desire to explore bioremediation as a viable method to clean-up the toxic materials on the site and how landscape architecture can phase in redevelopment as the island undergoes decontamination. My methods are based on a synthesis of extensive case studies to determine which theoretical approaches could best be applied to this site. Bioremediation practices are based on three different organisms: bacteria, fungi and plants. My initial findings have led to the creative potential and limitations of bioremediation and that the complexity of the problem of Treasure Island lies in the growing threat of sea level rise. The significance of this project is its application to improve the condition of other degraded environments rather than abandoning the landscape or developing a contaminated site without fully understanding the implications of its toxicity.

Learning Across Voices: Link Between Exposure to Voices and Infants' Vocabulary Size

Madeline Wenner

Sponsor: Katharine Graf Estes, Ph.D.
Psychology

The purpose of this research is to identify how exposure to a varying number of speakers' voices relates to early vocabulary and language development. To address this, we analyzed data from language interviews conducted with parents. Parents reported the number of speakers their child heard on a regular basis, what language(s) these individuals spoke, and the length of exposure to each speaker's voice. Data was also gathered from vocabulary inventories for which parents indicated the words their child understands and/or says. Preliminary evidence with 15- to 17-month-olds shows a positive correlation: the more speakers the child hears, the larger the vocabulary. This implies that hearing more voices may facilitate learning and word comprehension, potentially because this allows the child to experience the words and phrases in different contexts. This data is important for further understanding the relationship between an increased variety of social interactions and early vocabulary and language acquisition.

Charlotte Brontë and the Politics of Feeling

Megan West

Sponsor: Kathleen Frederickson, Ph.D.
English

The history of literary criticism focused on Charlotte Brontë's 1847 novel, *Jane Eyre*, has long been analyzed through the lens of psychoanalysis and/or postcolonial theory. In Sandra Gilbert and Susan Gubar's famous work, *The Madwoman in the Attic*, the characters Jane Eyre and Bertha Mason are locked in a Freudian exchange of psychological "doubling" revealing problems embedded within patriarchal gender ideologies. On the other hand, postcolonial readings in the wake of Jean Rhys' 1966 novel, *Wide Sargasso Sea*, address the issues of race within *Jane Eyre* and seek to uncover systems of inequality resulting from British colonialism. In my research, I attempt to reconcile these two critical frameworks by drawing upon more recent affect theory. Sianne Ngai, for example, argues that the affect of envy, in which two people engage in an aesthetic exchange, actually addresses fundamental issues of disparity. This concept of affective mirroring through performance might provide a new perspective that joins together the interpretations of second-wave feminist and postcolonial theories. My research shows how the racialized characters' expression of disagreeable emotions are not attempts to emulate hegemonic ideals of white English womanhood, but strategies to subvert and destabilize power structures through aesthetic performance.

Antibiotic Resistance in Invasive Non-Typhoidal *Salmonella* Isolates

Nicoel White

Sponsor: Renee Tsoilis, Ph.D.
MED: Medical Microbiology & Imm

Non-typhoidal *Salmonella* (NTS) typically causes a diarrheal disease; however, in malnourished children, NTS can cause a deadly systemic infection, known as invasive NTS (iNTS) disease. The CDC estimates that 3,400,000 cases of iNTS occur annually, with nearly half of the global incidents occurring in Africa. Clinically treating iNTS in the field is becoming increasingly difficult as multidrug resistance (MDR) is common in iNTS, with some strains resistant to all standard antibiotics.

Antibiotic resistance is one of the largest threats to global health today. This study will use minimum inhibitory concentration (MIC) assays to look at clinical isolates from cases of iNTS disease, and the antibiotics trimethoprim/sulfamethoxazole (TMP/SMX) and enrofloxacin to quantify the concentration at which bacterial growth is inhibited. The MIC for enrofloxacin will be determined for iNTS strains D23580 and JK1128. It is expected that strain D23580 will show resistance at all concentrations of TMP/SMX and that JK1128 will be susceptible. MICs are important in pre-clinical drug development because they can inform how to conduct animal studies. Future studies will use the information from the MIC assays to supplement antibiotic treatment and evaluate more effective co-treatments.

Effect of Atrazine Exposure on Chromosome Segregation in Mouse Oocytes

Tabitha Wibowo

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

Atrazine is a widely used herbicide that can be detected in the groundwater of many countries, including the United States. Low levels of atrazine detected in pregnant women is associated with low newborn birth weight. Other studies have shown that in male mice, atrazine decreases the number of spermatozoa and testosterone levels; in female mice exposed to atrazine during embryonic development, oocytes have decreased number of MLH1 foci, indicating less crossing over. In this study, we investigate the effect of atrazine exposure on chromosome mis-segregation and aneuploidy in both meiotic divisions of mouse oocytes. Analysis of crossing over in metaphase I oocytes indicates that fetal exposure to atrazine reduces the number of crossovers and causes higher incidences of unattached univalents, which is a high risk for chromosome missegregation. Consistent with this, elevated rates of oocytes with chromosomal abnormalities are observed at metaphase II. When adults are exposed to atrazine, chromosome alignment on the spindle apparatus and subsequent segregation are disrupted, although the number of crossovers is unchanged. Our data demonstrate that atrazine exposure can disrupt both early events of meiosis, such as crossing over, and late events, such as chromosome segregation, leading to increased incidence of aneuploid eggs.

Restorative Landscapes on A College Campus: A Study on How UC Davis Students Can Achieve Mental Restoration in a High-Pressure Environment

Jovita Widjaja

Sponsor: Elizabeth Boult, M.L.A.
Human Ecology

The purpose of this study is to apply restorative environment theory in a high-pressure landscape such as a college campus to relieve mental fatigue of students. My motivation is based on research that suggests the trait of "perfectionism" is particularly evident among college students. Perfectionism is the desire to achieve while being overly critical of oneself and others. This trait has been linked to anxiety and depression, which are mental illnesses that have negative impact on psychological well-being if left untreated. My methods are based on the work of environmental psychologists Stephen Kaplan who studied attention restoration theory. I will gather additional data by conducting student interviews and site observations. The responses will reveal the kind of restorative environments students prefer and help me determine potential sites for a landscape design proposal. Based on these findings, I hope to understand what types of activities students engage in to achieve mental restoration and how long they participate within the landscape. My goal is to analyze this data and apply it to a hypothetical landscape design of a restorative environment on the UC Davis campus in hopes to relieve mental fatigue and ultimately improve the mental health of students.

Effects of Changing Perceived Predation Risk of the Black Turban Snail, *Tegula funebris* on Algal Consumption

Elliot Wilde

Sponsor: Brian Gaylord, Ph.D.
Evolution & Ecology

Many organisms exhibit fear responses, changes in their behavior, when in the presence of a predator. These behavioral changes are exhibited in a variety of ways, many of which can end up impacting the local density of the species exhibiting the response. Fear responses are often even stronger in aquatic ecosystems, as is the case with the Black Turban Snail, *Tegula funebris*. This snail can detect waterborne cues of its primary predator, the Ochre Sea Star, *Pisaster ochraceus*. This experiment shows that as the strength of the cue increases in the water, *Tegula* will flee the water more often, and as a result its algal consumption will decrease, such that the predatory starfish indirectly benefits the algae. The findings of this study can be applied to different conditions seen within rocky intertidal tide pools, and furthermore provide insight into species interactions changes that can be expected with anthropogenic climate change, specifically sea level rise.

How Anthropogenic Noise Affects Vigilance and Nest Visitation in Adult Tree Swallows

Dylan Wilder

Sponsor: Gail Patricelli, Ph.D.
Evolution & Ecology

Anthropogenic activities can impact natural environments in unseen ways. Noise pollution is one such activity and affects many animals, but birds are especially vulnerable due to their dependence on sound for communication. Noise can mask information or create distractions, causing birds to avoid noisy areas or adjust their behavior. They can adjust their song frequency or vigilance, and can demonstrate noise avoidance through population distribution, nest selection, or nest attendance. To understand how Tree Swallows (*Tachycineta bicolor*) respond to noise, we studied their behavior at nest boxes during the incubation period. We exposed treatment nest boxes to vehicular traffic playbacks and transcribed incubation and vigilance bouts during nest visits from video recordings. We hypothesized that noise negatively affects Tree Swallows, distracting them during incubation and reducing nest suitability. As a result, we predict that birds at noisy nests will allocate more time to vigilance and spend less time visiting the nest box. Altering these behaviors could impact energy budgets, parental care, or future site occupancy. Humans may permanently damage biological communities if effects are negative and persistent.

Heavy Metal Intercalation in Bismuth Selenide

David Williams

Sponsor: Kristie Koski, M.D., Ph.D.
Chemistry

We demonstrate a series of new wet chemical strategies to intercalate elemental semiconductors, semi-metals, and heavy metal atoms into layered chalcogenides. Routes to intercalate: Bi, Cr, Ge, Mn, Mo, Ni, Os, Pb, Pd, Pt, Rh, Ru, Sb, W are developed using either reduction with tin chloride or organometallic decomposition of associated organometallics or carbonyls at low temperatures. Using Bi₂Se₃ as a trial host, intercalant concentrations up to 43 atomic of some heavier elements are detected (e.g. Sb_{3.8}Bi₂Se₃). We demonstrate that this host of chemical routes can be used for other lighter elements and work for intercalation into other chalcogenide hosts such as NbSe₂. These intercalation reactions greatly expand the library of elemental intercalants and give access to unique physical behaviors including stripe phases, polytypic superlattice structures, and optical phonon anomalies. Our group is the first to accomplish intercalation of these elements using chemical methods and is another step in our goal of intercalating the entire periodic table.

The Effect of Breed and Lactation Period on the Composition of Pig Milk Oligosaccharides

Savanna Won

Sponsor: Daniela Barile, Ph.D.
Food Science & Technology

Oligosaccharides are complex sugars found in mammalian milk. They are indigestible to the neonate but have demonstrated significant bioactive effects: promoting the growth of beneficial microorganisms in the gut, reducing pathogen adhesion and influencing neurological and immunological development. Due to their efficacy for growth promotion and disease prevention in livestock, oligosaccharides are being explored as potential alternatives to antibiotics in the food industry. Concerns regarding the resistance to antibiotics by pathogenic organisms has sparked a quest for alternate solutions and more research is necessary to elucidate the influence of oligosaccharides on animal health. This project involves the characterization and quantification of pig milk oligosaccharides via advanced mass spectrometry (MALDI-ToF) and application of high performance anion exchange chromatography (HPAEC-PAD). To date, the changes in the abundance of pig milk oligosaccharides across lactation periods are unknown. Our characterization by mass spectrometry revealed variation in oligosaccharide composition across the different breeds and a positive association between the relative abundances of some oligosaccharide structures and the piglets' live weight. Subsequent quantitation of oligosaccharides in samples at different lactation periods and parity will further clarify these findings and allow for a more definitive understanding of the relationship between milk composition and neonate health.

Cultivation and Characterization of Urea-Degrading Bacteria from the Termite Gut

Sung Joon Won

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

Termites are remarkable for their ability to digest cellulose as their main source of energy. Because cellulose is low in nitrogen, an element essential for sustaining life, it is crucial to understand the roles that bacterial symbionts in the gut may play in conserving nitrogen for their hosts. Urea is a nitrogen-rich metabolic waste product secreted in the gut, and many bacteria have urease enzymes that convert urea into ammonium for reabsorption. We used a targeted cultivation method to characterize the microbiota capable of hydrolyzing urea from the guts of lab-reared and wild termites (*Reticulitermes hesperus*). Using aerobic (21% O₂) and hypoxic (2% O₂) culture conditions, we obtained higher numbers of cultivable bacteria from wild than lab-reared termites. PCR assays revealed the presence of the urease-encoding ureC gene in 92.5% and 86.61% of our isolates from lab-reared and wild termites, respectively. Screening showed positive urease enzyme activities in 1.64% and 11.76% of our isolates from wild and lab-reared termites. Preliminary analysis of 16S rRNA gene sequences from urease-positive strains revealed that these bacteria belong to the Burkholderiales, Enterobacteriales, and Flavobacteriales clades. The screening and identification of our collection of 192 isolates is ongoing.

Effects of Milk and Recombinant Osteopontin on Growth of the Small Intestine in Infancy

Kristy Wong

Sponsor: Bo Lonnerdal, Ph.D.
Nutrition

Osteopontin (OPN) is a highly phosphorylated glycoprotein and is abundantly present in milk. OPN is a pleiotropic protein and is involved in multiple functions, including proliferation. OPN exerts its multiple functions by binding its receptors on the surface of target cells and initiates various signaling pathways. Our previous results showed that human milk OPN is resistant to digestion and promotes intestinal growth. In the present study, whether bovine milk OPN (bmOPN), recombinant human OPN (rhOPN) and recombinant bovine OPN (rbOPN) have similar effects were examined. To explore this, wild-type (WT) mouse pups were fed by WT dams, OPN knock-out (KO) dams without or with supplementation with bmOPN, rhOPN, or rbOPN. Mouse pups were fed bmOPN, rhOPN, or rbOPN (12 µg/g) from postnatal D1 to D10. Duodenum samples collected from D10 pups were fixed in paraformaldehyde, embedded in paraffin, and cut by a microtome. Duodenum sections were stained with hematoxylin and eosin, images were taken under a microscope, and the villus height and crypt depth were measured using ImageJ. The results show that all three OPN supplements increased the ratio of villus height-to-crypt depth, suggesting that bmOPN, rhOPN, and rbOPN exhibit similar pro-proliferative effects as human milk OPN.

Evaluating the Community and Diversity of Airborne Fungi in Outdoor Environments in Davis, California

Meaghan Woody

Sponsor: David Rizzo, Ph.D.
Plant Pathology

Airborne fungi can pose major health threats to humans, animals, and plants. Therefore, it is useful to track the composition and diversity of airborne fungal communities in specific areas. Fungal communities of outdoor environments may vary depending on human impacts and ecological factors. Studies show that the mean spore concentrations of airborne fungi are significantly higher in rural environments than in urban environments. In addition, land use type, such as agriculture, is likely to impact the concentration of spores in the air. The goal of this study is to compare the communities of airborne fungi at three sites: forest, agriculture field, and outdoor urban. The main hypothesis is that diversity (as measured by various diversity indexes) will be highest in the forest community, second highest in the agriculture field community, and lowest in the urban outdoor community. We will use a culture-based method to study the fungal communities by employing 1) morphotyping based on cultural characteristics, 2) genus-level identification using microscopic examination of subcultured colonies, and 3) species-level identification employing internal transcribed spacer DNA sequences.

Tweet Like the Fox: A Machiavellian Explanation of Donald Trump's Presidential Campaign

Michaela Worona

Sponsor: John Scott, Ph.D.
Political Science

Many voters saw Donald Trump's behavior during his presidential campaign as outrageous or even dangerous, yet he was successful in mobilizing a voter base strong enough to win the presidency. Both members of the general public and the political "elite" regard President Trump as an unseasoned anomaly. However, I am investigating the possibility that his unorthodox entrance to the American political arena was calculated and intentional. Specifically, I am exploring whether President Trump embraced the political philosophies of Niccolò Machiavelli, resulting in his unexpected victory against Hillary Clinton. To measure both the general public's and the elite's response to his politics, I isolate four quintessential moments along Trump's campaign. Then, I analyze editorials published by both liberal and conservative newspapers in a number of swing states, in addition to public opinion polls conducted in the states in question. My findings are that Donald Trump did in fact employ numerous Machiavellian principles throughout his campaign, which can serve as a partial explanation for the momentum he achieved that won him the election -- seemingly against all odds and conventional expectations.

FPGA-based Real Time Analysis of the Effects of Battery Charging Methods on the Energy Storage in Small Scale Portable Devices

Nathandis Wyley

Sponsor: Hussain Al-Asaad, Ph.D.
Elect & Comp Engr

Field programmable gate arrays (FPGA) have been used for real time acquisition of data and modeling of natural phenomena. Combining an FPGA running an optimized algorithm and battery charging technology, allows us to construct a model that distinguishes the homogeneity between charging methods and the small battery energy storage capability. The charging methods will include hardwired with various cord types (including lighting, USB 2.0, and USB C) and wireless charging (magnetic induction). The algorithm will be the procedural steps in which the FPGA collects and categorizes data. This variant analysis provides critical information allowing the creation of a model that identifies the effects charging methods on the longevity and charge capacity of batteries in small devices. The proposed model will be used to identify the efficiency of distinctive charging methods while classifying their behavior traits including charging time, charging capacity, and battery capacity decay with time as parameters. This model has the possibility to yield validity on charging methods utilizing solar panels and the practicality of using alternative energy to charge small scale devices. Possible future applications include creating portable chargers that rely on readily available photovoltaic energy, reducing daily power consumption, and individual's carbons foot print.

Frustrated Phagocytic Spreading of Human Neutrophils on Different Densities of Surface-Immobilized IgG

Zhiyu Xiao

Sponsor: Volkmar Heinrich, Ph.D.
Biomedical Engineering

Due to the difficulty of analyzing irregular, three-dimensional phagocyte shapes, quantitative insights into phagocytic protrusion dynamics of immune cells remain scarce. We address this difficulty by examining antibody-mediated, frustrated phagocytic spreading of individual human neutrophils on flat coverslips that were coated with four different densities of rabbit IgG. We use reflection interference contrast microscopy (RICM) to measure the growing cell-substrate contact area with high precision. We find that the overall speed of the contact-area growth is largely independent of the IgG density, confirming that this type of cell spreading is governed by the "protrusive zipper" rather than the adhesion-driven "Brownian zipper" mechanism. We quantify two additional cell mechanical responses: the roundness and the maximum area of the contact regions. Although our results indicate that the density does not affect the roundness, the maximum area often remains smaller for cells spreading on lower IgG densities. We concurrently monitor the cytosolic free calcium concentration, and we found cells spreading on lower IgG densities exhibit a later global burst in intracellular calcium concentration. This result indicates that the timing of calcium bursts is governed by a threshold of the number of engaged Fc γ -receptors of the spreading neutrophil.

Nitrogen Footprint of UC Davis

Breanna Xiong

Sponsor: Benjamin Houlton, Ph.D.
Land Air & Water Resources

Reactive nitrogen is an integral part of human life and ecosystems. An excess of this resource contributes to a wide range of environmental and human health problems including worldwide declines in biodiversity, climate change, and compromised air and drinking water quality. A nitrogen footprint provides a standardized measure for the amount of reactive nitrogen released by an entity, such as a university, thereby guiding opportunities for reductions in excess nitrogen emissions. The Sustainability Indicator Management and Analysis Platform (SIMAP) developed by the University of New Hampshire Sustainability Institute will calculate both the nitrogen footprint and carbon footprint of UC Davis. We present the nitrogen footprint results for major sectors at UC Davis: food, utilities, transportation, research, and wastewater. The updated results add new data that contributes to a more complete accounting of upstream and downstream losses of reactive nitrogen. This quantitative measurement, as well as the predictive scenarios and projections provided by SIMAP, will aid in the formation of future abatement targets and sustainable management actions for nitrogen at UC Davis.

Targeting Phosphorylation of Type I Insulin Growth Factor-1 Receptor in MTAP-Lost Renal Cell Carcinoma

Jihao Xu

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

Renal cell carcinoma has emerged as a metabolic disease characterized by dysregulated metabolic enzymes. To ultimately improve the cancer treatment and survival rate, there is an urgent need to reveal the mechanisms by which metabolic enzymes and aberrant pathways regulate oncogenic signaling. Through an integrated two-step analysis of RCC metabolic pathways, we previously identified dysregulated expression of methylthioadenosine phosphorylase in aggressive RCC. An accumulation of cellular methylthioadenosine has been observed in MTAP-deleted cancer cells. Interestingly, we found a decreased of protein-methylation level with concomitant with an increase in tyrosine phosphorylation after MTAP knockout. Next, we performed phospho-kinase antibody array screen and identified type 1 insulin-like growth factor-1 receptor as the top-one candidate with upregulated tyrosine phosphorylation in response to MTAP loss. IGF1R phosphorylation acted upstream of Src and STAT3 signaling in MTAP-knockout RCC cells. Reduction of phospho-IGF1R by a selective inhibitor of IGF-1R, linsitinib, inhibited the cell migration and invasion capability of MTAP-deleted cells. Data from cell viability assays showed that MTAP loss enhanced linsitinib-mediated cytotoxicity in RCC cells. Our data suggest that IGF1R signaling is a driver pathway to confer aggressive nature of MTAP-deleted renal cell carcinomas.

Traditional Mud Silk in Contemporary Fashion

Fusi Xu

Sponsor: Susan Avila, M.F.A.
Design Program

This project explores how xiang-yun-sha (traditional mud silk) can help reinforce sustainable fashion and cultural value in designers. Xiang-yun-sha is a two-toned natural silk fabric originating in the Lingnan region of Guangdong, China and dyed using the mud from the Pearl Delta River and a yam called shu-liang. Since the 1980s, the number of manufacturers of xiang-yun-sha has declined from five hundred to less than ten factories due to the rise of mass production. Nowadays, people like to associate xiang-yun-sha with outdated fashion because it was commonly used to make traditional Chinese garments worn mostly by elders. Over time, xiang-yun-sha lost attention and became unknown to new generations. The authentic xiang-yun-sha does not involve any synthetic fiber or toxic chemicals so it lends itself to sustainable fashion. This project remarkets the image of mud silk and promotes its sustainable and cultural value to younger audiences through a youthful contemporary ready-to-wear collection targeting women age twenty to thirty-five.

Combined Effect of 2,2',4,4'-Tetrabromodiphenyl Ether (BDE-47) and Soluble Copper on Purple Sea Urchin Development

Joshua Yanez

Sponsor: Gary Cherr, Ph.D.
Environmental Toxicology

In this work, the combined toxic effects of two common contaminants found near e-waste recycling facilities, 2,2',4,4'-tetrabromodiphenylether (BDE-47) and soluble copper, were examined using a purple sea urchin model. EC₅₀ values for pluteus stage embryos at 96 hours post fertilization were determined to be 412 ppb and 10.4 ppb for BDE-47 and soluble copper, respectively. The probable mechanism of BDE-47 toxicity was determined to be the generation of reactive oxygen species (ROS) based on observation of whole embryos stained with dichlorofluorescein, and indicator of ROS in cells. Mixtures containing low concentrations of BDE-47 (10-25 ppb) and 10 ppb copper showed reduced toxicity compared to 10 ppb copper alone, suggesting a hormetic response. Whole embryos stained with phengreen-FL, a fluorescent indicator of soluble copper in cells, were seen to have less copper accumulation in groups co-exposed to 10ppb BDE-47 and 10 ppb copper than those exposed to 10 ppb copper alone. Based on observation of whole embryos stained with calcein-AM, an indicator multidrug resistance efflux pump inhibition, BDE-47 at 150 and 300 ppb, and copper at 5 and 10 ppb were both found to inhibit MDR activity.

X-Ray Nanodiffraction Studies of Strain in Ferroelectric PbZr(0.2)Ti(0.8)O₃ Thin Films

Morris Yang

Sponsor: Roopali Kukreja, Ph.D.
Materials Science&engineering

PbZr(0.2)Ti(0.8)O₃ (PZT) exhibits piezoelectric and ferroelectric properties which are of interest for applications in sensor and actuator devices. We have performed x-ray nano-diffraction experiments to understand the nanoscale properties of PZT layers and characterize the inhomogeneities present at nanoscale. X-ray nanodiffraction provides a direct way to investigate nanoscale lengthscales without the need for advanced sample preparation or sample damage which can occur during transmission electron microscopy (TEM). In x-ray nanodiffraction setup, a focused beam (25 nm) is used to raster scan the sample and a 2D detector is used to capture the diffraction patterns. Using these images to calculate the movement of the peak on the detector, we can map out the strain present in the sample with nanometer resolution. However, the analysis process is difficult due to complex geometry of diffraction and convolution of diffraction from focusing optics and the sample. In this project, we use MATLAB and other image processing techniques to quantify and characterize the local strain present in the PZT samples. Successful completion of the project will provide detailed information on the local structure and epitaxy of the PZT films.

A Deep Learning Approach to Sustainable Waste Management

Jiayin Yang

Sponsor: Ilias Tagkopoulos, Ph.D.
Engr Computer Science

According to the Environmental Protection Agency's (EPA) report, USA generated 254.1 million tons of trash in 2013. Compared to 1960 when USA generated only 88.1 million tons, the municipal solid waste generation has increased by a staggering 188.4%. Despite our best efforts to recycle and compost, we are lagging behind as we were only able to achieve a 34.3% recycling rate in 2013. Here, we propose to address the problem at the source by building an inexpensive smart trash can that takes trash images, processes them and then automatically segregates it into Compost, Recyclable & Landfill bins. We do this by implementing Convolutional Neural Networks (CNNs) and Computer Vision algorithms on a Raspberry Pi 3 to correctly identify the images of trash. Our dataset includes the 2527 labelled TrashNet images coupled with an increasing set of images acquired by our smart trash can. Preliminary results show a performance of 60% in trash classification, with further refinement under way. This project paves the way for intelligent, inexpensive and sustainable waste management across a wide spectrum of commercial and residential facilities.

Enhancing Therapeutic Potential of MSC Spheroids with Perfusion

Osamu Yasui

Sponsor: Jonathan Leach, Ph.D.
Biomedical Engineering

Cell-based therapies are under widespread evaluation in tissue engineering but are limited by widespread cell death in vivo. When aggregated as spheroids, mesenchymal stem cells (MSCs) have improved in vivo survival and growth factor production compared to dissociated cells. Bioreactor culture provides another method to guide MSC function, as fluid shear stress drives osteogenic differentiation and matrix production. Although MSC spheroids have been evaluated in rotating wall and continuous stirred tank bioreactors (CSTR), no efforts have been described to capture the instructive potential of tailorable shear flow in perfusion bioreactors. We hypothesize that perfusion culture will apply uniform shear stress to MSC spheroids that enhances cell viability, matrix deposition, and osteogenic differentiation compared to CSTR bioreactors. To investigate this hypothesis, we developed a perfusion system in which cell spheroids are cultured between freeze-dried alginate sponges. Sponges facilitated more thorough and uniform perfusion compared to solid or perforated alginate hydrogels. In addition, this method facilitated more effective seeding of spheroids as a layer between alginate sponges than distributing spheroids into the sponge by perfusion or centrifugation. This perfusion culture system will be used to characterize the osteogenic differentiation of MSC spheroids under varying levels of fluid shear stress.

Rhetorical Analysis of the Nutrition Discourse Community

Rachel Yee

Sponsor: Daniel Melzer, Ph.D.
University Writing Program

The purpose of this study is to examine the nutrition discourse, specifically its main goals and values and the types of writing in this community. The main research questions I want to address are: How does the nutrition discourse community communicate with one another to achieve common goals? Why are these modes of communication so successful when used in professional work? To learn more about nutrition discourse, I interview a graduating senior in the major, where she discusses several types of writing she has been exposed to while becoming more involved in this discourse community. She goes into detail about the importance of the ADIME note and how it applies to professional dietetic work such as counseling patients. Additionally, I analyze a research publication written by a UC Davis professor to portray the relationship between writing and the process in which knowledge gets passed down through communication. Findings show that nutrition is a major based mostly on critical thinking and communication combined with science and health. In order to succeed in this major and field of work, students should be able to collaborate with others to promote healthy living and examine how food affects the body processes.

Identifying and Quantifying Phosphorylation of Tyrosine Using Mass Spectrometry

Victoria Yee

Sponsor: Armann Andaya, Ph.D.
Campus Mass Spec Facilities

Proteins control the fundamental functions of biological processes. Thus, a deeper understanding of protein alterations and the subsequent effects are important. Protein phosphorylation is a well-known modification occurring predominantly on serine, threonine, and tyrosine residues. Though 99% of phosphorylation happens on serine and threonine, only less than 1% are with tyrosine. Despite its scarcity, tyrosine phosphorylation often sets into motion a cascade of important intracellular processes some of which have been implicated in disease progression. However, due to its low occurrence, phosphorylation of tyrosine has proven difficult to detect. Mass spectrometry allows for specific detection of trace targets despite interfering substances. We propose a protocol that identifies and quantifies low abundant phosphorylation of tyrosine using mass spectrometry. Thus far, phosphorylated tyrosine standards have been analyzed and potential candidate ions have emerged for its presence and quantity. We will apply our protocol on complex samples which will allow us to investigate low abundant markers that regulate other cellular processes.

Determining the Roles of CrkII, CrkL, and YAP1 in Force-Sensitive Protein Interactions Surrounding Zyxin

Jacqueline Yee

Sponsor: Soichiro Yamada, Ph.D.
Biomedical Engineering

Physical forces exerted by adjacent cells and the extracellular matrix alter cell and tissue physiology. Thus, understanding how cells convert these mechanical signals to chemical signals should lead to insight on a variety of biological processes. We have focused on the focal adhesion protein zyxin, which is thought to be involved in adhesion-stimulated signal transduction pathways. Using proximal biotinylation, we identified CrkII, CrkL, and YAP1 as potential force-sensitive zyxin binding partners. Crk proteins are adaptor proteins, and YAP1 is a transcriptional co-activator. Both Crk and YAP1 are involved in mechano-sensing pathways. Since zyxin is a potential force-sensitive binding partner of CrkII, CrkL, and YAP1, we hypothesize that zyxin may be the link between Crk and YAP1 mechano-transduction pathways. Our data shows that CrkII has a unique localization along circumferential actin filaments. We are currently characterizing changes in zyxin-Crk and zyxin-YAP1 co-localization in response to transient, local mechanical stress and cyclic, steady state stretch. Determining how physical forces alter zyxin-Crk-YAP1 interactions will ultimately help piece together a complete mechano-sensing protein interactome that governs cell behavior.

Effect of Single Nucleotide Polymorphism rs6983267 on Cancer Risk

Colleen Yi

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

The single nucleotide polymorphism (SNP) rs6983267 has been linked to increased risk for colorectal cancer. It has been proposed in previous research that the beta-catenin–TCF7L2 transcriptional activation complex preferentially binds to the risk allele (G) of rs6983267, which is located within an enhancer element that is known to upregulate the proto-oncogene c-MYC. However, it is still unclear whether a single base change is able to significantly affect transcription because previous studies have only compared different cell lines, which have more genetic differences than rs6983267. To more precisely elucidate the mechanism of rs6983267, this study used CRISPR-Cas9 genome editing technology to scarlessly edit cell lines at the single nucleotide level to create isogenic cell lines that span all three genotypes for this SNP. Normal and cancerous cell lines for colon and breast tissue were used. Gene expression of c-MYC, beta-catenin, and TCF7L2 were measured with RT-qPCR. This study will help determine whether the rs6983267 mechanism proposed to increase colon cancer risk is consistent between cancers and cell types. By further elucidating the mechanism of rs6983267, this study could help inform individuals of their cancer risk as well as providing new targets for therapeutics.

The Sexuality of Gothic Literature: An Analysis of the Connection Between the Portrayal of Sexuality in Gothic Literature and Victorian Repression

Michael Yoakam

Sponsor: Elizabeth Freeman, Ph.D.
English

Popularized in the late eighteenth and nineteenth centuries, gothic literature blends horror, suspense, and sex into a genre that is as beautiful as it is macabre. Yet, the overt sexuality of the gothic novel stands in stark contrast to the ideals of repressed Victorian society. Drawing upon works such as *Carmilla*, *The Strange Case of Dr. Jekyll and Mr. Hyde*, *The Castle of Otranto*, and *The Picture of Dorian Gray*, this paper seeks to reconcile the gap between Victorian ideology and the apparent popularity of the gothic novel. It will assert that, instead of opposition, the dark portrayal of sex is a function of society's repression. By exploring the propensity of the gothic novel to depict the sexualities behind characters as corrupting, divisive, and sinful, and by denying those that engage in such behaviors the means of returning to society via a social institution, i.e. marriage, the gothic novel ultimately reveals its impression that the nature of sex itself is an object of horror.

Utilizing Viral Vectors to Detect the Projection of OT Neurons Associated in Anxiety Like Behavior

Sae Yokoyama

Sponsor: Brian Trainor, Ph.D.
Psychology

Recent findings have shown that OT can increase anxiety-like behavior under certain conditions. We have previously shown that social defeat stress induces social withdrawal in female but not male California mice. There is an increase in the activity of OT neurons in the bed nucleus of the stria terminalis (BNST), an area associated with anxiety. Intranasal administration of OT increases social interaction behavior in males but reduces this behavior in females. Additionally, administration of OT receptor antagonist reverses stress induced social withdrawal in females while decreasing social interaction behavior in males. These results suggests that OT has differential effects in males and females. Here, we use viral vectors to selectively express a green fluorescent protein (GFP) into OT neurons in BNST or paraventricular nucleus (PVN). GFP is transported into fibers allowing us to detect projections of these neurons. Preliminary data indicate that BNST OT neurons project to more anterior regions of BNST while OT fibers in the Nucleus Accumbens originate in PVN. An ongoing project will use Designer Receptors Exclusively Activated by Designer Drugs to activate OT neurons in BNST or PVN. We predict that activation of OT neurons in BNST of females will induce anxiety-like behavior.

Transformation and Selection of Heterozygous NHX Knockout Mutants with *Agrobacterium tumefaciens* Harboring DII-VENUS Expression Vectors

Cari Young

Sponsor: Eduardo Blumwald, Ph.D.
Plant Sciences

Maintaining a suitable pH and ion homeostasis within the plant cell is essential for plant growth. In *Arabidopsis thaliana*, a key regulator of pH and ion homeostasis is the family of Na^+/H^+ Exchangers (NHXs) that catalyzes the electroneutral exchange of Na^+ and/or K^+ for H^+ in the plasma membrane, endosomal compartments, and vacuolar membrane. Interestingly, our research showed that knocking out all four vacuolar-residing NHXs (NHX1-NHX4) may cause a loss of auxin homeostasis. The vacuolar NHX quadruple knockout mutants (nhx1/2/3/4) lost apical dominance and had shorter roots compared to the wildtype, which indicated auxin accumulation in the roots. To test this hypothesis, plasmids containing DII-VENUS, an auxin sensor whose fluorescence intensity inversely reflects auxin levels, were transformed into knockout lines homozygous recessive for NHX2 to NHX4 but heterozygous for NHX1. Positive transformants in the T_1 and T_2 generations were selected by hygromycin resistance and DII-VENUS fluorescence and their genotypes were checked using PCR. Plants expressing DII-VENUS and were homozygous quadruple knockouts for NHX1 to NHX4 were used for imaging. We found that wildtype plants had higher DII-VENUS compared to nhx1/2/3/4, indicating the mutants contain higher auxin levels than the wildtype, proving the hypothesis and paving the way for future research.

The Effect of 9-Year Chinese Compulsory Education Policy on the Household Consumption Behaviors

Qiaoying Yuan

Sponsor: Giovanni Peri, Ph.D.
Economics

Much discussion of the benefits of the more schooling attainment has been associated with higher lifetime income obtainable. However, more education may lead to other effects other than increased earning on an individual's total utility. For example, education may enable people to appreciate finer things or be more efficient in making consumption decision. On the other hand, education may enable people to be more farsighted or invest/save more portion of their income with less consumption. During the development of Chinese economic system, an education policy-- Compulsory Education Law officially went into effect on July 1, 1986. This was the first time that China used a law to specify educational policies for the entire country while provinces were allowed to have different effective dates for implementing the law. In this paper, I will use empirical evidence to examine whether the change of schooling years due to this specific policy will boost the average propensity to consume or not on the household level.

Striving for Better Patient Outcomes: Opportunities for Early Detection of Patients with Acute Myocardial Infarction and Highly Infectious Diseases in Central Vietnam

Amanullah Zadran

Sponsor: Gerald Kost, M.D., Ph.D.
MED: Pathology & Lab Medicine

This research investigates the unmet needs and diagnostic capabilities for cardiac biomarker and infectious disease testing in hospitals in Central Vietnam, and recommends strategies for implementing point-of-care testing (POCT). Patients with acute myocardial infarction (AMI) must fend for themselves, because ambulances transfer patients primarily between hospitals, rarely picking up from homes, requiring rural rescue by taxi or motorbike to interventional care. One surveyed hospital (6.7%, 1/15), the Provincial Hospital, provided interventional treatment and cardiac troponin (cTn) I and T testing. We recommend implementing POC cTn I or T throughout Hue Province. In regard to infectious diseases, two community health centers had diagnostic tests available for detection of Malaria (29%, 2/7). Most community health centers lacked laboratory facilities (85%, 6/7). The Provincial Hospital had broader diagnostic testing capabilities, but was not prepared for outbreaks of highly infectious diseases, such as Ebola virus disease and Zika. Preparedness for infectious diseases outbreaks warrants improvement in rapid POC diagnosis and treatment of critically ill patients. Early diagnosis in community's health centers and placement of POCT on ambulances will facilitate direct transfers to hospitals capable of quarantining and intervening, thereby improving patient outcomes by decreasing transmissibility and enhancing patient survival.

Evaluating the Environmental Robustness of a Point-of-Care WBC Differential Device: Humidity & Relevance to Use in Outbreaks

Layma Zadrán

Sponsor: Gerald Kost, M.D., Ph.D.
MED: Pathology & Lab Medicine

We evaluated the effects of humidity on the ability of a FDA-investigational point-of-care (POC) instrument (HemoCue, Sweden) to measure white blood cell and differential (WBC-DIFF) counts in capillary whole-blood specimens. Elevated WBC and DIFF can indicate the presence of critical infections. POC instruments must withstand environmental stresses (ES) to achieve impact in disease prevalent areas, such as epidemics of highly infectious diseases like Ebola. We used Tenney ES chambers to establish high and low humidity conditions less than and greater than 90% RH, the manufacture specified limit, to investigate the simultaneous environmental robustness of the instrument and its reagents. Temperature was maintained in the manufacturer acceptable range of 24-30 °C to ensure it was not a confounding variable. Measurements were obtained using whole-blood capillary samples from consented volunteers in an approved human subjects protocol (IRB 294372-10). Findings suggest that humidity exceeding manufacturer specifications impairs WBC-DIFF system performance. These results illustrate the importance of the ability of the WBC-DIFF system and other POC devices to endure environmental extremes. Robustness is needed to improve diagnosis and evidence-based decision making in regions at risk, including screening in primary care and homes.

Development of Working Memory in Infants

Sonia Zafiratou

Sponsor: Lisa Oakes, Ph.D.
Psychology

Working memory, the kind of memory we use when we retain information while solving other tasks, seems to emerge by 6.5 months of age (Reznick et al, 2004). However, measuring working memory in infancy is difficult. We are replicating a study conducted by Kaldy et al (2016), in which they presented the Delayed Match Retrieval task of working memory. The task resembles a memory card game; infants are shown two cards with different images (e.g., a smiley face and a tree), and the cards are then flipped over, hiding the image. A third card is revealed that is matching one of the previous two cards. If infants have stored the images in working memory, they will look at the card that hides the matching pattern. Infants' performance will be quantified using eye tracking to measure where they look and evaluate whether they recognized the match. The study will include 72 infants ranging from 8 to 10 months of age and will examine how their ability to remember the match changes over this age range. We predict that their performance will improve with age, as observed in the findings of the original study.

Fototestimonios: Campus Climate in Davis

Diana Zaragoza

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

How can we foster diversity and inclusive spaces for all current and incoming students? What are the spaces students find most safe and how can we work with campus administration to create more of these across campus? Conversely, how can we also fix the unsafe, harmful spaces that subject students, particularly underrepresented minority respondents, people of color, women, LGBTQIA folks to discrimination, marginalization, sexual assaults, alienation, microaggressions, and crimes? By leading a community-based participatory research with UC Davis students we are co-creating a UC Davis map that highlights where students feel safe or not. Students are using fototestimonios (photos and accompanying narratives). The photos and narrative allowed us to investigate what makes a space safe or unsafe for students, and what will it take to make to make spaces safer on campus and thus improve campus climate and the well-being of students. This project is creating awareness of campus climate problems, as well as a call to action for students who can no longer condone a toxic climate or general passivity.

Local Regulation and Potentiation of L-type $\text{Ca}_v1.2$ by Adenylyl Cyclase 5 During Diabetic Hyperglycemia

Juan Zarate

Sponsor: Manuel Navedo, Ph.D.
MED: Pharmacology

Elevated blood glucose, known as hyperglycemia (HG), is a metabolic abnormality of diabetes that has been associated with increased arterial myocyte contractility and consequently, excessive vascular constriction that can lead to high blood pressure and reduced blood flow. Increased arterial constriction in response to HG involves enhanced activation of L-type $\text{Ca}_v1.2$ channels ($\text{Ca}_v1.2$) mediated by protein kinase A (PKA) phosphorylation of the channel. However, the upstream mechanism regulating PKA activity is not known. Here, we describe a critical role for adenylyl cyclase isoform 5 (AC5), upstream of PKA, in potentiation of $\text{Ca}_v1.2$. Electrophysiology and arteriography recordings in WT isolated cerebral arteries and arterial myocytes, respectively, showed that the specific AC5 and AC6 inhibitor 2,5,DDA prevented increased $\text{Ca}_v1.2$ activity and vasoconstriction in response to HG. Moreover, HG failed to enhance $\text{Ca}_v1.2$ channel activity and vasoconstriction in arterial myocytes and arteries isolated from AC5 knockout mice, which was not observed for AC6 knockout mice. Interestingly, a subset of $\text{Ca}_v1.2$ channels was found within nanometer proximity of AC5 in arterial myocytes with significantly higher association than AC6. Altogether, these findings suggest a role of local AC5 signaling in HG-induced increased $\text{Ca}_v1.2$ activity and vasoconstriction during diabetic hyperglycemia.

Innate Immunity in the Olfactory Neuroepithelium to Viral Infection

Ahmad Zedan

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

Nasal cavity is constantly exposed to environmental pollutants and pathogens. The olfactory neuroepithelium (OE) is located in the nasal cavity and has a direct route into the brain through olfactory sensory neurons (OSNs). The defense mechanisms in the OE are not yet fully understood. To better understand the innate immunity in the OE, we designed a set of experiments to study the responses of the OE to viral exposure. Recombinant attenuated vesicular stomatitis viruses were inoculated into the nasal cavities of C57BL/6J mice. Transcriptional changes of type I and III interferons and selected cytokines and chemokines were examined in the OE and olfactory bulb (OB) by RT-PCR at 12, 24, 48 hours after viral exposure. To determine the cell types responding to viral stimulation, in situ hybridization and immunohistochemistry were performed on the OE. Recombinant Viral genes were observed 12 hours after virus exposure in the OE and it travels through OSN axons to the OB of the brain where it is observed robustly at 48 hours. This research aims to map out defense mechanisms of the olfactory system against viral invasion into the brain, which will allow us to identify preventative and therapeutic strategies against viral infection.

Acclimation Effects on Temperature Preferences of Largemouth Bass, *Micropterus salmoides*

Thuraiya Zerrouk

Sponsor: Nann Fangue, Ph.D.
Wildlife & Fisheries Biology

Largemouth bass, *Micropterus salmoides*, are ectothermic, relying on the environment to regulate body temperatures within a necessary range. It is widely accepted that fish tend to select temperatures that are physiologically optimal. The aim of this study was to measure the thermal preference and avoidance (behavioral thermoregulation) in largemouth bass acclimated to two different temperatures. Farm reared largemouth bass were separated into two thermal exposure groups, 18°C and 24°C. After a minimum of 21 days, individual fish were placed in an annular temperature preference apparatus (TPA) which presented a bimodal water temperature gradient from 11°C to 28°C for 22 hours. The acute thermal preference was measured shortly after exposing the fish to the thermal gradient. A second measurement of temperature preference was taken after the fish had been exposed to the temperature gradient for 22 hours to determine the final preferred temperature (final preferendum). We hypothesize that biologically different acclimation temperatures will influence the preferred temperature and result in selection that reflects their thermal history in an acute period. However, after 22 hours we hypothesize that there will be a species-specific temperature preference shared by all individuals regardless of acclimation treatment.

Reimagination of Self: Transnational Human Quality Embodiment in Contemporary China

Lienong Zhang

Sponsor: Donald Donham, Ph.D.
Anthropology

“Waiguo” means foreign nations and is often used by Chinese people to categorize a singular and utopian foreign land which contains only certain developed world countries or areas, such as Hong Kong, Japan, America, Canada, the UK, New Zealand and sometimes, Israel. However, the apparent desire for Chinese people to become part of “waiguo” contradicts with the claim that Chinese people can never be “waiguoren”, people from “waiguo” (in the sense that a person cannot be native and foreign at the same time). Thus, I want to investigate this dilemma by asking what “waiguo” is? After six weeks of fieldwork in Wuhan and Xian, China, I find Reinhart Koselleck’s idea of time-space is useful in explaining the existence of “waiguo”; the conceptual distance between the Chinese-ness and “waiguo” is infinite and a person cannot be Chinese and “waiguoren” at the same time, just like a person cannot live in the past and present at the same time. With the facilitation of assemblage theory and human capital accumulation (in the form of “suzhi”), I want to show how this binary opposition can help us to think beyond culture and society.

Stochastic Ion Channel Activity in Ischemic Regions of the Heart can Cause Reflected Waves and Promote Cardiac Arrhythmias

Zixuan Zhang

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

Sudden cardiac arrest (SCA) is the leading cause of natural death in the United States. Researchers have been investigating the underlying mechanisms of SCA in order to prevent and treat heart malfunctions. SCA most often results from abnormal heart rhythms, known as arrhythmias, which can be triggered by the presence of myocardial ischemia. In this study, we construct a computational model of myocardial ischemia and investigate the mechanisms of arrhythmias. We model heart tissue as a one-dimensional excitable cable and assume the ischemic region to be non-excitable. It is known that non-excitable gaps in excitable media can cause a “reflected” wave, i.e., a wave propagating in one direction induces another wave to travel in the retrograde direction. Reflected waves have been linked to the onset of arrhythmias. Our study examines wave reflection under prescribed non-excitable gap lengths and stochastic ion channel activity. Our results show that stochastic channel activity promotes the initiation of reflected waves, especially when reflected waves are sensitive to the non-excitable gap length.

Influence of Antipsychotic Medications on Brain Structure in Patients with First Episode Schizophrenia

Zaiyang Zhang

Sponsor: Cameron Carter, M.D.

MED: Psychiatry & Behav Sci

Brain structure changes have often been observed during chronic first or second-generation antipsychotic treatment in patients with schizophrenia. However, much of the existing literature relies only upon cross-sectional studies comparing regional brain volume changes within a short amount of time. In this study, we collect antipsychotic medication information over time and use structural MRI to examine brain volume and cortical thickness changes over a 12 months period. This longitudinal design allows for the examination of brain structure fluctuations in individuals who discontinue or start medication treatment over the duration of the study. We hypothesize lower whole-brain gray matter volume in antipsychotic treated individuals, as well as localized cortical thinning in prefrontal and temporal cortices. Subcortical structures, such as the basal ganglia are predicted to be increased in volume in individuals taking antipsychotics. Finally, we predict that these brain changes may occur relatively quickly over one year duration of the study, which suggests high structural plasticity in response to antipsychotic medications. These findings will be interpreted in the context of existing studies showing that while antipsychotic treatment may be associated with volume changes, there are other clear benefits to clinical symptomatology and brain activity.

Antimicrobial and Rechargeable Alginate Hydrogel Beads for Highly Efficient Fresh Produce Sanitizing

Mengxiao Zhang

Sponsor: Gang Sun, Ph.D.

Textiles & Clothing

With the increasing consumption of fresh produce, the foodborne diseases caused by infectious microorganisms are currently one of the greatest food safety issues in the United States. Data collected by the Centers for Disease Control and Prevention's (CDC) reveal that about 44% of the foodborne illnesses can be attributed to the contaminations of fresh produce with pathogens. Therefore, it is crucial to explore new efficient ways of cleaning fresh produce. Fresh produce is washed with chlorine water under vigorous agitation to remove bacteria attached to the surface. But the folds and folded areas of vegetable leaves are not thoroughly sanitized in this process. We prepared rechargeable antibacterial hydrogel beads by emulsion polymerization of acrylamide, 3-allyl-5,5-dimethylhydantion (ADMH), and natural polysaccharide alginate. The resulting hydrogel beads exert excellent mechanical strength, rechargeable chlorination capability, and high contact-killing bactericidal efficiency with the rate of 99.99%, which enable the hydrogel beads efficiently to sanitize fresh produce. The bactericidal hydrogel beads would be the promising material for various produce cleaning application.

Immunoprecipitation and Mass Spectrometry to Identify Host Target Proteins of a Downy Mildew Effector in Lettuce

Chi Zhang

Sponsor: Richard Michelmore, Ph.D.

Plant Sciences

Downy mildews are oomycete-caused diseases on many ornamental and edible plants, including lettuce. Pathogens release effector proteins into their host plants, manipulating a variety of biological pathways to facilitate nutrient uptake and inhibit host immune responses. RxLR3 is an effector protein from oomycete *Bremia lactucae*. It has been shown to suppress small RNA mediated RNA interference (RNAi), which is an essential component of the plant's immune system. However, the underlying molecular mechanism remains unknown. Here, we narrow down the range of candidate target proteins, which were purified by immunoprecipitation (IP) from protein extracts of lettuce overexpressing RxLR3. Candidate proteins were profiled by mass spectrometry and identified using the lettuce reference genome. IP was optimized by running multiple samples under different conditions whose results were then viewed with western blot. The discovery of the target protein is critical to understand the mechanism of RxLR3-target interaction and may become the foundation of a novel approach to improve downy mildew resistance in lettuce.

Impact of Sample Prep Methods on the Peroxide Values of Almond Oil

Junjia Zhang

Sponsor: Alyson Mitchell, Ph.D.

Food Science & Technology

Peroxide value (PV) is used to determine the extent to which a lipid-rich food has undergone primary oxidation. Currently there is a lack of standardization of sample prep method in commercial labs. Recently, we observed that the PV of oil pressed from whole almond is significantly higher than that from ground almond. Our hypothesis is the outer layer of kernel is more oxidized during storage compared to the inner. Therefore, the oil pressed from whole almond, contains more oil from the outer layer, will exhibit a higher PV compare to that from grounded almond, which have an even mixture of oil from inner and outer layers of the almond. Almonds were roasted under 125°C for 20 minutes, separated into four groups and stored as 55°C for up to 6 weeks to accelerate oxidation. Almonds were dissected into inner and outer layers, with mass ratio of 3:7. Oil was obtained by manual pressing and the PV was measured following the AOAC standard method. The results demonstrate significant differences in PV between the two layers as storage time increases, which are critical for standardizing commercial methods as processors rely on these values to judge almond quality.

Detector Mechanics R&D for the Compact Muon Solenoid Upgrade at CERN

Gayle Zheng

Sponsor: Maxwell Chertok, Ph.D.
Physics

At CERN, particle physics experiments utilize the most powerful collider in the world, the LHC, to search for exotic particles that may accompany the Higgs boson. Improvements to the Compact Muon Solenoid tracker detector are required to prepare for the upcoming High Luminosity run of the LHC. Structural components with high thermal conductivity and tensile strength are under study. Carbon foam has proven ideal, but ways to effectively implement it into mechanical structures warrant further research. We have created and tested a wide variety of carbon foam samples using novel materials such as thermally conductive epoxy and tape, reactive bonding film (RBF), and Kapton films. Thermally conductive epoxy exhibits the strongest tensile bond, but also fluctuates greatly in regard to conductivity. Thermally conductive tape samples are more consistent, but are less conductive and yield weaker bonds. Tensile strength of RBF samples improves substantially when high pressure is applied during bonding, as seen with a new apparatus made for this purpose. We also present studies with a heater circuit and cooling pipe integrated into carbon foam to study heat transfer through the glue-foam interface.

Variation in Cortical Oxytocin Receptor Density in Voles With Differing Amounts of Parental Care

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 and neuronal connections, and differences in 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. We know that oxytocin receptor (OXTR) expression in the prairie vole cortex--the part of the brain responsible for complex social behaviors--is highest in regions that are involved in multisensory integration. In this project, we use autoradiography to quantify and compare OXTR expression in the cortex of prairie voles that received different amounts of parental care. The results of this study will give us insight into how early experience can influence brain organization.

Interaction Between α -lactalbumin and Human Milk Enzyme Cathepsin D at Different pH

Jingyuan Zheng

Sponsor: J German, Ph.D.
Food Science & Technology

Understanding human milk proteins is important for improving newborn infant's health because human milk is their main food source. Alpha-lactalbumin, a dominant protein in human milk, can be enzymatically degraded into small peptides that are beneficial to human. However, alpha-lactalbumin is thought to be not degradable in a newborn infant's stomach, where the pH is at 4 – 5, at which the only gastric enzyme, pepsin, is inactive. In contrast, our research group recently found peptides released from alpha-lactalbumin at pH 4, which suggested an alternative conclusion. This study focuses on whether cathepsin D, a maternal enzyme found in human milk and active at pH 4, is responsible for the hydrolysis of alpha-lactalbumin and how the peptide concentration would vary when they are incubated at various pH levels. So far, the reaction product has been quantitatively analyzed, and peptide concentration is high at pH 2, 3, 6 and 7. In contrast, at pH 4, where most peptide production is expected, the peptide concentration is low. These results could be used to provide additional information to the reaction behavior and products of alpha-lactalbumin in human milk and infant gut.

Directional Relationship Between Depression and Exercise Self-Efficacy

Di Zhou

Sponsor: Siwei Liu, Ph.D.
Human Ecology

Researchers have shown that regular exercise can improve mental health conditions such as depression and stress. Others demonstrate that people's confidence in their own ability to stick to exercise routine significantly positively correlates with their persistence in exercising regularly. Few, however, investigate whether the confidence in one's own ability to achieve exercise goals directly relieves depression and stress. The present study examines the directional relationship between depression and exercise self-efficacy. One hundred and ninety-four adults were recruited and each was given a Fitbit at the baseline to monitor their own daily physical activities. Depression and exercise self-efficacy were measured through questionnaires at three occasions (baseline, 100 days after baseline, six months after baseline). A repeated measures ANOVA was conducted to assess the overall trend of depression and exercise self-efficacy across time. A cross-lagged regression model was tested to examine the directional relationship between the two. The preliminary results showed that depression at the prior occasion could predict exercise self-efficacy at the later occasion. More implications of the result will be discussed at the conference.

How the Deferred Action for Childhood Arrivals (DACA) Program Affects Immigrants' Mental Health

Cenxiao Zhu

Sponsor: Caitlin Patler, Ph.D.

Sociology

Until 2012, there were approximately 11.4 million undocumented immigrants living in the United States. They are mainly from Mexico, Guatemala, El Salvador, Honduras and China. More than half of them resided in California, Texas, New York and Florida (Migration Policy Institute). As a response to the large population of undocumented immigrants, on June 15, 2012, the Secretary of Homeland Security announced Deferred Action for Childhood Arrivals, also called DACA. This provides certain people who came to the United States before age 16 and met several guidelines to apply for deferred action for a period of two years (US Citizenship and Immigration Services). Although DACA does not provide lawful status as American citizens, it provides accessibility to apply for social identifications and work authorization, which includes driving licenses and social security numbers. Based on these information, my research question is whether DACA has positive influence on undocumented immigrants' psychological wellbeing, and in which ways immigrants are impacted by DACA status. I hypothesize that DACA status positively improves immigrants' mental health by decreasing stress level, depression level, anxiety level or other negative emotions.

Novel Diterpenes in Maize Repress Growth in Major Fungal Pathogens

Yong Zhu

Sponsor: Philipp Zerbe, Ph.D.

Plant Biology

The global population is predicted to reach 10 billion by 2050. Thus, improving crop yield to feed a hungry world is more critical than ever. Zea mays (maize) is an essential food and biofuel crop for much of the world's population, but the fungus *Fusarium* causes significant crop loss in maize each year. Preventing these losses would increase global food security. Diterpenes are a large group of anti-stress metabolites found in all plants. Our lab recently showed maize to produce a previously unrecognized group of defensive diterpenes called dolabraloxins in response to *Fusarium* pathogens. The dolabraloxins of interest include a hydrocarbon called dolabradiene, along with two similar compounds with different oxygen functional groups. One of these metabolites has also been shown to inhibit growth of several *Fusarium* species in vitro. To assay their antifungal efficacy, we first transform and grow *Escherichia coli* to produce sufficient quantities of dolabraloxins. We then perform fungal assays in hopes of learning which *Fusarium* species are susceptible to dolabraloxins and the importance of the oxygen functional groups. This research continues the progression towards global food security by providing an understanding of the structural-functional relationship of plant-derived antifungal molecules and different fungal species.

