UCDAVIS

24th Annual Undergraduate Research, Scholarship & Creative Activities Conference

Poster Presentations

Friday, April 26, 2013
3 – 6 p.m.
Freeborn Hall

Arts Exhibit

Friday, April 26, 2013
6 – 7 p.m.
Memorial Union, MU II

Oral Presentations

Saturday, April 27, 2013
1 – 6 p.m.
Wellman Hall

Sponsored by: Office of the Provost & Office of the Vice Chancellor, Student Affairs

24th Annual Undergraduate Research, Scholarship & Creative Activities Conference

WELCOME 2013

Welcome to the 24th Annual UC Davis Undergraduate Research, Scholarship & Creative Activities Conference, co-sponsored by the Office of the Vice Provost—Undergraduate Education and the Office of the Vice Chancellor for Student Affairs. This year we are proud to showcase the research endeavors of 532 undergraduate students from all academic fields.

The conference is designed to acquaint undergraduates with the process and rigors of presenting research in a scholarly manner in an academic setting. This opportunity allows for stimulating interaction between students and an audience of faculty, administrators, peers and family. An added goal is to encourage undergraduates to pursue advanced degrees that will lead to opportunities in research and teaching.

At UC Davis, many students have been participating in research that is part of a larger grant where faculty sponsors have given them substantial levels of responsibility to carry out specific components, either individually or collaboratively. Other students have initiated their own projects and have been conducting their research independently under faculty guidance. While many students are reporting on completed projects, some are presenting the latest data on research still in progress.

Students present their work at the conference orally, in poster format, or as part of an arts exhibit. In the oral sessions, students are divided into groups; each student gives a 15-minute presentation that includes a question-and-answer period. A faculty member, who may also serve as a faculty sponsor for one or more of the student-presenters, moderates the session. In the poster sessions, students present a visual representation of their research and discuss the content with circulating conference attendees. The arts exhibit highlights creative activity and affords an opportunity to interact with the student scholars who will discuss their creative work with those attending this session.

Each student presenter is recognized for his/her contribution to University research by being awarded a certificate as an Undergraduate Research Scholar. We congratulate these students for their accomplishments and hope that this experience helps to launch productive and satisfying academic and professional careers.

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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. Among these are the following: Biology Undergraduate Scholars Program (BUSP); California Alliance for Minority Participation in Science, Engineering, and Mathematics (CAMP); Center for Biophotonics Science & Technology (CBST); Davis Honor's Challenge; Integrated Studies Honors Program; Internship and Career Center; McNair Scholars Program; 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; Undergraduate Research Center; UC Davis Washington Program; and UC Leadership Excellence Through Advanced Degrees (UC LEADS).

Sponsors

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Special Thanks

Dean Witter Fund

Valeria La Saponara, Mechanical & Aerospace Engineering, National Science Foundation grant

AGENDA

Poster Sessions: Friday, April 26, 2013

3:00–6:00 p.m., Freeborn Hall

3:00–4:00 p.m. ..... Poster Session A
Freeborn Hall

4:00–5:00 p.m. ..... Poster Session B
Freeborn Hall

5:00–6:00 p.m. ..... Poster Session C
Freeborn Hall

Arts Exhibit: Friday, April 26, 2013

6:00–7:00 p.m., Memorial Union, MU II

6:00–7:00 p.m. ..... Arts Exhibit D
Memorial Union, MU II

Oral Sessions: Saturday, April 27, 2013

1:00–6:00 p.m., Wellman Hall

12:00–1:00 p.m. ..... Presenter Check-in
Wellman Hall Lounge

1:00–2:30 p.m. ..... Oral Session 1
Wellman Hall

3:00–4:30 p.m. ..... Oral Session 2
Wellman Hall

5:00–6:00 p.m. ..... Oral Session 3
Wellman Hall

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PRESENTERS

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Lessler, Faye .....Exhibit D ....Art Exhibit 1 ... 6:00 p.m. .....MU II

LeTran, Duke.....Session A ..... Poster 25 ... 3:00 p.m. .... Freeborn Hall

Leu, Wayne .....Session 2 ..... Oral .. 4:15 p.m. ... 216 Wellman

Lewis, Katherine .....Session B ..... Poster 71 ... 4:00 p.m. .... Freeborn Hall

Li, Amy .....Session B ..... Poster 118 ... 4:00 p.m. .... Freeborn Hall

Li, Kevin .....Session B ..... Poster 50 ... 4:00 p.m. .... Freeborn Hall

Li, Yiran ..... Session 1 ..... Oral .. 1:15 p.m. ... 115 Wellman

Liang, Edmond ..... Session 2 ..... Oral .. 3:45 p.m. ... 119 Wellman

Lim, Rebecca..... Session B ..... Poster 32 ... 4:00 p.m. .... Freeborn Hall

Lim, Sunghun..... Session 3 ..... Oral .. 5:15 p.m. ... 229 Wellman

Lin, Sharon ..... Session B ..... Poster 98 ... 4:00 p.m. .... Freeborn Hall

Lin, Kristi ..... Exhibit D ....Art Exhibit 9 ... 6:00 p.m. .....MU II

Liong, Shannon ..... Session B ..... Poster 106 ... 4:00 p.m. .... Freeborn Hall

Loh, Gregory ..... Session 3 ..... Oral .. 5:15 p.m. ... 226 Wellman

Lopez, Sydney ..... Session 1 ..... Oral .. 1:30 p.m. ... 126 Wellman

Lotti, Samantha..... Session B ..... Poster 21 ... 4:00 p.m. .... Freeborn Hall

Lucas, Rebecca ..... Session 2 ..... Oral .. 3:30 p.m. ..... 6 Wellman

Lurie, Eugene ..... Session B ..... Poster 22 ... 4:00 p.m. .... Freeborn Hall

Ly, Henry..... Session C ..... Poster 79 ... 5:00 p.m. .... Freeborn Hall

Ly, Irene ..... Session 2 ..... Oral .. 3:15 p.m. ... 106 Wellman

Macabales, Sarah ..... Session B ..... Poster 51 ... 4:00 p.m. .... Freeborn Hall

MacIver, Lily ..... Session 3 ..... Oral .. 5:30 p.m. ... 229 Wellman

Mahmood, Saman ..... Session C ..... Poster 18 ... 5:00 p.m. .... Freeborn Hall

Makker, Maya..... Session 3 ..... Oral .. 5:30 p.m. ... 226 Wellman

Malins, Kevin ..... Session B ..... Poster 52 ... 4:00 p.m. .... Freeborn Hall

Mandell, Samantha..... Session 1 ..... Oral .. 1:45 p.m. ... 216 Wellman

Mann, Phillip..... Session B ..... Poster 40 ... 4:00 p.m. .... Freeborn Hall

Maring, Gregory ..... Session A ..... Poster 26 ... 3:00 p.m. .... Freeborn Hall

Marquino, Louise ..... Session 1 ..... Oral .. 2:00 p.m. ..... 26 Wellman

Martin, Stephanie ..... Session 1 ..... Oral .. 2:15 p.m. ... 202 Wellman

Martinez, Ixchel ..... Session B ..... Poster 33 ... 4:00 p.m. .... Freeborn Hall

Martinez, Marty ..... Session C ..... Poster 91 ... 5:00 p.m. .... Freeborn Hall

Masarweh, Chad ..... Session 1 ..... Oral .. 1:30 p.m. ... 234 Wellman

Mateos, Susana..... Session C ..... Poster 49 ... 5:00 p.m. .... Freeborn Hall

Matsuyama, Yuka..... Session 3 ..... Oral .. 5:00 p.m. ... 126 Wellman

McAlister, Michelle ..... Session 1 ..... Oral .. 2:00 p.m. ... 106 Wellman

McCarthy, Collin..... Session 3 ..... Oral .. 5:15 p.m. ... 119 Wellman

McGarry, Brian ..... Session B ..... Poster 68 ... 4:00 p.m. .... Freeborn Hall

McGehee, James ..... Session 2 ..... Oral .. 3:15 p.m. ... 126 Wellman

McKenzie, Jennifer..... Session A ..... Poster 57 ... 3:00 p.m. .... Freeborn Hall

McKinnon, Lucas..... Session 1 ..... Oral .. 1:45 p.m. ... 234 Wellman

McUmber, Harrison ..... Session C ..... Poster 50 ... 5:00 p.m. .... Freeborn Hall

Mehta, Pooja ..... Session B ..... Poster 53 ... 4:00 p.m. .... Freeborn Hall

Mejorado, Rolando..... Session B ..... Poster 41 ... 4:00 p.m. .... Freeborn Hall

Melnik, Mikhail ..... Session A ..... Poster 48 ... 3:00 p.m. .... Freeborn Hall

Menchaca, Herlinda ..... Session 2 ..... Oral .. 4:00 p.m. ... 119 Wellman

Mendoza, Ryan ..... Session B ..... Poster 107 ... 4:00 p.m. .... Freeborn Hall

Mendoza, Daniel ..... Exhibit D ....Art Exhibit 3 ... 6:00 p.m. .....MU II

Merrill, Gregory ..... Session B ..... Poster 73 ... 4:00 p.m. .... Freeborn Hall

Mikell, Carlos ..... Session B ..... Poster 88 ... 4:00 p.m. .... Freeborn Hall

Mikhailova, Alexandra ..... Session C ..... Poster 51 ... 5:00 p.m. .... Freeborn Hall

Miller, Lillian ..... Session A ..... Poster 10 ... 3:00 p.m. .... Freeborn Hall

Mittal, Vaishali ..... Session 2 ..... Oral .. 4:00 p.m. ... 216 Wellman

Mohanakrishnan, Raagav... Session B ..... Poster 45 ... 4:00 p.m. .... Freeborn Hall

Montes, Carlos ..... Session 3 ..... Oral .. 5:15 p.m. ... 126 Wellman

Moore, Rebecca..... Session 2 ..... Oral .. 4:00 p.m. ... 233 Wellman

Moya, Jackelyn ..... Session A ..... Poster 97 ... 3:00 p.m. .... Freeborn Hall

Mu, Andrew ..... Session 2 ..... Oral .. 4:15 p.m. ... 119 Wellman

Munjal, Gitanshu ..... Session B ..... Poster 17 ... 4:00 p.m. .... Freeborn Hall

Munoz, Manuel ..... Session B ..... Poster 69 ... 4:00 p.m. .... Freeborn Hall

Munoz Gomez, Mayra..... Session C ..... Poster 21 ... 5:00 p.m. .... Freeborn Hall

Munoz-Teng, Felix..... Session B ..... Poster 42 ... 4:00 p.m. .... Freeborn Hall

Murray, Christina ..... Session B ..... Poster 65 ... 4:00 p.m. .... Freeborn Hall

Myers, Zachary..... Session A ..... Poster 83 ... 3:00 p.m. .... Freeborn Hall

Naik, Rachel ..... Session C ..... Poster 96 ... 5:00 p.m. .... Freeborn Hall

Naranjo, Anna ..... Session C ..... Poster 103 ... 5:00 p.m. .... Freeborn Hall

Naszeerah, Wan Nurul..... Session B ..... Poster 54 ... 4:00 p.m. .... Freeborn Hall

Navea, Frances..... Session 1 ..... Oral .. 1:45 p.m. ... 115 Wellman

Neckelmann, Alexander ..... Session C ..... Poster 104 ... 5:00 p.m. .... Freeborn Hall

Ng, Adrienne ..... Session A ..... Poster 11 ... 3:00 p.m. .... Freeborn Hall

Ngai, Angela ..... Session B ..... Poster 34 ... 4:00 p.m. .... Freeborn Hall
Nguyen, An ..... Session B ..... Poster 89 ... 4:00 p.m. .... Freeborn Hall
Nguyen, Karin ..... Session B ..... Poster 77 ... 4:00 p.m. .... Freeborn Hall
Nguyen, Longphi ..... Session B ..... Poster 61 ... 4:00 p.m. .... Freeborn Hall
Nguyen, Ngoc-Bich ..... Session B ..... Poster 9 ... 4:00 p.m. .... Freeborn Hall
Nguyen, An ..... Session C ..... Poster 66 ... 5:00 p.m. .... Freeborn Hall
Nguyen, Dieu ..... Session C ..... Poster 10 ... 5:00 p.m. .... Freeborn Hall
Nguyen, Kristy ..... Session C ..... Poster 14 ... 5:00 p.m. .... Freeborn Hall
Nguyen, Thong ..... Session C ..... Poster 5 ... 5:00 p.m. .... Freeborn Hall
Nguyen, Jennifer Trang ..... Session 1 ..... Oral .. 2:15 p.m. ... 106 Wellman
Nguyen-Huu, Phuong An .... Session 2 ..... Oral .. 4:15 p.m. ... 226 Wellman
Nisan, Danielle ..... Session 1 ..... Oral .. 1:30 p.m. ... 119 Wellman
Novakov-Ritchey, Christina .. Session 2 ..... Oral .. 4:15 p.m. ... 234 Wellman
Nunez, Chase ..... Session 2 ..... Oral .. 3:45 p.m. ..... 6 Wellman
Oberg, Erica ..... Session B ..... Poster 99 ... 4:00 p.m. .... Freeborn Hall
Ochoa, Obdulio ..... Session A ..... Poster 93 ... 3:00 p.m. .... Freeborn Hall
Olson, Cassandra ..... Session 1 ..... Oral .. 1:15 p.m. ... 212 Wellman
Ordaz, Rafael ..... Session B ..... Poster 46 ... 4:00 p.m. .... Freeborn Hall
Orozco, Crystal ..... Session B ..... Poster 55 ... 4:00 p.m. .... Freeborn Hall
Ortega, Francisco ..... Session 2 ..... Oral .. 3:00 p.m. ... 233 Wellman
Ota, Marissa ..... Session C ..... Poster 105 ... 5:00 p.m. .... Freeborn Hall
Ou, Tingwei ..... Session 3 ..... Oral .. 5:45 p.m. ... 202 Wellman
Padakanti, Sowmya ..... Session B ..... Poster 2 ... 4:00 p.m. .... Freeborn Hall
Padilla, Julia-Rose ..... Session 1 ..... Oral .. 2:00 p.m. ... 216 Wellman
Pak, Chongin ..... Session C ..... Poster 67 ... 5:00 p.m. .... Freeborn Hall
Parekh, Mira ..... Session B ..... Poster 56 ... 4:00 p.m. .... Freeborn Hall
Pasner, Jacob ..... Session 1 ..... Oral .. 2:00 p.m. ... 233 Wellman
Pasquiers, Mar-y-sol ..... Session 2 ..... Oral .. 3:30 p.m. ... 226 Wellman
Patel, Vedang ..... Session B ..... Poster 111 ... 4:00 p.m. .... Freeborn Hall
Patel, Raina ..... Session 3 ..... Oral .. 5:15 p.m. ... 202 Wellman
Patton, Christopher ..... Session B ..... Poster 47 ... 4:00 p.m. .... Freeborn Hall
Pereira, Aaron ..... Session 3 ..... Oral .. 5:30 p.m. ... 126 Wellman
Perez, Luis ..... Session C ..... Poster 15 ... 5:00 p.m. .... Freeborn Hall
Petchprom, Mick ..... Session C ..... Poster 58 ... 5:00 p.m. .... Freeborn Hall
Pham Lam, Ngoc ..... Session C ..... Poster 11 ... 5:00 p.m. .... Freeborn Hall
Pham, Tuong ..... Session C ..... Poster 6 ... 5:00 p.m. .... Freeborn Hall
Phan, Amy ..... Session B ..... Poster 30 ... 4:00 p.m. .... Freeborn Hall
Phan, Athena ..... Session 3 ..... Oral .. 5:15 p.m. ... 106 Wellman
Pierce, James ..... Session 1 ..... Oral .. 2:15 p.m. ... 229 Wellman
Pirondini, Ken ..... Session C ..... Poster 87 ... 5:00 p.m. .... Freeborn Hall
Pittman, Scott ..... Session 3 ..... Oral .. 5:45 p.m. ... 226 Wellman
Poulsen, Amanda ..... Session B ..... Poster 94 ... 4:00 p.m. .... Freeborn Hall
Powell, Meredith ..... Session C ..... Poster 59 ... 5:00 p.m. .... Freeborn Hall
Prado, Kimberly ..... Session B ..... Poster 23 ... 4:00 p.m. .... Freeborn Hall
Preciado, Gladys ..... Session C ..... Poster 62 ... 5:00 p.m. .... Freeborn Hall
Preto, Cindy ..... Session 2 ..... Oral .. 3:00 p.m. ... 202 Wellman
Procida, Kimberly ..... Session A ..... Poster 38 ... 3:00 p.m. .... Freeborn Hall
Puhger, Kyle ..... Session B ..... Poster 3 ... 4:00 p.m. .... Freeborn Hall
Qian, Chenghao ..... Session 1 ..... Oral .. 1:45 p.m. ... 126 Wellman
Quach, Christina ..... Session B ..... Poster 112 ... 4:00 p.m. .... Freeborn Hall
Quintanilla, Mariah ..... Exhibit D .... Art Exhibit 4 ... 6:00 p.m. ..... MU II
Rainbolt, Chadwick ..... Session C ..... Poster 60 ... 5:00 p.m. .... Freeborn Hall
Rajagopalan, Krishnan ..... Session 3 ..... Oral .. 5:00 p.m. ... 212 Wellman
Ramanujam, Akshaya ..... Session B ..... Poster 100 ... 4:00 p.m. .... Freeborn Hall
Ramesh, Ashwin ..... Session A ..... Poster 90 ... 3:00 p.m. .... Freeborn Hall
Ramireddy, Swetha ..... Session A ..... Poster 12 ... 3:00 p.m. .... Freeborn Hall
Ramirez-Corona, Bryan ..... Session 1 ..... Oral .. 2:00 p.m. ... 230 Wellman
Ramos, Nasario ..... Session C ..... Poster 22 ... 5:00 p.m. .... Freeborn Hall
Rashid, Amani ..... Session 3 ..... Oral .. 5:45 p.m. ... 229 Wellman
Raza, Ahmad ..... Session 1 ..... Oral .. 2:00 p.m. ... 226 Wellman
Resseguie, Elodie ..... Session C ..... Poster 82 ... 5:00 p.m. .... Freeborn Hall
Richardson, Ella ..... Session 2 ..... Oral .. 4:15 p.m. ... 126 Wellman
Rios, Irene ..... Session C ..... Poster 68 ... 5:00 p.m. .... Freeborn Hall
Rizvi, Laila ..... Session C ..... Poster 63 ... 5:00 p.m. .... Freeborn Hall

Roberts, Brandon ..... Session 2 ..... Oral .. 3:15 p.m. ... 233 Wellman
Rodd, Rebecca ..... Session C ..... Poster 70 ... 5:00 p.m. .... Freeborn Hall
Rodgers, Andrea ..... Session B ..... Poster 31 ... 4:00 p.m. .... Freeborn Hall
Rodríguez, Tomás ..... Session B ..... Poster 24 ... 4:00 p.m. .... Freeborn Hall
Rodriguez-Torres, Axana ..... Session C ..... Poster 7 ... 5:00 p.m. .... Freeborn Hall
Ronne, Eric ..... Session B ..... Poster 57 ... 4:00 p.m. .... Freeborn Hall
Rose, Samuel ..... Session C ..... Poster 64 ... 5:00 p.m. .... Freeborn Hall
Rushakoff, Joshua ..... Session 2 ..... Oral .. 3:30 p.m. ... 115 Wellman
Russom, Nebay ..... Session B ..... Poster 25 ... 4:00 p.m. .... Freeborn Hall
Ryser-Oatman, Jonathan ..... Session A ..... Poster 39 ... 3:00 p.m. .... Freeborn Hall
Saenz, Marissa ..... Session 2 ..... Oral .. 3:45 p.m. ... 115 Wellman
Sagun, John ..... Session C ..... Poster 88 ... 5:00 p.m. .... Freeborn Hall
Sahagun Parez, Elizabeth .. Session B ..... Poster 48 ... 4:00 p.m. .... Freeborn Hall
Salazar, Raul ..... Session 1 ..... Oral .. 1:15 p.m. ... 119 Wellman
Salazar, Christopher ..... Session 2 ..... Oral .. 3:45 p.m. ... 229 Wellman
Salgaonkar, Sachin ..... Session C ..... Poster 65 ... 5:00 p.m. .... Freeborn Hall
Samborsky, Susan ..... Session B ..... Poster 101 ... 4:00 p.m. .... Freeborn Hall
Sanchez, André ..... Session B ..... Poster 78 ... 4:00 p.m. .... Freeborn Hall
Sanchez, Monique ..... Session C ..... Poster 92 ... 5:00 p.m. .... Freeborn Hall
Sandher, Sukhjot ..... Session C ..... Poster 45 ... 5:00 p.m. .... Freeborn Hall
Sandhu, Surinder ..... Session B ..... Poster 35 ... 4:00 p.m. .... Freeborn Hall
Sandhu, Angad ..... Session C ..... Poster 89 ... 5:00 p.m. .... Freeborn Hall
Santos, Erica ..... Session C ..... Poster 97 ... 5:00 p.m. .... Freeborn Hall
Sarabia, Francisco ..... Session 2 ..... Oral .. 3:15 p.m. ... 119 Wellman
Sareshwala, Farhan ..... Session B ..... Poster 36 ... 4:00 p.m. .... Freeborn Hall
Sarsam, Reta ..... Session 3 ..... Oral .. 5:30 p.m. ... 202 Wellman
Sarvian, Yassaman ..... Session 2 ..... Oral .. 3:15 p.m. ... 226 Wellman
Saunders, Jessie ..... Session 3 ..... Oral .. 5:45 p.m. ... 106 Wellman
Scanlan, Tawny ..... Session C ..... Poster 53 ... 5:00 p.m. .... Freeborn Hall
Scearce-Miles, Deborah ..... Session B ..... Poster 37 ... 4:00 p.m. .... Freeborn Hall
Schutt, Andrew ..... Exhibit D .... Art Exhibit 5 ... 6:00 p.m. ..... MU II
Sears, Nicole ..... Session 3 ..... Oral .. 5:30 p.m. ... 216 Wellman
Sebhatu, Rahwa ..... Session C ..... Poster 69 ... 5:00 p.m. .... Freeborn Hall
Seither, Marquel ..... Session 2 ..... Oral .. 4:00 p.m. ... 115 Wellman
Seubert, Emily ..... Session C ..... Poster 93 ... 5:00 p.m. .... Freeborn Hall
Shafique, Haroon ..... Session C ..... Poster 46 ... 5:00 p.m. .... Freeborn Hall
Shalinsky, Claire ..... Session 1 ..... Oral .. 2:15 p.m. ... 216 Wellman
Sharp, Alexzander ..... Session B ..... Poster 95 ... 4:00 p.m. .... Freeborn Hall
Shelley, Alexandra ..... Session B ..... Poster 38 ... 4:00 p.m. .... Freeborn Hall
Sheth, Preya ..... Session B ..... Poster 43 ... 4:00 p.m. .... Freeborn Hall
Shevchyk, Ivan ..... Session C ..... Poster 8 ... 5:00 p.m. .... Freeborn Hall
Shu, Jingyang ..... Session 3 ..... Oral .. 5:30 p.m. ... 230 Wellman
Simionas, David ..... Session C ..... Poster 52 ... 5:00 p.m. .... Freeborn Hall
Singh, Vikram ..... Session B ..... Poster 44 ... 4:00 p.m. .... Freeborn Hall
Siu, Anthony ..... Session C ..... Poster 80 ... 5:00 p.m. .... Freeborn Hall
Siu, Rachel ..... Session C ..... Poster 16 ... 5:00 p.m. .... Freeborn Hall
Skipp, Daniel ..... Session C ..... Poster 40 ... 5:00 p.m. .... Freeborn Hall
Smith, Thale ..... Session 3 ..... Oral .. 5:15 p.m. ... 212 Wellman
Sohal, Mandeep ..... Session 1 ..... Oral .. 1:15 p.m. ..... 26 Wellman
Solis, Ryan ..... Session 2 ..... Oral .. 3:30 p.m. ... 126 Wellman
Son, Grace ..... Session 2 ..... Oral .. 4:00 p.m. ..... 6 Wellman
Song, Xiao ..... Session B ..... Poster 4 ... 4:00 p.m. .... Freeborn Hall
Sonti, Anup ..... Session C ..... Poster 47 ... 5:00 p.m. .... Freeborn Hall
Sotelo, Cindy ..... Session C ..... Poster 94 ... 5:00 p.m. .... Freeborn Hall
Sowa, Nicholas ..... Session C ..... Poster 41 ... 5:00 p.m. .... Freeborn Hall
Sowell, Maxwell ..... Session 1 ..... Oral .. 2:15 p.m. ... 212 Wellman
Spawton, Kayla ..... Session 1 ..... Oral .. 1:45 p.m. ... 119 Wellman
Spilman, Leonna ..... Session 1 ..... Oral .. 1:15 p.m. ... 216 Wellman
Stange, Matthew ..... Session C ..... Poster 29 ... 5:00 p.m. .... Freeborn Hall
Stauffer, Weston ..... Session C ..... Poster 95 ... 5:00 p.m. .... Freeborn Hall
Steele, Amanda ..... Session 3 ..... Oral .. 5:30 p.m. ... 115 Wellman
Stewart, Shauna ..... Session 2 ..... Oral .. 3:15 p.m. ... 234 Wellman
Sticlaru, Michael ..... Session A ..... Poster 82 ... 3:00 p.m. .... Freeborn Hall
Stone, Annemarie ..... Session 1 ..... Oral .. 1:00 p.m. ... 216 Wellman

Stripe, Miranda ..... Session C ..... Poster 71 ... 5:00 p.m. .... Freeborn Hall
Su, Chun ..... Session B ..... Poster 39 ... 4:00 p.m. .... Freeborn Hall
Su, Linda ..... Session B ..... Poster 96 ... 4:00 p.m. .... Freeborn Hall
Sultani, Hawa ..... Session C ..... Poster 30 ... 5:00 p.m. .... Freeborn Hall
Sun, Xiaolan ..... Session C ..... Poster 61 ... 5:00 p.m. .... Freeborn Hall
Symons, Ashley ..... Session C ..... Poster 1 ... 5:00 p.m. .... Freeborn Hall
Tatapudy, Sumitra ..... Session B ..... Poster 26 ... 4:00 p.m. .... Freeborn Hall
Tatiossian, Kristina ..... Exhibit D .... Art Exhibit 8 ... 6:00 p.m. ..... MU II
Tavárez Varela, L. Carolina . Session 1 ..... Oral .. 2:15 p.m. ... 226 Wellman
Taylor, Austin ..... Session 1 ..... Oral .. 2:15 p.m. ... 234 Wellman
Taylor, Alexandra ..... Session 2 ..... Oral .. 3:45 p.m. ... 212 Wellman
Taylor, Kevin ..... Session 3 ..... Oral .. 5:45 p.m. ... 212 Wellman
Teaford, Hilary ..... Session 2 ..... Oral .. 4:15 p.m. ..... 6 Wellman
Teague, Meghan ..... Session C ..... Poster 98 ... 5:00 p.m. .... Freeborn Hall
Teixeira, Lisa ..... Session C ..... Poster 54 ... 5:00 p.m. .... Freeborn Hall
ter Haar, Julia ..... Session C ..... Poster 2 ... 5:00 p.m. .... Freeborn Hall
Thompson, Abbie ..... Session C ..... Poster 3 ... 5:00 p.m. .... Freeborn Hall
Thompson, Megan ..... Session 1 ..... Oral .. 2:15 p.m. ... 115 Wellman
Thorngren, Daniel ..... Session 1 ..... Oral .. 2:15 p.m. ... 233 Wellman
Tirado, Denise ..... Exhibit D .... Art Exhibit 6 ... 6:00 p.m. ..... MU II
Toure, Aicha ..... Session C ..... Poster 23 ... 5:00 p.m. .... Freeborn Hall
Toussi, Atrin ..... Session 1 ..... Oral .. 2:00 p.m. ... 126 Wellman
Tran, John ..... Session A ..... Poster 13 ... 3:00 p.m. .... Freeborn Hall
Tran, Duy ..... Session C ..... Poster 12 ... 5:00 p.m. .... Freeborn Hall
Tran, Jacqueline ..... Session 3 ..... Oral .. 5:30 p.m. ... 119 Wellman
Trejo, Daniel ..... Session 2 ..... Oral .. 3:15 p.m. ... 230 Wellman
Trice, Hunter ..... Session C ..... Poster 36 ... 5:00 p.m. .... Freeborn Hall
Truong, Anh-Thu ..... Session C ..... Poster 9 ... 5:00 p.m. .... Freeborn Hall
Truong, Richard ..... Session C ..... Poster 13 ... 5:00 p.m. .... Freeborn Hall
Truong, Sarah ..... Session C ..... Poster 31 ... 5:00 p.m. .... Freeborn Hall
Truong, Lance ..... Session 2 ..... Oral .. 3:15 p.m. ... 202 Wellman
Truxton, Alexandra ..... Session 2 ..... Oral .. 3:45 p.m. ... 226 Wellman
Tsang, Fiona ..... Session C ..... Poster 37 ... 5:00 p.m. .... Freeborn Hall
Tsao, Raymond ..... Session C ..... Poster 24 ... 5:00 p.m. .... Freeborn Hall
Turkiewicz, Joanna ..... Session 1 ..... Oral .. 2:15 p.m. ..... 26 Wellman
Tyson, Terence ..... Session C ..... Poster 4 ... 5:00 p.m. .... Freeborn Hall
Urtecho, Guillaume ..... Session C ..... Poster 25 ... 5:00 p.m. .... Freeborn Hall
Van, Mike ..... Session B ..... Poster 90 ... 4:00 p.m. .... Freeborn Hall
Van Donk, Saskia ..... Session 1 ..... Oral .. 1:30 p.m. ... 212 Wellman
Villanueva, Kristin ..... Session C ..... Poster 101 ... 5:00 p.m. .... Freeborn Hall
Villasenor, Hector ..... Session 1 ..... Oral .. 1:15 p.m. ... 202 Wellman
Viswanath, Varsha ..... Session C ..... Poster 90 ... 5:00 p.m. .... Freeborn Hall
Vo, Alexandre ..... Session C ..... Poster 55 ... 5:00 p.m. .... Freeborn Hall
Wade, Jordon ..... Session 1 ..... Oral .. 2:15 p.m. ... 230 Wellman
Walker, Hannah ..... Session C ..... Poster 32 ... 5:00 p.m. .... Freeborn Hall
Walker, Lauren ..... Session C ..... Poster 74 ... 5:00 p.m. .... Freeborn Hall
Wall, Tiffany ..... Session C ..... Poster 38 ... 5:00 p.m. .... Freeborn Hall
Wang, Theodore ..... Session C ..... Poster 99 ... 5:00 p.m. .... Freeborn Hall
Warmack, Rebeccah ..... Session 1 ..... Oral .. 2:00 p.m. ... 234 Wellman
Warren, Matthew ..... Session 2 ..... Oral .. 4:15 p.m. ... 212 Wellman
Wasielewski, Julia ..... Session C ..... Poster 42 ... 5:00 p.m. .... Freeborn Hall
Webb, Julia ..... Session 1 ..... Oral .. 1:30 p.m. ... 216 Wellman
Wei, Sharon ..... Session C ..... Poster 43 ... 5:00 p.m. .... Freeborn Hall
Weiss, Grant ..... Session C ..... Poster 39 ... 5:00 p.m. .... Freeborn Hall
Weninger, Jan ..... Session C ..... Poster 72 ... 5:00 p.m. .... Freeborn Hall
West, Marie ..... Session B ..... Poster 86 ... 4:00 p.m. .... Freeborn Hall
Westrick, Nathaniel ..... Session C ..... Poster 44 ... 5:00 p.m. .... Freeborn Hall
Whitestone, Karen ..... Session 1 ..... Oral .. 2:00 p.m. ... 119 Wellman
Whitney, James ..... Session C ..... Poster 75 ... 5:00 p.m. .... Freeborn Hall
Wilkerson, Ryan ..... Session 3 ..... Oral .. 5:45 p.m. ... 119 Wellman
Williams, Breanna ..... Session C ..... Poster 33 ... 5:00 p.m. .... Freeborn Hall
Williams, Samuel ..... Session 3 ..... Oral .. 5:45 p.m. ... 230 Wellman
Wilson, Christine ..... Session C ..... Poster 34 ... 5:00 p.m. .... Freeborn Hall
Windham-Herman, Marley . Session C ..... Poster 84 ... 5:00 p.m. .... Freeborn Hall

Winter, Mitchell ..... Session 2 ..... Oral .. 4:15 p.m. ... 233 Wellman

Wittman, Margaret ..... Session C ..... Poster 56 ... 5:00 p.m. .... Freeborn Hall

Wong, Angel ..... Session A ..... Poster 81 ... 3:00 p.m. .... Freeborn Hall

Wong, Rebecca ..... Session C ..... Poster 48 ... 5:00 p.m. .... Freeborn Hall

Wong, Michael ..... Session 1 ..... Oral .. 2:15 p.m. ..... 6 Wellman

Wong, Spencer ..... Session 2 ..... Oral .. 4:15 p.m. ... 106 Wellman

Wood, Katherine ..... Session 1 ..... Oral .. 2:15 p.m. ... 119 Wellman

Wood, Rachael ..... Session 2 ..... Oral .. 3:30 p.m. ... 202 Wellman

Wu, Eureka ..... Session C ..... Poster 26 ... 5:00 p.m. .... Freeborn Hall

Xu, Chenling ..... Session C ..... Poster 57 ... 5:00 p.m. .... Freeborn Hall

Yan, Zhengchi ..... Session A ..... Poster 84 ... 3:00 p.m. .... Freeborn Hall

Yazdi, Anahita ..... Session 3 ..... Oral .. 5:45 p.m. ... 126 Wellman

Yeung, Hoi Ting ..... Session C ..... Poster 102 ... 5:00 p.m. .... Freeborn Hall

Yoshisato, Jenna ..... Session C ..... Poster 76 ... 5:00 p.m. .... Freeborn Hall

Young, Cassandra ..... Session C ..... Poster 77 ... 5:00 p.m. .... Freeborn Hall

Yu, Jay ..... Session B ..... Poster 97 ... 4:00 p.m. .... Freeborn Hall

Zabalza, Christina ..... Session C ..... Poster 73 ... 5:00 p.m. .... Freeborn Hall

Zareie, Andrew ..... Session C ..... Poster 17 ... 5:00 p.m. .... Freeborn Hall

Zavala, Gloria ..... Session C ..... Poster 85 ... 5:00 p.m. .... Freeborn Hall

Zavala, Rosio ..... Session C ..... Poster 86 ... 5:00 p.m. .... Freeborn Hall

Zhao, Cunyi ..... Session C ..... Poster 35 ... 5:00 p.m. .... Freeborn Hall

Zumpano, Danielle ..... Session 2 ..... Oral .. 4:15 p.m. ... 202 Wellman

Zuskov, David ..... Session C ..... Poster 78 ... 5:00 p.m. .... Freeborn Hall

6 Wellman Hall · Moderator: Ann Powell

1:00 William M. Christie – Biological Sciences
Expression of Colorless-Non Ripening (CNR) Provides Insight into Susceptibility of Tomato Fruit to Pathogens

1:15 Jacob Conston – Cell Biology
Analysis of the Role of a Small Bacterial Protein in Triggering Rice Xa21-mediated Immunity

1:30 Robert M. Eshbaugh – Biochemistry & Molecular Biology
Genetic Variation in the Necrotrophic Pathogen, Botrytis Cinerea

1:45 Natalie N. Gath – Genetics
Uncovering Novel Genes Related to Internode Elongation and Heightened Shade Avoidance Response in Solanum Lycopersicum

2:00 Bryan D. Kelleher – Biochemistry & Molecular Biology
Screening and Analysis of New Arabidopsis Mutants to Identify Genes Involved in the Regulation of Ovule Development

2:15 Michael M. Wong – Biotechnology
Quantitative Trait Loci (QTL) Mapping of a High Temperature Germination Locus in Lettuce

26 Wellman Hall · Moderator: Aldrin Gomes

1:00 Asadullah K. Awan – Neurobiology, Physiology & Behavior
Investigating the Presence of Serine Hydrolase Proteases in Rat Liver Tissue

1:15 Mandeep Sohal – Neurobiology, Physiology & Behavior
Effect of Type I Diabetes on the Proteasome in Mouse Skeletal Muscle

1:30 Naficeh Dastgheyb – Neurobiology, Physiology & Behavior
A Comparison of Homogenization Methods for Proteomic Analysis of Human Skin

1:45 Jaskiran K. Khosa – Biochemistry & Molecular Biology
The Role of Alpha Helix Three of Cardiac Myosin Binding Protein C on Actomyosin Interactions

26 Wellman Hall · Moderator: Aldrin Gomes

2:00 Louise A. Marquino – Exercise Biology
The Effect of Estrogen on the Anterior Cruciate Ligament

2:15 Joanna V. Turkiewicz – Neurobiology, Physiology & Behavior
Investigating the Role of MMP13 in Osteoarthritic COMP Degradation

106 Wellman Hall · Moderator: Dag Yasui

1:00 Justin O. Aflatooni – Biochemistry & Molecular Biology
Elucidating the Best Method for Fragmenting Chromatin for MeCP2 ChIP-Sequencing

1:15 Roy Chu – Biotechnology
Analysis of MeCP2 Binding Sites Through Bioinformatics

1:30 Daniel J. Hu – Cell Biology
Rett Syndrome: Developing a Cell System to Measure MeCP2 Isoform Stability

1:45 Peter Deng – Neurobiology, Physiology & Behavior
Gene Therapy for Prader-Willi Syndrome

2:00 Michelle McAlister – Biotechnology
Gene Therapy in Angelman Mice and the Impact on Coordination

2:15 Jennifer Trang T. Nguyen – Chemistry
Using Fluorescence in-situ Hybridization Studies to Detect Specific RNA Levels in Angelman Mice

115 Wellman Hall · Moderator: Angelique Louie

1:00 Jenny T. Giang – Biological Sciences
Imaging Alzheimer's Disease with Multimodal Probes Targeted to Activated Microglia

1:15 Yiran Li – Biomedical Engineering
Imaging Alzheimer's Disease with Multimodal Probes Targeted to Activated Microglia

1:30 Stuart M. Altman – Biomedical Engineering
Characterizing the Role of Calprotectin as Part of the Immune Response

1:45 Frances A. Navea – Biomedical Engineering
Characterizing the Role of Calprotectin as Part of the Immune Response

2:00 Colin K. Deniston – Biological Sciences
Increasing the Kinetic Activity of a Polyethylene Terephthalate Degrading Protein: A Rational Protein Engineering Approach

2:15 Megan Thompson – Biomedical Engineering
Quantitatively Measuring the Accuracy of Tissue Slicing in ex-vivo Breast Tissue Analysis

119 Wellman Hall · Moderator: Artyom Kopp

1:00 Don Q. Hoang – Microbiology
Yeast Species Differ in Their Ability to Survive in the Drosophila melanogaster Gut

1:15 Raul Salazar – Neurobiology, Physiology & Behavior
The Making of a Pest: Novel Ovipositor Morphology Opens a New Ecological Niche in Drosophila

1:30 Danielle Nisan – Animal Biology
Determining Haplotype Diversity of Modern North Pacific Albatross Using Ancient and Historic DNA Cytochrome b and D-Loop Sequences

1:45 Kayla A. Spawton – Evolution, Ecology and Biodiversity
Gall Insect Richness Increases with Size but Not Age of Big Sagebrush (Artemisia tridentata)

2:00 Karen Whitestone – Biological Sciences
Evaluation of the Endangered Konocti Manzanita at Clear Lake State Park

2:15 Katherine E. Wood – Evolution, Ecology and Biodiversity
Unintended Consequences of Plant Competitor Removal Experiments in the Field: Plants Without Neighbors Experience Greater Herbivory

126 Wellman Hall · Moderator: Hwai-Jong Cheng

1:00 Danielle J. George – Animal Biology
Consumption of Milk from Human Lactoferrin Producing Transgenic Cows Effects Relative Numbers of Leukocytes Present in the GI Tract of Young Pigs

1:15 Ellen Hosein – Clinical Nutrition
Protein Tyrosine Phosphatase 1B Deficiency Potentiates PERK/eIF2α Signaling in Brown Adipocytes

1:30 Sydney A. Lopez – Neurobiology, Physiology & Behavior
Identification of Regulators of Zonal Olfactory Receptors

1:45 Chenghao Qian – Neurobiology, Physiology & Behavior
Localization of Cfh Transcript in Retinal Tissue

2:00 Atrin Toussi – Neurobiology, Physiology & Behavior
Regulatory Mechanisms Underlying Stereotyped Axon Pruning in the Mammalian Visual System

202 Wellman Hall · Moderator: Lisa Pruitt

1:00 Mojan N. Azarmi – Psychology
Factors Associated with Approval and Denial of Temporary Restraining Orders Filed in the Yolo County Superior Family Court

1:15 Hector E. Villasenor – Neurobiology, Physiology & Behavior
Factors Associated with the Approval and Denial of Temporary Restraining Orders Sought in the Yolo County Superior Family Court

1:30 Shannon R. Carter – Sociology
To Stop or Not to Stop? An Analysis of Cyclists' Compliance or Noncompliance with Stop Signs

1:45 Tasslyn Gester – Science and Technology Studies
Taking the Temperature: Public vs. Private High School Seniors' Knowledge of Climate Change

2:00 Daniel Kent – International Relations
The President and Peacekeeping: What Does the Public Think?

2:15 Stephanie A. Martin – Environmental Policy Analysis & Planning
Having Your Cake and Eating it Too: Vote Switching in the California State Assembly

212 Wellman Hall · Moderator: Naomi Janowitz

1:00 Jonathan E. Dyer – Religious Studies
God and Godzilla: How an Atomic Metaphor Became a Modern Day Deity

1:15 Cassandra J. Olson – Religious Studies
A New Generation of Leaders: The Ideological Influence of September 11 on Naval Academy Graduates and Their Perception of Leadership and Ethics

1:30 Saskia M. Van Donk – Religious Studies
The Role of Spirituality Versus Religion in Successful Aging

1:45 Lindsey A. Black – History
Faith in Aid: Exploring the Evolution of Religious Humanitarianism in the Twentieth and Twenty-First Centuries

2:00 Kelli L. Garrett – Japanese
The Female Archetype as Portrayed in Japanese and Western Bildungsromane

2:15 Maxwell J. Sowell – Philosophy
Moore's Paradox and a Dichotomous Theory of Belief

216 Wellman Hall · Moderator: Gregory Dobbins

1:00 Annemarie A. Stone – English
"The Writer Should Never Be Ashamed of Staring": A Study of Flannery O'Connor's Form

1:15 Leonna Spilman – English
Comparative Mythology in T.S. Eliot's The Waste Land

1:30 Julia B. Webb – English
Narrative Voice and Madness

1:45 Samantha R. Mandell – English
East vs. West: Cultural and Physical Directionality of the American Westward Movement in "East of Eden"

2:00 Julia-Rose V. Padilla – English
Borders in the Construction of Gender in Díaz's "The Brief Wondrous Life of Oscar Wao" and Cisneros' "Caramelo"

2:15 Claire Shalinsky – English
Place, Possibility, and Progress: Social Mobility in "A Tree Grows in Brooklyn" and "The Great Gatsby"

226 Wellman Hall · Moderator: Raul Aranovich

1:00 Kaitlyn Harper – Linguistics
Just in Case (Marking): An Investigation into the Potential Origins of Ergativity in Case-marking and Syntactic Alignment

1:15 Erin Hollander – Linguistics
Hella Stigmatized: A Linguistic Analysis of the Word and an Exploration into its Divisiveness

1:30 Sana Jafri – International Relations
Education, Democracy, Tolerance and Peace

1:45 Alissa P. Kubochi – History
Reparations Require International Agency and Universal Standards

2:00 Ahmad Raza – Political Science
Global Citizens: Pakistanis in England and America

2:15 L. Carolina Tavárez Varela – Spanish
Kreñòl: A New Language in Hispaniola?

229 Wellman Hall · Moderator: Wilton Agatstein

1:00 Noor Baker – Psychology
The Influence of Rejection and Social Confidence on Interpersonal Sensitivity

1:15 Amanda D. Burnett – English
Fan-Writing and Social Inclusion

1:30 Danielle Burnstein – Spanish
Trial and Error: Creating a Successful Music Industry Business

1:45 Lakisha Gregorio – Communication
This Product is so Scandalous

2:00 Sadalia King – Sociology
Invisibility and Worth

2:15 James T. Pierce – English
A New Eternal Flame: The Preservation of Identity Through Social Media

230 Wellman Hall · Moderator: John Yoder

1:00 Cristina Covblic – Biotechnology
Evidence of Frankia Presence Indicates Nitrogen-fixing Root Nodule Symbiosis with the Endangered Species, Ceanothus ferrisiae, on Serpentine Soil

1:15 Anna Ruth Crittenden – Land, Air and Water Resources
Percent Root Colonization of Arbusular Mycorrhizal Fungi (AMF) on the Roots of Wheat Plants

1:30 Sagar B. Jain – Biotechnology
Differentially Expressed Genes in the Parasitic Plant Genome Project

1:45 Saarah N. Kuzay – Plant Sciences
SNP (Single Nucleotide Polymorphism) Genetic Analysis: A Method for Evaluating Breeding Compatibility in Common Bean

2:00 Bryan A. Ramirez-Corona – Genetics
Genetic Diversity and Population Structure of Root Aphid Daktulosphaira vitifoliae in California

2:15 Jordon Wade – Land, Air and Water Resources
Combining Nitrification Inhibitors and Fertilizers in Mitigating N_2O Emissions in Corn (Zea mays L.)

233 Wellman Hall · Moderator: TBA

1:00 Ramya Bhaskar – Physics
Trusting the Photometric Redshifts of Deep Lens Survey

1:15 Brian D. Busemeyer – Physics
Modeling Magnetic Properties of Wurtzite NiO Thin Films

1:30 Daine L. Danielson – Physics
Determining the Hierarchy of Neutrino Masses Using Fourier Analysis and Matched-Filter Signal Processing

1:45 Jonathan Leaf – Physics
Data Acquisition of a Compton Suppression System for Measuring Radioactive Decays

2:00 Jacob M. Pasner – Physics
Development of a Data Analysis Framework for High Energy Physics

2:15 Daniel P. Thorngren – Physics
Fast Photon Simulation in LUX

234 Wellman Hall · Moderator: Daniela Barile

1:00 Mara Couch – Chemistry
Investigation of Sulfur Dioxide Disappearance in Wine Under Anaerobic Conditions

1:15 Cassy Gardner – Biological Systems Engineering
Real-time Glucose Biosensor for Biofuel Production

1:30 Chad F. Masarweh – Microbiology
Profiling Bottled Kombucha Drinks Using Terminal Restriction Fragment Length Polymorphism Analysis

1:45 Lucas J. McKinnon – Biological Sciences
Plant Cell Walls: An Attempt to Further Our Understanding of Their Biology and Why They May be Important to Human Energy Consumption

2:00 Rebeccah Warmack – Biotechnology
Engineering of Lignocellulolytic Fungal Strain for Optimization of Biofuels Production from Cellulosic Materials

2:15 Austin W. Taylor – Environmental Science & Management
Lights, Camera, Action! Studying the Effects of Wave Action on Intertidal Snail Chlorostoma (Tegula) funebralis Behaviour with Underwater Cameras

6 Wellman Hall · Moderator: Nancy L. Keim

3:00 Tessa J. Artale – Spanish
Should the Environment be Commodified? Case Studies in Indigenous Social Movements as a Response to Natural Resource Privatization in Latin America

3:15 Eli I. Figueroa – Chicana/Chicano Studies
Normal Weights Against All Odds: A Qualitative Analysis of the Healthy Weight Range of Mexican American Children in Firebaugh, California

3:30 Rebecca K. Lucas – Sociology
Sustainable Agriculture and Social Capital: Alleviating Food Insecurity in Sub-Saharan Africa

3:45 Chase L. Nunez – Anthropology
Sex and Birth Order Predict Infant Growth and Survival: Consequences of Differential Maternal Investment in Rhesus Macaques (Macacca mulatta)

4:00 Grace Son – Environmental Science & Management
Achieving Food Security Through Urban Agriculture: Environmental and Social Benefits

4:15 Hilary Teaford – Biochemistry & Molecular Biology
The Relationship Between Breakfast Consumption and Physical Activity Levels in Healthy, Premenopausal Women

106 Wellman Hall · Moderator: Kit Lam

3:00 Yow-Ren Chang – Chemical Engineering
Polymeric Materials for Cell Culture Studies

3:15 Irene Ly – Biological Sciences
Assaying HTM Phagocytosis on Biomimetic Substrates

3:30 Derrick R. Hicks – Biochemistry & Molecular Biology
Design of a Novel Plastid Transformation Vector Containing an Inducible Recombinase Enzyme for Marker Removal

3:45 Jesus E. Juarez – Genetics
R-loop Formation Enhances the Efficiency of DNA Demethylation Mediated by the AID Enzyme

106 Wellman Hall · Moderator: Kit Lam

4:00 Mohammad M. Karimzada – Biochemistry & Molecular Biology
Optimization of a Cell-Based Assay That Screens One-Bead One-Compound (OBOC) Libraries

4:15 Spencer S. Wong – Genetics
Analysis of the Effect of R-loop Formation on Nucleosome Occupancy

115 Wellman Hall · Moderator: Gene Gurkoff

3:00 Devin Fenton – Neurobiology, Physiology & Behavior
Mathematical Measures of Sulcal Complexity in the Aging Brain

3:15 Rahil T. Ghiasvand – Biochemistry & Molecular Biology
NAAG Peptidase Inhibitor Improves Motor Function and Reduces Cognitive Dysfunction in a Model of TBI with Secondary Hypoxia

3:30 Joshua A. Rushakoff – Biochemistry & Molecular Biology
Maternal Immune Activation Alters Autism-like Behaviors in BTBR and C57BL/6J Mice

3:45 Marissa Saenz – Animal Science
Fatty Acid Binding Protein 7 & Plasmolipin mRNA Expressions are Downregulated in the CNS of Postpartum vs. Virgin Mice

4:00 Marquel Seither – Psychology
An Examination of How Fragile X Mental Retardation Protein Affects the Size of the Corpus Callosum in Children and Adolescents with FXSI

119 Wellman Hall · Moderator: Jared T. Shaw

3:00 Molly R. Fensterwald – Neurobiology, Physiology & Behavior
Design and Synthesis of Antimicrobial Compounds to Identify Inhibitors of Gram-Negative Bacteria

3:15 Francisco J. Sarabia – Chemistry
Derivation of Zantrin Z3 Towards Antibacterial Efficacy

3:30 Karina Diaz – Microbiology
A Screen for Determinants of β-lactam Induced Cell Lysis in Escherichia Coli

3:45 Edmond W. Liang – Biological Sciences
Directed Localization of Xylella fastidiosa Serine Protease PD0218 to the Outer Membrane of Escherichia coli

4:00 Herlinda Menchaca – Microbiology
Identification of the Chemoreceptor for p-coumarate Chemotaxis in Pseudomonas putida F1

4:15 Andrew Y. Mu – Microbiology
Viewing Regulated Genes in Myxococcus xanthus Through RNAseq

126 Wellman Hall · Moderator: Sean M. Burgess

3:00 Sonia M. Chapiro – Biochemistry & Molecular Biology
Nonhomologous Chromosome Interactions During Meiosis in Budding Yeast

3:15 James M. McGehee – Biochemistry & Molecular Biology
Live Cell Imaging of Chromosome Movement During Meiosis in Saccharomyces cerevisiae

3:30 Ryan D. Solis – Biological Sciences
Identifying Pch2 Binding Protein Partners in Saccharomyces cerevisiae

3:45 Perla G. Castaneda – Biochemistry & Molecular Biology
Drosophila Kinesin-5 Truncated Mutants Influence Mitotic Spindle Length

4:00 May S. Hao – Neurobiology, Physiology & Behavior
Are DNA Repair Genes Conserved Between Worms and Plants?

4:15 Ella Richardson – Biological Sciences
Polarity Proteins Asymmetrically Localize LET-99, a Regulator of Mitotic Spindle Positioning, in the C. elegans One-cell Embryo

202 Wellman Hall · Moderator: William K. Reisen

3:00 Cindy Preto – Viticulture & Enology
The Chronological Distribution of European Grapevine Moth's Life Stages

3:15 Lance V. Truong – Environmental Toxicology
Post-harvest Methyl Bromide Fumigation Against the Brown Marmorated Stink Bug, Halyomorphas halys (Stál)

3:30 Rachael Wood – Animal Biology
Correlation Between West Nile Virus Persistence and Relative Fitness of House Sparrow Hosts

3:45 Rebecca L. Campbell – Animal Science
Bloodfeeding Patterns of Culex Mosquitoes in Sutter and Yuba Counties of California

4:00 Desirae Costello – Animal Biology
Association of SNPs in Desiccation Resistance Genes of Malaria Vector, Anopheles gambiae s.l. in Cameroon

4:15 Danielle L. Zumpano – Neurobiology, Physiology & Behavior
Assessing Changes in Midgut Permeability During Blood Meal Digestion in Anopheles stephensi Using Fluorescent Beads

212 Wellman Hall · Moderator: Frank Mitloehner

3:00 Joseph F. Dorsch – Animal Science
Effect of Dietary Nitrate Supplementation on Dairy Cattle Enteric Methane and Nitrous Oxide Emissions

3:15 Neena Kashyap – Animal Science
The Environmental Implications of Supplementing Nitrate Versus Urea on Rumen Ammonium Production

3:30 Ellen Lai – Animal Science
Effects of Inoculant Blends on Emissions of Volatile Organic Compounds, Oxides of Nitrogen, Carbon Dioxide, Ammonia, and Dry Matter Losses in Alfalfa

3:45 Alexandra N. Taylor – Animal Science
Housing Strategies to Improve Calf Well-being During Weaning

4:00 Melanie LaCava – Wildlife, Fish & Conservation Biology
Genetic Analysis of Delta Smelt Spawning Strategies

4:15 Matthew F. Warren – Animal Science
Analysis of Bacteria-Killing Assay Using Chicken Plasma Samples

216 Wellman Hall · Moderator: Soichiro Yamada

3:00 Alexandra Blee – Biochemistry & Molecular Biology
The Roles of Afadin in Epithelial Cell Migration and Cell Adhesion

3:15 Rachel E. Gurlin – Biomedical Engineering
The Analysis of Force-Dependent Zyxin Recruitment in Epithelial Cells

3:30 Courtney Gegg – Biomedical Engineering
The Effects of Parathyroid Hormone on Scaffold-less Articular Chondrocyte-based Tissue Engineered Constructs

3:45 Nandor Laszik – Biomedical Engineering
Effects of Media Perfusion on Engineered Bone Growth

4:00 Vaishali Mittal – Biomedical Engineering
The Impact of Osteogenic Stimulation Time on Stable Mesenchymal Stem Cell Commitment

4:15 Wayne F. Leu – Biomedical Engineering
Cryohydrogels for Stem Cell Therapeutic Applications

226 Wellman Hall · Moderator: Daniel Potter

3:00 Mandeep Chahal – Neurobiology, Physiology & Behavior
Bridging the Disconnect: Understanding the Factors of Patient Satisfaction

3:15 Yassaman Sarvian – Environmental Policy Analysis & Planning
Bridging the Disconnect: Understanding the Factors of Patient Satisfaction

3:30 Mar-y-sol N. Pasquiers – Anthropology
Cultural Competence and Practices of Translation

3:45 Alexandra Truxton – Anthropology
Inner Demons: Evaluating Health Disparities Among the Homeless Population Involving Addiction

4:00 Sarah Laudenslayer – Design
Designing a UC Davis Smartphone App for Student Mental Health Resources

4:15 Phuong An Nguyen-Huu – Biological Sciences
Evaluation of the Necessity of Pre-discharge Functional Testing in Low Risk Patients Presenting to the Emergency Department: A Clinical Study

229 Wellman Hall · Moderator: Julie M. Schoenung

3:00 Victoria F. Chin – Chemical Engineering
Comparing the Environmental and Economic Disadvantages of Two Thin Film Solar Cells

3:15 Yadira Gutierrez – Chemical Engineering
Environmental and Human Health Effects of Materials in Organic Photovoltaic Solar Cells

3:30 Felicia Y. Lau – Civil Engineering
Expressway Disaster Prevention Monitoring Using Soil-Water Characteristic Curve

3:45 Christopher Salazar – Civil Engineering
Micromechanics of Fiber Pullout in High-performance Cement Composites

230 Wellman Hall · Moderator: Katharine P. Burnett

3:00 Maizy E. Enck – Art History
More Than a Religious Painting: The Untold Depth of Augustus Vincent Tack's Mystical Crucifixion

3:15 Daniel A. Trejo – Art History
Mao Zedong: Challenging Calligraphy within Strict Conventions

3:30 Kevin R. Adamski – Dramatic Art
Integrating Dramatic Arts and Communications in the Craft of Stage Directing and Peer Leadership

3:45 Sarah E. Bietz – Art Studio
Monet's Water-Lilied Defense

4:00 Stephen S. Hudson – Music
"Burning Away All Structure:" Rhythmic Perception and the Music of Meshuggah

4:15 Jacklyn M. Joanino – Dramatic Art
Storytelling: Exploration, Empowerment, and Transformation

233 Wellman Hall · Moderator: Naomi Janowitz

3:00 Francisco A. Ortega – Religious Studies
The Integral Role of Religious Repetition in Culture

3:15 Brandon Roberts – Religious Studies
The Machiavellian Lens for Understanding Protestant Militia Groups in Northern California

3:30 Teghpreet K. Ahluwalia – Religious Studies
Power Hierarchies and the Catholic Involvement in Immigration Reform: A Critical Discourse Analysis

3:45 Emily A. Fox – Religious Studies
Social Reproduction in Education: The School of Nisibis and Christian Identity in Late Ancient Mesopotamia

4:00 Rebecca Moore – History
The Secret Life of Bees: Religion and Gender in Classical Greece

4:15 Mitchell A. Winter – Religious Studies
Framing Religious Heritages: Negotiating Traditional Space in Three South Indian Temples

234 Wellman Hall · Moderator: Frances E. Dolan

3:00 Katie D. English – English
Screening the Nightmare: Terror Management in Children's Media

3:15 Shauna Stewart – English
Celebrity Culture in The Hunger Games and The Fault In Our Stars

3:30 Annika Cunningham – English
Mama Love Papa: Establishing Gender in Gentlemen Prefer Blondes

3:45 Leanna M. Friedrich – English
The Voice of a Child: The Relationship Between Adult Readers and Child Narrators in Response to Trauma

4:00 Corrie Jacobs – English
Jane Austen's Spinsters

4:15 Christina Novakov-Ritchey – Comparative Literature
Investigating Justice: Assia Djebar's La Femme en Morceaux

106 Wellman Hall · Moderator: Dawn Y. Sumner

5:00 Marisol Juarez Rivera – Geology
Exploring Archean Microbial Ecology Through Comparison of Ancient and Modern Microbial Mat Structures

5:15 Athena Phan – Geology
Exploring Microbial Preservation in Iron Oxides with X-ray and Neutron Ray Computed Tomography

5:30 Adam K. Aleksinski – Geology
Assessment of the Geothermal Viability of Surprise Valley

5:45 Jessie K. Saunders – Applied Physics
Outer Rise Fault Behavior in Subduction Zones

115 Wellman Hall · Moderator: John Richards

5:00 Valeria V. Farias – Chemistry
Alteration of White Blood Cell Count with Amphetamine and Cocaine Use

5:15 Marian Lara – Genetics
Whole Exome Sequencing Detection and Analysis of Two Untranslated GFPT1 Mutations in a Family with Limb-Girdle Myasthenia

5:30 Amanda Steele – Biomedical Engineering
Predicting Acute Kidney Injury Using a Novel Quantitative Analysis Method During Burn Resuscitation

119 Wellman Hall · Moderator: Andre Knoesen

5:00 John P. Flynn – Electrical Engineering
The Communication Architecture of the Interactive Surface Project

5:15 Collin McCarthy – Computer Engineering
System Design and Integration of a Tilting Ball Maze

5:30 Jacqueline M. Tran – Electrical Engineering
Interactive 2D Surface: Design Procedures from Prototype to Final Product

5:45 Ryan P. Wilkerson – Electrical Engineering
Ball Bearing Arpeggiator

126 Wellman Hall · Moderator: Nesrin Sarigul-Klijn

5:00 Yuka Matsuyama – Mechanical Engineering
Prediction and Validation of the Influence of Length on Residual Stress in a Long, Quenched Bar

5:15 Carlos F. Montes – Aerospace Science & Engineering
Optimizing UAV Design to Achieve Maximum Payload Fraction

5:30 Aaron Pereira – Mechanical Engineering
An Optimum Acceleration Strategy for Wind Turbines in Winds of Varying Velocities

5:45 Anahita T. Yazdi – Mechanical Engineering
Proton Exchange Membrane (PEM) Hydrogen Fuel Cell Interdigitated-Parallel Design and Performance

202 Wellman Hall · Moderator: Andrew J. Fisher

5:00 Danna Hong – Biochemistry & Molecular Biology
CANCELLED
Using X-ray Crystallography to Solve the Structure of a Novel Archaea Protein of Unknown Function

5:15 Raina H. Patel – Biochemistry & Molecular Biology
Characterization of MJ0066 PUA Domain by X-ray Crystallography

5:30 Reta D. Sarsam – Biochemistry & Molecular Biology
The Kinetic and Structural Analysis of CysQ, a Sulfate Activation Pathway Regulator

5:45 Tingwei Ou – Biochemistry & Molecular Biology
The Three-dimensional Structural Analysis of HEP230-bound Hepatitis E Virus-like-particles

212 Wellman Hall · Moderator: Alan Balch

5:00 Krishnan A. Rajagopalan – Chemical Engineering
Investigation into the Effects of Heat Treatment Conditions on Mechanical Properties and Microstructure of an Al-Fe Alloy

5:15 Thale R. Smith – Materials Science and Engineering
Investigation of Aging Kinetics in Ultra-Fine Grained Aluminum 7075 Alloy

5:30 Sahar Fakhri – Biochemistry & Molecular Biology
Is It Possible to Isolate and Characterize Y_3C_{102}?

5:45 Kevin D. Taylor – Applied Physics
Unsupervised Learning of Environments on a Simple Robotic Platform

216 Wellman Hall · Moderator: Carolyn de la Peña

5:00 Jia Chong – Psychology
Love and Laughter: Attachment Style and the Use of Humor When Emotionally Supporting a Relationship Partner

5:15 Jhunehl T. Fortaleza – Communication
Aggressive, Muscular Men in the Media and How They Affect Young Adult Males

5:30 Nicole A. Sears – Anthropology
Bitch: An Anthropological Study of Femininity and Power

5:45 Jhamere Howard – Sociology
A Game of Domino's: Insight into African American Women's Companion Selection Process While in College

226 Wellman Hall · Moderator: Kathryn Olmsted

5:00 Bianca S. Johnson – History
Rebuilding Community: Japanese Americans and Resettlement in Sacramento County, 1945-1960

5:15 Gregory W. Loh – History
The U.S. Abduction and Imprisonment of Peruvian Japanese During World War II: War Necessity or Business Negotiation?

5:30 Maya Makker – History
French or Jewish: Moroccan-Jewish Movements for Citizenship in the Interwar Era

5:45 Scott A. Pittman – History
Who Killed Everitt Hudson?: Communist Indoctrination During Second Red Scare

229 Wellman Hall · Moderator: Giovanni Peri

5:00 Natalie H. Ho – Economics
The Resource Curse and the Quality of Education Channel

5:15 Sunghun Lim – Economics
International Marriage Women by Agency: Do They Really Succeed in Economic Status After Marriage?

5:30 Lily MacIver – Community and Regional Development
The Implications of American Hegemony in Global Higher Education: The Case of Brazilian Students at UC Davis

5:45 Amani B. Rashid – Economics
Religion's Impact on the Correlation Between Education and Political Participation: Evidence Across Countries

230 Wellman Hall · Moderator: Bagher Modjtahedi

5:00 Aileen Devlin – Economics
Eligibility Dynamics of the Earned Income Tax Credit

5:15 Eric Gribkoff – Computer Science
Distributed, Parallel Evaluation of Regular Path Queries on Big Data

5:30 Jingyang Shu – Mathematics
Exchange-Rate Models for CNY/USD – Assessment and Prediction

5:45 Samuel J. Williams – Anthropology
Statistical Approaches to Occupation Type in a Mid-Holocene Site in Mendocino County, CA

Abstracts

Rhesus Monkey as a Unique Model System for Studies on Lipoprotein(a)

Adnan Abbuthalha
Sponsor: Enkhmaa Byambaa, Ph.D.
Internal Medicine

Cardiovascular disease is the leading cause of mortality, resulting in one death every 39 second. Lipids, such as cholesterol, are well known risk factors for cardiovascular disease. Lipoprotein(a) [Lp(a)] is a type of lipid where higher levels are associated with cardiovascular risk. However, underlying mechanisms of this association, as well as Lp(a) metabolic pathways, are not well understood. Unlike other plasma lipoproteins, Lp(a) levels are, to a major extent, genetically regulated and thus are not appreciably affected by lifestyle factors or lipid-lowering treatments. Lp(a) is only present in humans and Old World monkeys, limiting use of animal models. In humans, Lp(a) is genetically heterogeneous due to size polymorphism of the *LPA* gene. To test the suitability of the rhesus monkey as an animal model for Lp(a), we measured Lp(a) levels and genetic variability in 59 rhesus monkeys. Lp(a) levels differed greatly between animals (*range*: 2-103 mg/dl; *median*: 23 mg/dl) and were influenced by *LPA* genetic variability. These findings demonstrate the advantages of using the rhesus monkey as a model system for future mechanistic studies on Lp(a).

The Effects of Soluble Epoxide Hydrolase Inhibition on Diabetic Neuropathic Pain and Motor Skills in Mice

Seth Abramson
Sponsor: Bruce D. Hammock, Ph.D.
Entomology

Despite the availability of many therapeutics, patients with chronic pain require more efficacious treatments, that minimize side effects such as sedation. Diabetic neuropathy, a chronic pain brought on by damage to nerve cells due to hyperglycemia, is currently treated with anti-seizure medications, opioids and anti-depressants. The soluble epoxide hydrolase (sEH) is an enzyme in the arachidonic acid cascade that hydrolyzes epoxyeicosatrienoic acids (EETs). Elevated EETs via sEH inhibition are known to reduce inflammatory pain and are tested here in reducing diabetic neuropathic pain. We hypothesized that inhibiting sEH reduces pain without altering spontaneous motor activity in mice. We compared sEHi to gabapentin, a first in class therapy for diabetic neuropathy. Both compounds were assessed for reducing pain and effects on spontaneous motor activity. We measured pain using the von Frey assay and spontaneous motor activity using the open field assay. The results show that while both compounds reduced pain, open field tests displayed no significant changes in motor activity of the mice treated with sEHi. Gabapentin decreased the spontaneous motor activity in mice. Thus, sEHi show promise in reducing pain without significant motor effects compared to gabapentin, which may potentially translate to improving human health.

Integrating Dramatic Arts and Communications in the Craft of Stage Directing and Peer Leadership

Kevin R. Adamski
Sponsor: Bella Merlin, Ph.D.
Theatre and Dance

My key research question addresses how double-major students in the humanities can effectively integrate and enhance the complementary aspects of each major. Leadership and strong peer communication are two of the most important skills to learn from an undergraduate education. The ability to lead and organize one's peers is fundamental in today's workplace. The opportunities provided by the Theatre and Dance department offer students this essential training. Combining skillsets from my education in Theatre and Communications, I directed Sarah Ruhl's *Dead Man's Cell Phone* and assistant directed William Shakespeare's *Richard III*. Ruhl's play explores themes of disconnect and the false intimacy of modern communication technology while *Richard III* is the classic story of the infamous insatiably power-hungry duke. Both plays deal with deceit in communication. As a first-person case study, I will analyze how education from the two different disciplines of Dramatic Arts and Communications influenced my directorial process and provided the necessary expertise to direct theatre successfully. I will also explore further practical applications of this training outside of the university setting. Through this practice-as-research (PAR), I gained the crucial knowledge of how to effectively lead my colleagues from a field often overlooked in academia.

Elucidating the Best Method for Fragmenting Chromatin for MeCP2 ChIP-Sequencing

Justin O. Aflatooni
Sponsor: Janine M. LaSalle, Ph.D.
Medical Microbiology & Immunology

Mutations in the X-linked gene *MECP2* have been shown to cause a severe autism spectrum disorder known as Rett Syndrome. Methyl CpG Binding Protein 2 (MeCP2) is a transcriptional regulator, which plays an important role in regulating the expression of various genes in the genome. Investigating the specific binding sites of MeCP2 throughout the genome can provide valuable insight into the specific genes regulated by MeCP2, as well as provide further information about the function of MeCP2. Chromatin Immunoprecipitation combined with high throughput sequencing (ChIP-Seq) is a powerful method used to identify specific binding sites of proteins throughout the genome in a given cell type. My project focuses on determining the best method to fragment chromatin for MeCP2 ChIP-Seq in neurons. The methods being investigated are conventional sonication, focused ultrasonication, and restriction enzyme digestion. Each method of chromatin shearing will be evaluated for its ability to produce a narrow distribution of fragments around 300 base pairs without damaging MeCP2 protein-DNA interactions. By elucidating the best method to shear chromatin, the MeCP2 ChIP-Seq method can be optimized to provide better epitope targets for Immunoprecipitation of chromatin. This optimized approach has important implications for all ChIP-Seq methods.

Is the JNK Signaling Pathway is a Positive Regulator of the *A. stephensi* Anti-Malarial Immune Response?

Alejandro Aguirre
Sponsor: Shirley Luckhart, Ph.D.
Medical Microbiology & Immunology

Malaria is an infectious disease that kills about 700,000 people annually and is caused by *Plasmodium* parasites that destroy red blood cells. A person contracts *Plasmodium* when an infected *Anopheles* mosquito bites them and injects the parasites into their blood. An uninfected mosquito can then bite the infected person and take up the parasites, restarting the cycle. Current strategies for controlling malaria include using insecticides and drugs to kill the mosquitoes and parasites, respectively. Unfortunately, the mosquitoes and parasites are developing resistance to these chemicals, so we must look for other control methods. One approach involves genetically modifying vectors with resistance to infection. This is possible by enhancing the mosquito immune system to kill the parasites before they can be transmitted to humans. The c-Jun N-terminal Kinase (JNK) is a signaling protein in mosquitoes that I hypothesize is involved in immune response, and thus might be a good target for modification. Here, I show that overexpressing JNK in mosquito culture cells via transfection increases immune gene expression as observed through RT-PCR of RNA. Thus my preliminary results suggest that JNK is a positive regulator of immune response in culture. Follow-up studies include investigating JNK's function with live mosquitoes and parasites.

Power Hierarchies and the Catholic Involvement in Immigration Reform: A Critical Discourse Analysis

Teghpreet K. Ahluwalia
Sponsor: Meaghan O' Keefe, Ph.D.
Religious Studies

The Archdiocese of Los Angeles, with over five million members, is the largest Catholic community in the United States. The Archdiocese of Los Angeles is 70% Hispanic and about 60% of their growth in the past ten years has been from Hispanic immigrants. The Archbishop of Los Angeles, José Gómez is a Mexican-born immigrant and he serves on the United States Conference of Catholic Bishops' Committee on Migration. Gómez is a very vocal advocate of immigration reform and immigrant human rights in the United States. This paper analyzes the rhetoric Gómez uses in four speeches that span from 2008-2012. I argue that Gómez uses specific, directive rhetoric to establish his power and position with his audience in order to persuade them and create solidarity between them to advocate immigration reform and support immigrant human rights. To do this, I use Critical Discourse Analysis to investigate the power hierarchies established by his use of in-group pronouns and authoritative language. I then use Jurgen Habermas' Theory of Communicative Action to show that Gómez's rhetoric is an attempt to create solidarity and establish authority between Catholics in order to achieve immigration reform.

Effect of Simvastatin and Auraptene on Liver Tripeptidyl Peptidase II Activity

Nicole I. Aimua
Sponsor: Aldrin V. Gomes, Ph.D.
Neurobiology, Physiology, and Behavior

Protein degradation, through the use of the 26S proteasome, plays the role of sustaining the existence of a cell by preventing the accumulation of unwanted proteins. Acting downstream of the 26S proteasome degradation pathway, tripeptidyl peptidase II (TPPII) further degrades the products of the proteasome. In the presence of proteasome inhibitors, TPPII can upregulate and perform some of the proteasome functions, degrading misfolded and damaged proteins in the cell. However, little is known about other roles TPPII may play in the functioning of the cell. The effect of two compounds, simvastatin and auraptene, on TPPII activity in rat liver was independently tested. Simvastatin, a common cholesterol lowering drug, is found to induce liver problems. Meanwhile, auraptene, an antioxidant found in citrus fruits, has been shown in other studies to function as a chemopreventitive agent against cancer cell formation. By utilizing fluorescence assays, low concentrations of simvastatin (1 micromolar) or auraptene (1 micromolar) did not affect TPPII actvity. However higher concentrations of simvastatin (0.1 mM) caused significant decreases in TPPII activity.

Proper Motion of Galactic Halo Stars in the Deep Lens Survey

Leo Y. Alcorn
Sponsor:Tthony Tyson, Ph.D.
Physics

The Deep Lens Survey (DLS) is a multi-wavelength optical survey of five fields from 2000 to 2005. While the survey was intended for weak gravitational lensing research, the depth of this survey allows further investigation of the Milky Way galactic halo, so knowledge of the distance to the limit of proper motion detection is critical to research in near-field cosmology. To find proper motion of halo stars, we used a point-spread-function in conjunction with cataloguing software (PSFExtractor and SourceExtractor) to increase the accuracy of position measurements, then used a nearest match program to compare the positions of stars to later images, and measured changes in the coordinates of stars relative to its nearest neighbors as proper motion. In addition to investigating the limits of proper motion detection of the DLS, we discuss the use of the halo proper motion to find dispersion of the inner and outer galactic halo, find merger activity from galactic streams, detect Carbon giant stars and dwarf stars, and constrain the mass of the galaxy.

Assessment of the Geothermal Viability of Surprise Valley

Adam K. Aleksinski
Sponsor: Robert A. Zierenberg, Ph.D.
Geology

Surprise Valley, located in the Lake City area of Modoc County, California is a tectonically active graben, formed by extension at the northwest edge of the Basin and Range geological province and bounded by volcanic rocks of the Warner Range to the west and the Hays Canyon Range to the east. In 1951, the hot springs of Lake City suddenly erupted spectacularly as a mud volcano, bringing with it a considerable volume of mud, as well as larger rocks from the subsurface. The goal of this project is to provide constraints on the subsurface temperature and origin of geothermal fluids in this region by investigating rock samples from this eruption, and comparing them with samples collected from a nearby fossil hydrothermal system and from local geothermal exploration wells. We performed preliminary analysis of the rock samples through thin section microscopy, and later implemented mass spectroscopy on cryogenically distilled carbon dioxide from calcite in the samples to determine the ratio of ^{13}C to ^{12}C and of ^{18}O to ^{16}O. These data will assist in determining the subsurface temperature at the time of the calcite formation, and thus be useful in ascertaining the best location for future geothermal exploration.

Examining the Challenges of Latina Students in Attaining Higher Education

Yvonne T. Allen
Sponsor: Natalia Deeb-Sossa, Ph.D.
Chicano Studies

Twenty five percent of college age Latinos/as attend college and of that number sixty percent are Latina. The majority of these students are attending community college and almost half attend part time. This study examines the social, cultural as well as economic challenges that young Latinas/Chicanas face in attaining higher education. Ten Latina/Chicana students were interviewed to provide understanding and insight into what kind of challenges these young women overcame to attend and succeed in higher education. Five of the young women went to community college or four year college within five years of graduating from high school and five of the women did not continue to higher education within five years of graduating from high school. Location of college, interdependence with family and extended family and the Latina's many responsibilities at home are considerations Latinas/Chicanas must make when choosing college. A discussion of these challenges and the implications on the young women's successful achievement of higher education is provided.

Characterizing the Role of Calprotectin as Part of the Immune Response

Stuart M. Altman
Sponsor: Scott I. Simon, Ph.D.
Biomedical Engineering

Neutrophils are the most abundant white blood cell in the human circulation and are the "first responders" at the site of infection, migrating into tissue and producing substances that are toxic to the invading organisms. Neutrophil cytoplasm consists of ~60% calprotectin protein. When induced and secreted by cells during inflammation, calprotectin binds tightly to divalent metal cations, thus "starving" bacteria of cations necessary for respiration. Furthermore, calprotectin can create a cascade of immune events by activating other cell types. Little is known about how neutrophils interact with calprotectin when released extracellular in tissue at the infection site. This motivated our study of calprotectin's ability to activate neutrophils and thereby initiate an immune response. In these experiments neutrophils were isolated from human donor blood and perfused through microfludic chambers that mimic shear forces at the wall of blood vessels, over different substrate conditions: either a natural calprotectin (two binding sites active) or a mutant calprotectin (no binding sites). The number of neutrophils firmly adhered to the substrate under shear stress indicates level of activation. Thus far we have observed that substrates with natural calprotectin, which present Mn^{2+}, tend to have higher levels of neutrophil arrest as compared to substrates without calprotectin.

What's Retaining About Retention Now? (Queer) People of Color and Retention Efforts at UC Davis

Aaron M. Alvarado
Sponsor: Amina Mama, Ph.D.
Women and Gender Studies

Many queer students face harassment on UC campuses daily while students of color are less likely than white students to be retained. At UC Davis various campus resource centers work to address these issues. My paper will examine campus resource centers to answer the questions: how do resource centers function to keep marginalized students in the university and do they affect student activism on campus? The research I will conduct will be using interdisciplinary feminist methods to examine these questions. Specifically I will conduct interviews with students who work at and/or use the centers, as well as interviews with professional staff members who also work at the centers, and perform archival research into the centers' origins. To interpret the interviews and archival findings my research will foreground the theoretical work of Roderick Ferguson and M. Jacqui Alexander. Ferguson gives an account of how power diffuses through the university and Alexander discusses the erasure of voices in hierarchies. Through this project I hope to illuminate the various structural forces that retain or push out marginalized students (with various intersecting identities). Understanding these structural forces will allow resource centers to better retain students and student-activists to better utilize the centers.

Societal Expectations of Women: Beauty and Self-Esteem

Deborah An
Sponsor: Mary Jackman, Ph.D.
Sociology

There is societal and cultural pressure on people, especially women, to achieve an ideal beauty. This pressure is exerted by society's norms, institutions, men, and even fellow women who see each other as competition. Women are attacked on their physical characteristics, actions, appearance, and personalities. The demands of society and culture on women cause them to harm themselves in the name of beauty. My study will be focusing on the various beauty practices that women engage in and how they affect their self-esteem and self-identity. Intensive reading on this subject has shown that these beauty practices are often time-consuming and involve physical pain. The motivations for engaging in these practices differ between women. Through interviews and surveys with young women (high school seniors), I will be looking at whether these women are motivated by the promise of rewards or whether they fear rejection and are responding to criticisms aimed towards them. I hope to use the information I gain to assert my belief that no matter what women do, they are stuck in a perpetuating cycle. The ideal beauty is not attainable and women will never be perfect.

Validity and Reliability of Group Administered 24-hour Diet Recall: A Review

Katherine J. Anderson
Sponsor: Marilyn S. Townsend, Ph.D.
Nutrition

24-hour diet recall is a "gold standard" dietary assessment method in which the practitioner interviews the client to obtain a list of all food and beverages consumed in the previous 24 hours. Administration of diet recall in a group setting entails a completely different dynamic. Although it has been implemented as the main form of dietary intake data collection in the Expanded Food and Nutrition Education Program of California and other states, group diet recall administration has not been extensively investigated. The purpose of this literature review is to analyze and summarize the current research on group administered 24-hour diet recall. We initially searched "nutrition assessment" and "diet recall" in PubMed, "diet recall" and "dietary surveys" in Agricola, and "dietary recall" in FOODnetBase which yielded 219, 455 and 62 results, respectively. Inclusion criteria are protocol for administering group recall. Exclusion criteria are not food frequency questionnaires, not computer-based recall, and not nutrient intake analysis. Two studies were deemed fit for analysis based on title and abstract. With one study meeting criteria for adults, insufficient studies have been reported to validate this method. The one study available has study design limitations.

Characterization of a Novel Method for Detection of Circulating Tumor Cells

Mark Antkowiak
Sponsor: Suzanne Miyamoto, Ph.D.
Internal Medicine

There are currently limited methods in the detection of circulating tumor cells (CTCs), cells that originated from a primary malignant neoplasm and have metastasized to the blood. Many of these methods are limited by their testing procedure, which usually relies on the recognition/binding of CTCs with an EpCAM antibody and results in drawbacks such as low sensitivity, specificity, and difficulty in isolation of live CTCs for further analyses. We are currently developing a highly sensitive detection method to identify CTCs through a collaborative effort with the UC Davis/NSF Center for Biophotonics Science and Technology (CBST) and the UC Davis Medical Center. Utilizing the fact that different types of cells can produce distinct light scattering spectra or 'signatures', our method consists of measuring the elastic light scattering (mie scatter) of cells in a sample and using the 'signatures' obtained to detect and identify CTCs within the sample. To allow for optimal measurement of 'signatures' we plan to parameterize and test a set of running conditions for a working prototype that optimize signal strength, specificity and precision.

Should the Environment be Commodified? Case Studies in Indigenous Social Movements as a Response to Natural Resource Privatization in Latin America

Tessa J. Artale
Sponsor: Michael Lazzara, Ph.D.
Spanish and Portuguese

In the second half of the 20th century, the United States perceived the potential spread of communism across Latin American as a threat to the US's presence as a global hegemon. In many cases, the US responded with policies to control Latin American economies via authoritarian regimes operating in tandem with American private interests and to quell popular uprisings. In several instances of natural resource privatization, instead of achieving the US's goals, neoliberal policies set in motion a backlash that gave new energy to indigenous social movements. I investigate natural resource privatization by neoliberal administrations in three case studies of indigenous social movements: copper mining in Chile in the 1970s-80s; the Water War in Bolivia in 2000, and land reform in Guatemala in the early 1950s. I evaluate these movements based on the acuteness of the threat, historical context, availability of resources, and the severity of oppression from authoritarian regimes. I find that each movement had differing outcomes based on the resources mobilized; each response was unique to its individual circumstances; and natural resource privatization policies stimulate indigenous social movements that demonstrate public discontent with private and governmental interference and abuse of the most public resource- the environment.

Factors Associated with Approval and Denial of Temporary Restraining Orders Filed in the Yolo County Superior Family Court

Sabreen K. Aulakh
Sponsor: Lisa R. Pruitt, J.D.
School of Law

My colleagues and I, as part of a Davis Honors Challenge class, analyzed 93 temporary restraining order (TRO) applications filed in Yolo County Superior Family Court in 2012. We did so in order to determine the factors that tended to lead to the granting or denial of the TROs, which all related to intimate or family violence. Our goal was to provide information that would inform the Yolo County Family Justice Center (YCFJC) regarding the factors most likely to lead to the granting of TROs so that YCFJC could better serve its clients. We gathered many data points from the TRO applications, data points selected on the basis of similar prior studies that investigated the influence of demographic factors, gender, and firearm possession on TRO approval rates. I will present the data analysis related to the demographic details of the applicant and the individual against whom the TRO was sought. I will also present findings regarding the influence of gender, the presence of children, and the presence of firearms in determining TRO outcomes. Our analysis will be complete in March, so I will be able to present our findings at the conference.

Identification of Genes Important for Double Strand Break Repair

Thi Y. Aung
Sponsor: JoAnne Engebrecht, Ph.D.
Molecular and Cellular Biology

Repairing DNA damage is vital for organisms because DNA is regularly being damaged by intrinsic and extrinsic factors. Damaged DNA induces checkpoint activity, which can lead to DNA repair or programmed cell death. Currently, not all genes involved in DNA damage repair are known. In *Arabidopsis*, ATM is a responder for DNA damage and many genes are induced in response to DNA damage in an ATM-dependent manner. Since double strand break (DSB) repair is a conserved process and generation time of *Arabidopsis* is inconveniently long to test the function of all of these DNA damage-induced genes, we are using the model animal *C. elegans*. To test whether *C. elegans* orthologs of these genes are involved in DNA damage repair, worms were first treated with RNAi to down-regulate the gene of interest and then treated with Methyl methanesulfonate to induce DSBs. Following treatment, the viability of the worms was monitored; genes whose inactivation results in decreased viability will be examined further. Successful identification of genes important for DSB repair will be helpful in understanding how cells deal with the constant onslaught of DNA damage.

Kindling Following Traumatic Brain Injury and Hypoxia and the Effect on Epileptogenesis

Angela Avitua
Sponsor: Gene G. Gurkoff, Ph.D.
Neurological Surgery

Annually, over 1.7 million people in the U.S. sustain a traumatic brain injury (TBI). TBI is associated with an increased prevalence of seizures and accounts for 30% of epilepsy observed in individuals between the ages of 15 and 34. Therefore, development of a rodent model of post-TBI epilepsy is important for evaluation of potential anti-epileptic therapeutic interventions. We hypothesized that TBI or TBI with hypoxia would increase the rate of epileptogenesis in a kindling model of epilepsy. Following TBI or TBI with hypoxia, rats were given daily amygdala stimulations (kindling) to induce epileptogenesis. Behavioral and electrographic data indicated that while the sham normoxia group took 7.2 ± 1.4 days to develop epilepsy, the TBI normoxia group took 12.3 ± 1.6 days, and the TBI + hypoxia group took 16.6 ± 0.4 days. Therefore, counter to our hypothesis, prior injury did not increase the rate of epileptogenesis. Based on the literature, it is possible that the brain is less responsive to activation in the initial days following TBI; therefore, it may require more stimulation to generate epilepsy. Our overall objective is to better understand how TBI affects the development of epilepsy with the goal of designing therapeutic interventions to prevent epileptogenesis.

Investigating the Presence of Serine Hydrolase Proteases in Rat Liver Tissue

Asadullah K. Awan
Sponsor: Aldrin V. Gomes, Ph.D.
Neurobiology, Physiology, and Behavior

Protein degradation is essential for maintaining homeostatic control of the body. Diseases such as several neurodegenerative disorders (including Alzheimer), cystic fibrosis, and multiple myelomas may be a result of damaged and pathological accumulation of proteins. As such it is imperative that we understand the mechanisms by which these proteins are degraded. Although the ubiquitin proteasome system is responsible for the majority of the protein degradation in most eukaryotic cells, it is only responsible for around 10% of the trypsin-like activity in the liver, suggesting that the liver has unique trypsin-like proteases. Serine proteases, which degrade proteins using a catalytic Ser residue, may play a physiologically important role degrading proteins in the liver, an organ that may have a higher turnover than other tissues. Rat liver homogenate was separated by gel filtration and ion-exchange chromatography to separate trypsin-like proteasome activity from non-proteasomal trypsin-like protease activity showed several fractions which had non-proteasomal trypsin-like protease activity. We are currently using a novel active site labeling technique to determine the identity of the serine like proteases in these fractions.

Factors Associated with Approval and Denial of Temporary Restraining Orders Filed in the Yolo County Superior Family Court

Mojan N. Azarmi
Sponsor: Lisa R. Pruitt, J.D.
School of Law

My colleagues and I, as part of a Davis Honors Challenge class, analyzed 93 temporary restraining order (TRO) applications filed in Yolo County Superior Family Court in 2012. We did so in order to determine the factors that tended to lead to the granting or denial of the TROs, which all related to intimate or family violence. Our goal was to provide information that would inform the Yolo County Family Justice Center (YCFJC) regarding the factors most likely to lead to the granting of TROs so that YCFJC could better serve its clients. We gathered many data points from the TRO applications, data points selected on the basis of similar prior studies that investigated the influence of demographic factors, gender, and firearm possession on TRO approval rates. I will present the data analysis related to the demographic details of the applicant and the individual against whom the TRO was sought. I will also present findings regarding the influence of gender, the presence of children, and the presence of firearms in determining TRO outcomes. Our analysis will be complete in March, so I will be able to present our findings at the conference.

Effect of Different Compounds on Tripeptidyl Peptidase II Activity

Jaspreet Bahia
Sponsor: Aldrin V. Gomes, Ph.D.
Neurobiology, Physiology, and Behavior

Protein degradation is important for maintaining cellular homeostasis and is implicated in a variety of different diseases such as diabetes, sarcopenia, and certain types of cardiomyopathy. Protein degradation is carried out by several proteases, one of which is tripeptidyl peptidase II (TPPII), the largest identified cytosolic protease. It is involved in important processes such as the processing of the proteasome's degradation products, cell apoptosis, cell division, and antigen processing. TPPII has been linked to diseases such as cancer and obesity; however ,there are still many gaps in our knowledge of TPPII in relation to these diseases. In this study, we investigated the effects of NSAIDs such as ibuprofen, acetaminophen, and other compounds such as curcumin and oleuropein on TPPII purified from rat liver using a fluorogenic peptide substrate. The use of NSAIDs is associated with cardiac dysfunction. One possible explanation for their detrimental effects on the heart could be that they inhibit enzymes involved in protein degradation. Findings in our lab have also shown that various NSAIDs also inhibit the proteasome; this study sought to determine if NSAIDs have similar effects on other enzymes involved in protein degradation such as TPPII.

The Influence of Rejection and Social Confidence on Interpersonal Sensitivity

Noor Baker
Sponsor: Cynthia L. Pickett, Ph.D.
Psychology

Although unpleasant, the experience of social rejection is common among people of all ages. Psychological research demonstrates that social rejection leads to increased interpersonal sensitivity. However, is this always the case? We proposed that rejection leads to increased interpersonal sensitivity only when individuals feel confident about their social abilities. To examine this, we manipulated feelings of rejection and social confidence before having participants complete several interpersonal sensitivity tasks. Participants played an online ball-tossing game in which they were either ignored throughout the game (rejection condition) or included (acceptance condition). Participants' confidence in their social abilities was then manipulated with false feedback indicating that they either scored low or high in social competence. Finally, we tested interpersonal sensitivity by measuring participants' ability to accurately identify emotions from facial displays and audio voice clips. We predict an interaction between the social confidence and rejection conditions. Specifically, we expect that rejected (vs. accepted) participants in the high social confidence condition will demonstrate heightened interpersonal sensitivity, replicating past research. In contrast, rejected (vs. accepted) participants in the low social confidence condition are predicted to show decreased interpersonal sensitivity. These results would highlight the importance of social confidence when examining how rejection influences interpersonal sensitivity.

Characterizing the Effect TIN2 Mutations Have on Telomerase Activity and Telomeric DNA Damage

Sara Balla
Sponsor: Lifeng Xu, Ph.D.
Microbiology and Molecular Genetics

Patients with Dyskeratosis Congenita (DC) are at high risk for developing bone marrow failure and multiple types of cancer. DC patients have extremely short telomeres, regions of repetitive sequence at chromosome ends. The telomeres of highly proliferative cells are elongated by telomerase. Telomerase access to the telomeres is regulated by the telomere-binding shelterin protein complex. Mutations within the subunits of telomerase have been found in some patients with DC. Recently, heterozygous mutations within the shelterin component TIN2 have been discovered in DC patients. We hypothesize that the TIN2 mutations affect telomerase function resulting in short telomeres, and critically short telomeres lead to chromosome end deprotection and DNA damage response. Fluorescent in situ hybridization (FISH) and immunofluorescence (IF) images allowed us to analyze the progression of DNA damage at the telomeres overtime. Images of stained wildtype and TIN2 mutant interphase cells at early and late population doublings (PD) were examined. Comparing the quantity of telomere foci and DNA damage foci overlap between the early and late PD images will help us better understand if the short telomeres of DC patients are de-protected, eliciting a DNA damage response overtime.

Preliminary Experiments in Elemental Analysis by Neutron Activation Induced X-ray Emission

Sean R. Barberie
Sponsor: Michael Lerche, Ph.D.
Physics

Neutron activation analysis (NAA) is a well-established technique for resolving elemental composition through the collection of a γ-ray spectrum after exposing a sample to the high neutron flux inside a nuclear reactor. In addition to γ-rays, an activated sample will produce delayed characteristic x-rays from the artificially produced radionuclides. These x-ray emissions were the focus of early experiments in the 1970's that sought to use the x-ray spectrum for elemental analysis in place of the γ-ray spectrum following neutron activation. The x-ray spectrum is less convoluted than the γ-ray spectrum, and is sensitive to elements that cannot normally be accessed through traditional NAA. However, the technique never gained widespread use due to the sensitivity and resolution limitations of the available detectors of the time. Recent advances in silicon drift (SD) detector technology present an opportunity to re-evaluate this once explored analytical method for renewed viability. Current progress in developing an NAA induced x-ray analytical technique, Neutron Activation Induced X-ray Emission (NAIXE), will be presented.

Elucidating the Immunoregulatory Functions of Tubby-like Protein 4

Tasha M. Barr
Sponsor: Lorena Navarro, Ph.D.
Microbiology and Molecular Genetics

In mammals, the tubby-like protein family consists of tubby, the founding member, and four tubby-like proteins (TULPs1-4). The TULPs are characterized by a highly conserved domain of approximately 260 amino acids located at the carboxyl-terminus, referred to as the tubby domain. TULP4 is unique in that it contains a suppressor of cytokine signaling (SOCS) domain and a WD40 domain. SOCS domains are generally involved in E3 ubiquitin ligase complexes, which are pertinent within the proteasomal degradation pathway. We demonstrate here that TULP4 reconstitutes a partial E3 complex, and therefore may function as an E3 ligase. Additionally, we show that full length TULP4 is a strong inhibitor of the type 1 interferon pathway and the NFκB pathway. In order to better understand the role of TULP4, we are performing a yeast two-hybrid assay to identify TULP4's binding partners. Although the molecular mechanism of TULP4's immune suppression and its relation to TULP4's possible E3 ligase activity are unknown, these data clearly implicate TULP4 as an important immune response regulator. These studies are critical to our understanding of the mammalian innate immune system and will likely reveal important targets for the development of novel therapeutic strategies for treatment of infectious diseases.

Light Emitting Diode Generated Red Light Modulates Keloid-Derived Fibroblast Proliferation

Jonathan J. Bartlett
Sponsor: Jared R. Jagdeo, M.D.
Dermatology

Keloids are a disorder characterized by increased fibroblast proliferation and extracellular matrix deposition. We previously found that light emitting diode-generated red light (LED-RL) can modulate normal human skin fibroblast proliferation. Here we hypothesized that LED-RL can modulate keloid-derived fibroblast proliferation. To test this hypothesis, two different keloid-derived fibroblast lines were irradiated with LED-RL, each matched with a temperature regulated "bench control plate" (BCP), to ensure that the measured effect was a result of LED-RL treatment and not due to other environmental factors. LED-RL at fluences of either 320 J/cm^2 or 480 J/cm^2 significantly decreased cell proliferation at 48hrs post irradiation (14 - 29% decrease from control, temperature-matched BCP cells, $p<0.05$), with no significant decrease in cell viability, as measured by trypan blue exclusion. Similar LED-RL-induced decreases in proliferation were observed in a second keloid-derived cell culture and two normal fibroblast cultures. We conclude that LED generated red light modulates keloid-derived human skin fibroblast functions that are associated with fibrosis. There are few effective treatment options for keloids and other cutaneous fibrotic diseases. We envision that our findings will serve as the foundation for future translational studies that contribute to the management of fibrotic skin disease.

Investigating the Effects the Cell Plate Inhibitor Edosidin 7 on the Algae Penium Margaritaceum

Alana S. Barton
Sponsor: Georgia Drakakaki, Ph.D.
Plant Sciences

Cell wall is important not only for plant survival and development, but also for human sustainability as a resource of biofuels, thus it is necessary to learn differences and similarity of the cell wall in evolutional hierarchy. This project establishes a method to observe *Penium margaritaceum* via time-lapse photography, which can be used to analyze the growth and life cycle of *Penium* under the affects of different chemical inhibitors. The method immobilizes *Penium*, while still allowing growth and is used to observe the phenotype of *Penium* in the presence of the chemical endosidin ES7, by taking images every 5 to 10 minutes for 12 to 24 hours. ES7 inhibits cell plate maturation resulting in incomplete cell division and a similar phenotype is shown in *Penium*, however, the mechanism of inhibition is unknown. Immunostaining of several cell wall polysaccharides will be performed to yield information on what component of the cell wall ES7 affects in *Penium*. The information that we will obtain will indicate similarities and differences between the synthesis and deposition of the simplified cell wall in algae and the cell wall in more complex eukaryotes.

Stomata Abundance in Almond Varieties

Sultan F. Beardsley
Sponsor: Louise Jackson, Ph.D.
Land, Air, and Water Resources

Since 1400 BC, almonds have had significant social and nutritional value. Originally grown in a dry Mediterranean climate, farmers selected varieties that performed well with little water. Limiting the number of stomata on a trees leaves is one way varieties adapted. Stomata are responsible for the uptake of CO_2, and as they open water is consequentially lost. Having fewer stomata implicates increased water retention. My project compared stomata abundance on the east/west sides between 6 varieties of almond trees. The varieties I observed were Mission, Aldrich, Price, Nonpariel, Butte, and Fritz. I took samples from 3 trees per variety, one leaf from east and west sides. I used stomatal imprints and a microscope camera to take a total of 72 pictures. With the paint program on my computer, I counted every stomata. I found a significant statistical difference in the Mission variety. Mission has been used by Mediterranean farmers for decades. My data showed mission to have the fewest stomata's, supporting a tradeoff between less CO_2 uptake and retaining water. Mission is a variety thought to be somewhat resistant to spider mites. For a future project, I would like to explore the mechanisms of how leaf architecture influences pest resistance.

Dissociating Egocentric and Allocentric Representations Following Map Learning and Real-World Navigation

John P. Beck
Sponsor: Arne D. Ekstrom, Ph.D.
Psychology

Integrating information following navigation of an environment is critical to acquiring knowledge of a city's layout or learning new routes. Here, we consider the benefits of real-world navigation versus learning from a cartographic map. To track acquisition of spatial knowledge, we compare learning based on two fundamental forms of spatial representation: egocentric (self-referenced) and allocentric (world-referenced). Subjects learned locations of eight targets within the Center for Neuroscience in two conditions. In map conditions, five minutes were given to learn the layout of eight colored target objects. In navigation conditions, subjects were physically guided to the eight locations. Egocentric pointing had subjects stand at each location and point to other targets. Allocentric pointing involved subjects imagining a target and heading while pointing to another target Results showed improved representation following navigation and map learning, with egocentric representation showing greater improvement than allocentric. Furthermore, comparing results with a previous study using virtual reality (VR), we found that egocentric representation showed a greater improvement for real-world navigation than VR; no differences were present for map learning. Our results suggest that both navigation and map drawing improve both forms of representation. Real-world navigation, however, results in greater improvement in egocentric representation compared to VR.

Variation Among Isolates of *Fusarium Circinatum* in Tolerance of the Anti-fungal Metabolite BOA

Amir Begovic
Sponsor: Thomas Gordon, Ph.D.
Plant Pathology

Fusarium circinatum is a fungal pathogen responsible for a disease affecting pines known as pitch canker. Although this is what *F. circinatum* is notorious for, recent work has shown that this fungus also can colonize grasses. However, the importance of grasses as a resource in the life history of *F. circinatum* is unknown. To learn more about how well adapted *F. circinatum* is to exploitation of grass hosts, the present study was undertaken to determine how well this fungus can tolerate anti-fungal compounds produced by corn, a member of the grass family. To this end, plates of PDA (potato dextrose agar) were amended with various concentrations of BOA (2-benzoxazolinone), and inoculated with a colonized agar plug of *F. circinatum*. All tested strains failed to grow at concentrations of 0.75 and 1.0 mg of BOA per ml of medium. Colonized plugs transferred from plates containing BOA to PDA without BOA did not grow, indicating the fungus was killed by exposure to this anti-fungal compound. The same strains were able to survive exposure to 0.5 mg of BOA per ml, although growth was strongly inhibited. The next step will be to test for heritable variation in tolerance of BOA in *F. circinatum*.

Critical Review of Bisphenol-A and Effects on Birth Outcomes

Rebecca A. Belloso
Sponsor: Ellen Gold, Ph.D.
Public Health Sciences

Bisphenol-A (BPA) is a chemical used worldwide in plastic manufacturing. BPA is frequently found in food-storage containers, water bottles, baby bottles, plastic wrap and metal food can linings. BPA is an endocrine-disrupting compound that induces estrogen receptor-mediated gene expression, thus potentially leading to adverse health effects. Substantial adverse effects in fetal growth and development may potentially result from prenatal exposure to BPA. Because products that contain BPA are widely found and frequently used, we hypothesize that pregnant women with higher exposures to BPA will have a greater likelihood of having low birth weight infants and adverse infant outcomes, such as small for gestational age and reduced head circumference, than those with low exposure levels. We will conduct a critical review, using systematic search criteria and based on peer-reviewed, published studies that indicate whether BPA exposure during pregnancy is adversely related to infant birth weight. We are interested in seeing if higher exposure levels result in lower birth weight. This critical review will also summarize the state of current knowledge and limitations of existing studies on this topic, as well as provide information that might benefit advice to pregnant women.

Producing a Draft Reference Genome of a *Microbacterium* Strain Isolated from the Built Environment

Zachary A. Bendiks
Sponsor: Jonathan Eisen, Ph.D.
Ecology and Evolution

Though people spend more than 90% of their lives indoors, our understanding of the microbial flora associated with the built environment is limited. This work was part of a project to sequence reference bacterial genomes from indoor environments to aid further study of these microbes. We obtained bacterial samples from a residential toilet, then cultured and transferred them to nutrient plates. Individual colonies were grown in liquid culture and genomic DNA was extracted and purified. A highly conserved gene sequence in each DNA sample was amplified and sequenced, which we then compared to the sequences of other organisms. This identified a novel *Microbacterium* strain amongst our samples, which we selected for full sequencing due to a lack of sequenced genomes available for this genus. I fragmented the genomic DNA and attached adaptors at the ends, allowing the fragments to be sequenced. This produced over 2 million fragment sequences of 160 base pairs each. I assembled these fragments into the genome and checked it for accuracy using assembly software, then annotated it with a gene prediction algorithm. This draft genome was of relatively high quality and has been submitted to a nucleotide database, as well as for a publication describing this work.

Connecting the U.S. Media: A Network Analysis of Mutual Fund Ownership in Communication Corporations

Grace A. Benefield
Sponsor: George A. Barnett, Ph.D.
Communication

Social scientists have long been interested in the ever-increasing concentration and effects of computer, telecommunication and media corporations, such as Google, Apple and Verizon. By gathering statistics on mutual fund and individual stock owners, the study compares the proportion of institutional investment across communication corporations, which are service or technology corporations responsible for the exchange of information. The research incorporates network analysis software to identify outliers and central players in this web of media owners. The study seeks to measure centrality as a connection between two companies and their investors' similar interest investments, such as a similarity in size, expectations for growth, company values, or industrial interests. Surprisingly, the study finds that market capitalization did not result in centrality, such as IBM's peripheral status. The results find that smaller telecommunications companies, such as Sprint and Comcast, share a large portion of the same mutual funds. In contrast, other industries appear to have intermixed and varietal institutional owners. There are also indications of mutual fund interest groupings based on geography, as in west coast companies Disney, HP, and Qualcomm. Further research is needed to compare the individual stock owners who control large interests in various companies.

The Impact of Floodplain Plants on Flow Velocities

Kaitlin S. Benner
Sponsor: Geoff Schladow, Ph.D.
Civil and Environmental Engineering

Plants in wetlands and floodplains provide resistance to flow. By impeding flow plants are able to alter flow velocities and residence times. Resistance to flow is important because increasing residence times have been known to help improve water quality. However, the degree to which plants slow flow is uncertain. We examined how plastic grass-like plants interacted with flow in an 8m x 0.45m x 0.06m laboratory flume. Water was recirculated in the flume during seventy-two different experiments. To measure the flow velocities, two Acoustic Doppler Velocimeters (ADVs) were placed in the flume, one ahead of and one behind the plants. We observed that the existence of plants slowed the flow. This is important because by decreasing flow rates plants increase residence times and thereby particle settling. We estimate how particle settling rates are impacted by the observed reductions in flow rates. Particles from the watershed affect water clarity in the Tahoe Basin so understanding how plants slow flow will help better quantify the impact of floodplains on water quality in the Tahoe Basin. Lake Tahoe clarity might be improved by increasing the number of floodplain plants that slow flow and thereby increase residence times and particle settling.

Divergent Feeding Kinematics in Two Amazonian Cichlids

Charlsie L. Berg
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Evolution and Ecology

The Amazon Basin is a hotspot of fish diversity containing the largest number of freshwater species in the world. We examined kinematics of feeding in two Amazonian cichlids with similar habitats but divergent morphology, *Pterophyllum scalare* and *Crenicichla strigata*. *P. scalare* have deep heads with small mouths suitable for picking prey off the underside of floating vegetation. *C. strigata* have elongate heads and large mouths, and are ambush predators that typically strike out from vegetative cover at passing prey. A high speed camera system recorded both species capturing small fish introduced via a feeding tube. We digitized the videos with a modification of the program Dltdv3 in MATLAB, tracking ten points on the predator and prey. Using mixed models we generated p-values for fixed effects of size (head length) and species using 10,000 Markov Chain Monte Carlo samples in R to analyze kinematic patterns. With the exception of a higher maximum jaw protrusion, *P. scalare* displayed less cranial kinesis than *C. strigata* in conjunction with shorter timings and higher velocitiy movements for gape, head elevation, jaw protrusion, and lower jaw rotation than *C. strigata*. Our results suggest that despite similar habitats, these cichlids exhibit extreme kinematic divergence.

Localization of MEI-1 Subunit of Katanin in *C. Elegans*

Evan Berg
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Molecular and Cellular Biology

Katanin is a heterodimeric microtubule-severing protein involved in meiotic spindle formation. In the nematode, *Caenorhabditis elegans (C. elegans),* katanin is composed of two subunits, MEI-1, the ATPase subunit, and MEI-2, the regulatory subunit, both of which are required for the correct formation and positioning of the meiotic spindle in the one-celled embryo. In normal embryos, the MEI-1 subunit of katanin localizes along the chromosomes and microtubules of the meiotic spindle. We wanted to know where MEI-1 was located in various strains of *C. elegans* containing mutations to MEI-1 or MEI-2. To answer this, spinning disk confocal microscopy and immunofluorescence staining of fixed worms were used to determine the localization of MEI-1 in several mutant strains of the organism. In meiotic embryos of worms containing the *mei-1(b284)* mutation, there is no selective localization of MEI-1 to the chromosomes or microtubules of the meiotic spindle. Similar results are seen in *mei-2(sb31)* mutant strains. These results suggest that these mutations of *mei-1* interfere with localization of the protein to meiotic chromosomes and spindle. To confirm that the spindle poles have formed normally in these mutant strains, the localization of ASPM-1 spindle pole marker will be assessed.

Reconstruction of Past Ocean Temperatures With Mg/Ca and Oxygen Ratios of Neogloboquadrina Dutertrei Shells

Jennifer Berjikian
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Geology

Foraminifera are single-celled marine organisms that secrete calcium carbonate shells. These organisms are either benthic or planktic, living on the bottom of the ocean or free floating, respectively. By analyzing the Mg/Ca ratios as well as $^{18}O/^{16}O$ ratios of the shell calcite, we can reconstruct past ocean temperatures by paring Mg/Ca ratios with oxygen isotope values. Trace metal analysis also allows us to reconstruct the salinity and pH of ocean waters. Mg/Ca ratios best determine temperatures at which foraminifera calcify. Four samples were collected from two separate regions, the Eastern Equatorial Pacific and the Caribbean. To better reconstruct a trend in changing ocean temperatures, samples dated from the Holocene and Last Glacial Maximum were collected at the two sites. These samples are analyzed through laser ablation ICP-MS to determine the Mg/Ca ratios of each chamber of Neogloboquadrina dutertrei, a planktic foraminifera. Through laser ablation ICP-MS, we find that each chamber of the foraminifera shell produces differing Mg/Ca ratios. This study deciphers why Mg/Ca ratios change within individual chambers and the relation of changing ratios to sea water temperatures.

Exploring the Relationship Between Top3-Rmi1 and Rad55-Rad57 in Regulating Homologous Recombination

Amber R. Berry
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Microbiology and Molecular Genetics

Homologous recombination is a high fidelity process to repair double-stranded DNA breaks using the Rad51 single-stranded DNA filament to search for homology and form a displacement loop (D-loop) by strand invasion of a duplex target DNA to prime DNA synthesis. Sgs1-Top3-Rmi1 is a protein complex with multiple roles in recombination. Sgs1 displays 3'-5' helicase activity, Top3 is a type I topoisomerase, and Rmi1 functions as a specificity factor for Top3.Some functions can be attributed to Sgs1 and Top3-Rmi1 separately.The Rad51 paralogs Rad55-Rad57 form a cofilament with Rad51 and stabilize the nucleoprotein filament. Immunoprecipitation experiments show that Rad51 interacts with Top3 *in vivo*, probably by a direct interaction. This interaction is likely involved in the specific dissolution of Rad51 mediated D-loops by Top3-Rmi1.In an epistatic mini-array profile screen with different rad55 mutants, the strongest positive interactions were observed with mutations in TOP3-RMI1.I hypothesize there is a physical interaction between Rad55-Rad57 and Top3-Rmi1 that may regulate the activity of Top3-Rmi1 to dissolve D-loops.I will be using coimmunoprecipitations and immunoblots as well as the purified proteins to explore the physical interaction between the two *in vivo* and *in vitro.*

Aquarium Biogeography and Succession of Microbial Communities in Aquatic Environments

Lakshmi Bharadwaj
Sponsor: Jonathan Eisen, Ph.D.
Evolution and Ecology

The biological sciences teaching laboratory for UC Davis maintains a wide variety of large aquaria, including freshwater and marine tanks, designed to mimic both temperate and tropical ecosystems. In this study, we seek to better understand the biogeography of microbial communities associated with these tanks. Using a culture-independent, DNA-based community census approach (i.e., 16S rRNA PCR surveys), we tackle two main questions: 1) how do microbial communities vary with respect to various environmental parameters (temperature, salinity, pH, oxygen and nitrogen concentrations, etc.) both within and across tanks; and 2) how does the structure of microbial communities change in response to ecosystem disturbance. To address this second question, we coincided our data collection with the establishment of two new aquarium systems (coral ponds). We use high-throughput DNA sequencing of the 16S rRNA gene to generate a microbial community profile from hundreds of samples. These microbial community profiles are then compared across tanks (marine vs. fresh water, warm vs. cold) and in response to disturbances introduced during the establishment of the coral ponds.

Trusting the Photometric Redshifts of Deep Lens Survey

Ramya Bhaskar
Sponsor: David Wittman, Ph.D.
Physics

We examine the impact of photometric redshift errors on the Deep Lens Survey (DLS). Photometric redshift is a widely used and relatively inexpensive method of approximating galaxy distance. Knowing a galaxy's distance is crucial when analyzing its behavior and properties. Here, we attempt to calibrate the confidence with which we trust our photometric redshifts. Ideally, 98% of galaxies' true redshifts are within their 98% confidence interval, 96% of redshifts are within their 96% confidence interval, and so on. However, what actually results is that most codes are overconfident. Plainly put, we try to determine if we have assigned the right sized error bar to the galaxies' redshift estimate. If we don't, we might ascribe too much confidence to the redshift estimates. As a result, we could misinterpret galactic distances, and draw incorrect conclusions from our data. In the scope of DLS, we attempt to verify that the confidences are accurate for all subsets of galaxies: bright vs, faint, near vs. distant, and elliptical vs. spiral galaxies.

Visualization of Changes in Neuron Structure in Stages of Medusa Development Using Confocal Microscopy

Atul Bhattarai
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Evolution and Ecology

The structure and function of neurons is best understood in bilaterian animals, however a growing body of research aims to their function in Cnidaria. Phylum Cnidaria includes taxa such as sea anemone and jellyfish and represents the sister group to bilaterians. The cnidarian life cycle is composed of life history stages that alternate between forms. In *Podocoryne carnea*, the nervous system performs different functions in different forms of the same colony-from feeding, defense, and budding in the sessile polyp to swimming in the reproductive medusa. These differences in function likely involve structural differences in the network of nerves and sensory cells. In this experiment, we use monoclonal anti-acetylated alpha tubulin to stain and visualize the system of neurons and sensory cells in the various stages of medusa development through confocal microscopy. We use three stages present during the development of the medusa-initial polyp stage, intermediate stage, and fully-developed medusa stage. The data from confocal microscopy reveals differences in the organization of nervous system between these stages that are similar in physical form but play different roles in a colony. This work provides a starting point for understanding the functional and morphological correlates of behavior in Cnidaria.

Innovation Under the European Union's Emissions Trading Scheme

Maya B. Biery
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Economics

Last year, 2012, was the hottest year on record for the United States, and we are observing an increased incidence of natural disasters. To address the pressing issue of climate change, cap and trade programs have been proposed and implemented around the world. In order to comply with the programs, firms can purchase permits, reduce emissions through existing technology, or invent new technology. According to economic theory, implementation of a cap and trade program provides incentive for firms to find new, creative ways to lower emissions. Invention of new technology may be necessary to avoid catastrophic climate change. But how effective have implemented programs been in inducing innovation? This study focuses on the European Union's (EU) Emissions Trading Scheme (ETS), and asks whether or not the program caused an increase in innovation of emissions-reducing technologies in regulated firms. Many existing studies rely on country-specific surveys that asked firms whether the ETS influenced their decisions. In contrast to these studies, this study analyzes patent data across the entire EU, examining realized behavior to see if the ETS induced firms to innovate. This study finds that the ETS so far may not have been effective in inducing innovation.

Monet's Water-Lilied Defense

Sarah E. Bietz
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Art History

The importance placed on society's influence on art is seen in critics' analysis of Claude Monet's water-lily paintings, *Agapanthus, Clear Morning with Willows, Green Reflections,* and *Clouds.* Painted during and after World War I, the paintings were donated to the French government by Monet himself, causing critics to theorize that the peaceful compositions were meant as a therapeutic viewing experience for Monet's homeland as it recovered from the horrors of war. This theory overlooks the significance of the water-lily series as Monet's final work. The painter was well aware of his increasing age and deteriorating health but instead of retiring or choosing to pursue multiple, smaller projects, Monet decided to dedicate the rest of his strength to his water-lilies. Tamar Garb analyzes a similar situation in her article,"Painterly Plentitude" with Monet's fellow Impressionist, Auguste Renoir. She theorizes that the aging Renoir's final painting, *The Bathers*, was a psychological defense against his oncoming mortality. Applying Garb's thesis to Monet's final series, his fascination with painting water, association of water with death, and decision to use huge canvases suggests that the popular paintings were an intensely personal project, rather than patriotic.

Lighted Newton's Cradle

Yernur Bimendiyev
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Electrical and Computer Engineering

The purpose of this project is to create an innovative, attention-gathering Newton's cradle that will attract people of various ages and interests, especially prospective engineering students. Newton's cradle, named after Sir Isaac Newton, is a series of swinging spheres. In building the exhibit, we set out to accomplish one main goal. The exhibit must show "the" illusion of wireless power transmission. We are using bright light emitting diodes to attract attention and a typical Newton's cradle. Newton's cradle consists of a series of identically sized balls suspended in a metal frame so that they are just touching each other at rest. Each ball is attached to the frame by two wires which equally angled away from each other. Inside of balls there are light emitting diodes connected to electrical wires perpendicular to the base. In the order to create "the" illusion, we used an optical switch which is triggered by a perpendicular wire connected to the top of the frame. When a lighted one on the end is lifted and released, it pushes the last one upward, while first turns off, the next turns on visually creating "the" illusion of wireless power transmission.

The Function of Putative Phosphorylated Residues of SynDIG1 in Mediating AMPA Receptor Abundance at Excitatory Synapses

Lucia Bisic
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Pharmacology

AMPA receptor abundance at excitatory synapses in the central nervous system underlies synaptic strength and plasticity, which are important for learning and memory. However, many of the molecular mechanisms of AMPA receptor plasticity are not well understood. Previous research in the Díaz lab has shown that Synapse Differentiation Induced Gene 1 (SynDIG 1) contributes to recruitment and regulation of AMPA receptor content at excitatory synapses in cultured neurons. Phosphorylation of synaptic proteins is a known mechanism regulating AMPA receptor trafficking and function. Serine to alanine point mutants (S120A, S137A, and S120/137A) of SynDIG1 were made to test the synaptic function of these phosphorylated residues. We used overexpression of Serine-Alanine mutants in heterologous cell and primary neuronal culture to analyze the correlation of SynDIG1 with synaptic density as well as GluA2 content during the period of synaptogenesis. Repeated experiments showed that these mutations do not affect the ability of SynDIG1 to increase AMPA receptor expression in COS cells or neurons. Future experiments will test phosphomimetic serine-to-glutamate point mutations in AMPA receptor trafficking to further elucidate the molecular mechanisms involved.

Faith in Aid: Exploring the Evolution of Religious Humanitarianism in the Twentieth and Twenty-First Centuries

Lindsey A. Black
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Religious Studies

Western humanitarianism blossomed in the twentieth century, and religious actors mobilized charitable acts into structures of "organized compassion," as defined by Michael Barnett. Three such religious actors include the American Friends Service Committee (AFSC) formed by Quaker Friends, Catholic Relief Services (CRS), and World Vision International (WVI) created from Evangelical Christian roots. I will argue that, despite distinctively different religious identities, each organization has followed a similar evolutionary framework of emerging at a time of war and upheaval, shifting from relief into development work, and creating an emphasis on peace-building initiatives. Furthermore, the three organizations continually share concerns over how to stay true to their core religious identities, engage with the US government, and remain relevant and useful in the 21st century. I draw these conclusions through combining archival research with a series of employee interviews conducted with AFSC, CRS, and WVI. The three organizations serve as case studies for how religious humanitarianism at large must continually and actively work to find its place in the constantly changing field of international aid and development in the twentieth and twenty-first centuries.

Physiological and Nutritional Correlates of Alopecia in Coppery Titi Monkeys

Charlotte S. Blanz
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Psychology

Alopecia, or hair loss, is problematic in captive non-human primates and can be caused by excessive hair plucking. We examined physiological correlates of hair-plucking in a captive colony of titi monkeys, *Callicebus cupreus*, housed at the California National Primate Research Center. Plucking is frequently observed at the end of pregnancy and the first weeks after birth, where a colony member plucks other members or themselves. The colony's pluckers were identified and compared to a control group of non-pluckers based on gestation period, age, and length post-pairing. Afterwards, hormonal assays will be run to determine pluckers' and non-pluckers' urinary cortisol and estrogen levels. Blood work will also be done to compare any differences in nutritional levels of vitamins and minerals, specifically iron and zinc. While the analyses of hormonal levels and nutritional status are on-going, patterns of heightened hair-plucking in late pregnancy lead us to predict that estrogen and cortisol will be higher in hair-pluckers. Our findings will aid in management plans to improve welfare of hair-pluckers.

The Roles of Afadin in Epithelial Cell Migration and Cell Adhesion

Alexandra Blee
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Biomedical Engineering

Over the course of a lifetime, 1 in 8 women will be diagnosed with breast cancer. Previous studies have found that the level of afadin, a filamentous actin (F-actin) binding protein, is reduced in breast cancer patients, and that loss of afadin correlates with poor patient survival. The majority of cancer fatalities results from metastasis, the dissemination of tumor cells throughout the body. Since cancer cell invasion is a critical first step in metastasis, one hypothesis is that afadin may regulate the cell's ability to migrate. Alternatively, since afadin localizes to epithelial cell-cell contacts, afadin may regulate cell-cell adhesion during metastasis. To test these hypotheses, I reduced afadin expression levels in normal epithelial cells, using shRNA specific to afadin. I am currently working to identify the exact role of afadin in epithelial cell adhesion, because my initial experiments showed afadin-deficient cells migrate similarly to wild-type cells. These results suggest afadin does not directly regulate cell migration. Instead, afadin may regulate loss of adhesion between migratory breast cancer cells and the original tumor, or re-adhesion to new areas of the body.

Pupil Size Indicates Level of Probability-Related Uncertainty in Attentional Control

Zachary Blumenfeld
Sponsor: Joy Geng, Ph.D.
Psychology

Pupil size has been used as an indicator of many cognitive functions, from internally guided thought to reward anticipation. In our project, we measured pupil size as a non-behavioral determinant of unexpected uncertainty (when the predictive properties of stimuli change unexpectedly) during attentional processing. Gilzenrat et al. (2010) demonstrated that smaller pupil diameters result from being engaged in task-relevant behaviors ("exploitation"), while larger pupil diameters indicate global arousal and environmental exploration. These pupillary and behavioral changes are thought to be mediated by the neurotransmitter norepinephrine (NE). The goal of this experiment was to examine if pupil size could reliably index unexpected uncertainty in a visual search task. For our experiment, participants were asked to find a target object amongst distracters. Unexpected uncertainty was manipulated through task-associated probabilities governing the probability of target and distracter luminance during the experiment at predetermined intervals. Changes in these probabilities were associated with decreases in performance accuracy. The results suggest that pupil diameter increases during periods of unexpected uncertainty (e.g., when probabilities changed or when errors were made). We conclude that pupil size is a viable indicator of probabilistic learning that is likely underwritten by changes in NE.

Impact of Attachment on Correspondence between Child and Parent Reports of Child Self-Esteem

Alexandria M. Bodas
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Human and Community Development

Does attachment in parent-child relationships impact parents' ability to accurately detect how their children feel about themselves? In theory, securely attached children have close relationships with their parents, but can closeness really indicate how well parents can gauge how their children are feeling? The current project will test the hypothesis that similar reports of children's self-views by both the parent and the child will be related to higher attachment security. Children aged 5-10 and their parents reported on the child's global self-esteem, and children reported attachment security with the parent and provided explanations for their self-esteem. First, a regression will be run to predict the child-reported self-esteem based on the parent-reported self-esteem. Then, attachment security will be added as a moderator of this relationship to test whether parents of securely attached children have higher correspondence with their child's self-report than parents of insecurely attached children. Finally, open-ended explanations for the child's self-esteem will be coded into categories and examined for correspondence between parent- and child-report. It is hypothesized that fewer discrepancies between the parent and child's open-ended responses will be related to higher attachment security in the parent-child relationship.

HYDJET and the Quark-Gluon Plasma

Gabriel S. Bonilla
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Physics

A few moments after the big bang, the predominant state of matter was the quark-gluon plasma. The quark-gluon plasma has a role in testing the relatively new theory of quantum chromodynamics, a physical theory like the well-tested theory of electrodynamics. Today, to probe the quark-gluon plasma, heavy ions are collided at high energies to recreate the conditions present in the early universe. Experiments like the Compact Muon Solenoid (CMS) at the Large Hadron Collider (LHC) examine the results of colliding lead nuclei together at high energies to recreate the quark gluon plasma. One effect of colliding two heavy ions includes jet quenching, which is when the jets of particles produced in the collision interact with the plasma. In this project, we use the HYDJET (Hydrodynamics plus Jets) program to simulate the production of the jet quenching effects. The results will be cross referenced with the results from the CMS experiment in order to achieve a deeper theoretical understand of how the jets are created. Understanding the mechanisms through which the jets are formed will help us better understand the quark-gluon plasma, which will in turn help us understand the conditions present in the early universe.

Generation and Characterization of Transgenic Alfalfa Plants Expressing Walnut Phenolic Biosynthetic Enzymes for Pest and Pathogen Resistance

Tim A. Brice
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Plant Sciences

Plants lack the ability to flee from pathogens and herbivores, instead relying upon a host of chemical defenses to reduce palatability and digestibility, poison herbivores and destroy pathogenic bacteria. Alfalfa is assaulted by phytophagous and phloem-sucking insects, nematode parasites and pathogenic bacteria. These pressures are commonly controlled by powerful chemicals that compromise farm worker health and water quality. We have generated transgenic alfalfa plants expressing two polyphenol biosynthesis genes from Walnut (*Juglans regia*), *Jr*PPO and *Jr*SkDH, in an effort to enhance pest and herbivore resistance. Polyphenol Oxidase (PPO) enzymes appear to be involved in host defense activating phenolic species while a particular isozyme of Shikimate Dehydrogenase (SkDH) enables the biosynthesis of hydrolysable tannins, a unique tannin class believed to possess antinutritive and antibacterial properties. Approximately 80 putative transgenic alfalfa events were generated; these events were characterized by PCR genotyping, extraction and fractionation of phenolic compounds, and measurement of PPO specific activity. These initial screens and characterizations have enabled us to identify approximately 5 events that will be characterized more fully. Future investigations will identify novel phenolic compounds using mass spectroscopy, section organs and stain deposited tannins, and assay plant toxicity in insect and nematode feeding assays.

Ileal Interposition (IT) Surgery Prevents Damage to Mitochondrial DNA in Fat Tissue of Diabetic Rats

Casey Bronec
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Molecular Biosciences

Millions of individuals are diagnosed yearly with Type II diabetes (T2D), a metabolic disorder characterized by resistance to insulin response. Ileal interposition (IT) surgery is a bariatric procedure that has shown to delay the onsets of T2D. The surgery involves the ileum segment of the gut to be inserted into the proximal jejunum, increasing the delivery of unabsorbed nutrients to the lower gastrointestinal tract. We hypothesized that the IT surgery improves mitochondrial function in tissues other than the gut in rats predispose to have T2D. Given that fat tissue is one of the target organs for insulin response, we studied the post-operative effects of IT on fat mitochondria by testing mtDNA copy number (CN) and deletions of mitochondrial genes, ND1 and CYTB. CN and deletions were measured with dual-labeled probes by qPCR. Individuals with IT surgery had higher CN of mtDNA, determined by the ratio of ND1 normalized to the nuclear gene APP, and less deletions, the ratio of CYTB to ND1, than controls. These results suggest IT surgery ameliorates mitochondrial function via a response originated in the gut and transmitted to the rest of the body via mediators, which coincides with the delay of T2D.

The Demise of the Black Middle Class

Jesse R. Brownbey
Sponsor: Danielle Heard, Ph.D.
English

The middle class is at a critical point in American history. While the US middle class is barely the majority at fifty-one percent, studies indicate that the Black middle class may be destroyed by 2035. While many may say that the Housing Crisis 2007-2010 affected all Americans, the purpose of this paper is to thoroughly investigate the details that are overlooked, such as geographic regions and groups of people particularly affected. Black Americans became targets of subprime loans, yet their decline in class and wealth cannot be narrowly critiqued this way alone. African Americans who lost their homes (wealth) across the US were also products of their own limitations as a consequence of their existence within the historical context of Black progress. Through literary review, researchable quantitative data, and interviews this paper will attempt to examine the decline in Black wealth and the Black middle class. I argue that so-called Black wealth was "perceived" wealth lost by Banking malpractices of intimidation, power, and greed in which the relationships of financial institutions and race have become power-relationships that have geographically and disproportionately effected the retention of Black wealth, while systematic inequality and internal deficiencies limited Black middle class growth simultaneously.

The Potential Implications for Shark Biology of Radiant Heat Transfer From Inundated Beach Rock at Heron Island, GBR, Australia

Scott Bugsch
Sponsor: Nann Fangue, Ph.D.
Wildlife, Fish and Conservation Biology

Observations of shark aggregations in warmer shallow waters adjacent to recently inundated beach rock on the beach edge of Heron Island led us to test the thermal profiles of beach rock before and during inundation in combination with careful observations of shark distribution. Simultaneous data logger records from three sites along the southern shore beach rock at Heron Island revealed that beach rock warmed by the sun at low tide exchanged heat to the water flowing over it. Weather data revealed differences in wind direction and temperatures across sampling days; P-values were 1.49E-05, 6.983E-11, 0.0784, and 0.0140 for each day of the study. A regression analysis showed a slight but not significant positive correlation between water temperature and the number of sharks utilizing an area. However, the ability of beach rock to influence near island marine thermal profiles may impact other organisms, especially with an ever-growing amount of beach rock exposed from anthropogenic activities on the island.

Fan-Writing and Social Inclusion

Amanda D. Burnett
Sponsor: Frances E. Dolan, Ph.D.
English

Fanfiction has, especially over the last two decades, become a major form of creative fan production. Creating fanfiction is an analytical act at its core, requiring detailed knowledge of source, or 'canon,' material, characterization, and a myriad of other literary considerations. I analyze fanfiction as a literary genre that, coupled with fan communities over the medium of the internet, helps shift the social exclusionary matrix away from heteronormativity, expanding it to include the formerly unlivable spaces of queerness. Specifically, I look at the Adventure Time fandom in its iteration over the blogging platform of Tumblr, as well as on several sites dedicated to the dissemination of fanfiction. I examine the ways in which pairings of characters, called 'ships,' are explicated and accepted both by the authors themselves, and by the larger fandom community, with a pointed focus on the social possibilities and problems that arise when queer and non-queer ships coexist within fandom. Finally, I offer for consideration the possible real-world implications of an exclusionary matrix shifted away from heteronormativity and toward personal agency, and suggest fanfiction as both an indicator and a creator of this shift in the social space of fandom.

Trial and Error: Creating a Successful Music Industry Business

Danielle Burnstein
Sponsor: Wilton Agatstein, Ph.D.
Child Family Institute for Innovation and Entrepreneurship

There is no step-by-step manual to creating a perfect business. Rather, trial and error guide the development of a business plan, where error tends to dominate the development of the business and contributes to the many sleepless nights of the entrepreneur. To investigate the best way to develop a successful start-up business, I have created my own web-based company, entitled BoomFeed. This music industry entity allows college students to easily discover concerts that are occurring around their college town. Through BoomFeed, I investigate the most efficient way to create a prototype website, examine the most lucrative revenue model for a web-based company and determine the most successful marketing strategies to reach my specific demographic. After many trials and countless errors, it is evident that a free site with ad revenue is the most lucrative revenue model and the use of a website construction service allows for the creation of a user-friendly prototype website. Furthermore, the use of social media, posting on music blogs and directly contacting students, promotes BoomFeed most efficiently. Although in a utopian society there would be a single guidebook for creating a successful business, every company is unique and thus requires a unique approach to facilitate success.

Modeling Magnetic Properties of Wurtzite NiO Thin Films

Brian D. Busemeyer
Sponsor: C. Y. Fong, Ph.D.
Physics

We study the electronic and magnetic properties of wurtzite NiO (w-NiO) thin films grown epitaxially on wide gap semiconductors to understand factors affecting their half metallic properties, in particular, the effect of film thickness, interface geometry, and dangling bonds. Half metals are materials which conduct electrons of one spin, and not the other. Applications include spintronics--a novel technology that shows promise to revolutionize modern electronic devices. w-NiO is predicted to be a potential half metal, however NiO naturally crystallizes in the rock salt structure. Realization of w-NiO may be possible if grown epitaxially on a ZnO substrate as a thin film, but thin films often exhibit novel properties as compared to their bulk counterparts. To understand this effect, we present ab-initio calculations of one, two and four layers of w-NiO buried in and grown on top of bulk ZnO. We find that the interface can influence the Ni d states in markedly different ways, depending on the geometry and the presence of dangling bonds. Moreover we find the half metallicity is potentially destroyed by the presence of small s and p states, likely produced by strain at the NiO-ZnO interface.

Lrig1 and Lrig3 in Breast Cancer

Shadd N. Cabalatungan
Sponsor: Colleen Sweeney, Ph.D.
Biochemistry and Molecular Medicine

Overexpression of oncogenic receptor tyrosine kinases is a common event in cancer. Aberrant activation of these receptors leads to abnormal and uncontrolled cellular growth. ErbB2, a member of the ErbB family of receptor tyrosine kinases, is overexpressed in 20% of breast cancer patients. Lrig1, a member of a large family of leucine-rich-repeat containing proteins, is a negative regulator of all members of the ErbB family. In a comparative study, preliminary data from our lab suggests that Lrig3, another member of the Lrig family, does the opposite of Lrig1 and leads to receptor stabilization. The function of Lrig3 in breast cancer is not completely understood and is still a controversial area of research. In this study, we show that reducing Lrig3 expression with siRNA in two ErbB2 positive breast cancer cell lines, JIMT-1 and MDA-MB-453, leads to increased cell proliferation. We also show that the functions of Lrig1 and Lrig3 are not dependent on growth factors when grown in various serum conditions.

Characterizing the Coordination of General Transciption Factor Proteins in Haloferax Volcanii

Cindy Y. Cai
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

Haloferax volcanii, an archaeon in the family Halobacteriacea, is a model organism for Archaea. As a model organism, *Hfx. volcanii* is responsive to genetic manipulation in a laboratory setting. TATA binding protein (TBP) is a general transcription factor required for transcription initiation in archaea, and is homologous to eukaryotic TBP. Several haloarchaea possess multiple TBP homologs, which are suspected to be involved in differential regulation of gene expression in response to environmental stimuli. *Hfx. volcanii* posesses four TBP homologs, each of which is present in only a single copy in the genome. This feature simplifies the creation of TBP mutant strains for studying differential gene regulation of the various TBP homologs. The goal of this project is to create knock-out and epitope-tagged strains for each TBP homolog in *Hfx. volcanii* using the integrative vector pTA131. Epitope-tagged TBP strains will enable us to track differential target gene binding of each TBP homolog, while knocking out each TBP individually will help us to understand the contributions of different TBP homologs to *Hfx. volcanii* fitness under various forms for environmental stress.

Co-immunoprecipitation Analysis of Protein Interaction Between DMI2 and RopGEF5 in M. Truncatula

Parker T. Cain
Sponsor: Douglas R. Cook, Ph.D.
Plant Pathology

Despite its abundance in the atmosphere, nitrogen is often a limiting nutrient for plant growth. Legumes enhance their uptake of nitrogen by forming a symbiotic relationship with nitrogen-fixing bacteria called rhizobia. Root nodules begin to form when a root hair curls around a rhizobium, which then travels from the root hair to the root cortex through a plant derived infection thread. These nodules house the rhizobia, which reduce atmospheric nitrogen to ammonia that the plant can utilize. DMI2 is a receptor-like kinase that regulates the infection and nodule development processes. RopGEFs are a family of proteins that regulate polar cell growth and root hair elongation. DMI2 and RopGEF5 physically interact in yeast, but this interaction has yet to be demonstrated *in planta*. We will test this in the model legume *Medicago truncatula* through co-immunoprecipitation of epitope-tagged DMI2 and RopGEF5 proteins extracted from transgenic roots. If RopGEF5 precipitates with DMI2, further studies can be performed to elucidate the nature of RopGEF5's involvement in nodulation.

Expression and Characterization of the Otubain-1 Deubiquitinating Enzyme

Giselle Camarillo
Sponsor: Kermit L. Carraway III, Ph.D.
Biochemistry and Molecular Medicine

The ErbB family of mammalian receptor tyrosine kinases play essential roles in propagating signals that regulate cellular proliferation, differentiation, motility, and survival. The aberrant overexpression of family member ErbB3 has been demonstrated to promote the onset and progression of breast cancer, and to contribute to the resistance of tumors to commonly employed therapeutics. These observations prompt questions concerning the mechanism by which breast tumor cells overexpress ErbB3, and whether anti-cancer therapeutic strategies may be developed that might suppress receptor overexpression. We have previously observed that the overexpression of Otubain-1 (Otb-1), a deubiquitinating enzyme, correlates with ErbB3 overexpression in breast cancer patient samples. Moreover, our observations suggest that the catalytic activity of Otb-1 may be required for receptor overexpression, raising the possibility that Otb-1-directed inhibitors could be employed to suppress ErbB3 overexpression in breast tumors. Here we have expressed the Otb-1 protein in bacteria and have begun to develop a fluorescence resonance energy transfer (FRET)-based assay to assess its deubiquitinase activity. When fully developed, this assay will be employed in experiments aimed at screening and characterizing small molecule inhibitors of Otb-1 activity.

Bloodfeeding Patterns of Culex Mosquitoes in Sutter and Yuba Counties of California

Rebecca L. Campbell
Sponsor: William K. Reisen, Ph.D.
Pathology, Microbiology and Immunology

West Nile Virus is a mosquito-borne flavivirus now endemic in California. The virus is transmitted mainly between birds and *Culex* mosquitoes, with spill-over transmission to mammals, including humans and horses. Host competence for WNV varies by species, so understanding bloodfeeding patterns of the vector mosquitoes will extend our understanding of viral transmission. To explore the influence of host abundance and diversity on *Culex* bloodfeeding patterns in California, mosquitoes were sampled from three rural farmsteads in Sutter and Yuba counties. Bloodmeal hosts were identified using a sequence of the mitochondrial gene, cytochrome oxidase I (*COI*), and the BOLD database. West Nile virus transmission as measured by mosquito infection rates was greatest at sites where the primary vector, *Culex tarsalis*, fed frequently on highly competent corvid hosts such as American Crows and Yellow-billed Magpies and lowest at sites where cows and other hosts with low competence were utilized. These data show how heterogeneity of host availability drives the dynamics of WNV transmission in California.

The Interactions Between *Aphidius Colemani* and *Linepithema Humile* and its Affect on *Aphis Gossypii* Parasitism for Biological Control

Edy Campos
Sponsor: Michael Parrella, Ph.D.
Entomology

The Argentine ant, *Linepithema humile,* is an invasive species from South America causing pest problems in agriculture and the urban landscape. One reason for the success of Argentine ants is their synergistic relationship with aphids; Argentine ants protect aphids from natural enemies, while aphids produce honeydew that the ants collect and use as food. An eco-friendly method for controlling aphids is the use of Hymenopteran parasitoids. One such parasitic wasp, *Aphidius colemani*, has been successful in parasitizing aphids like the melon aphid, *Aphis gossypii*. There is little information on the interaction between Argentine ants and parasitic wasps, but some studies suggest that the ants will attack the parasitic wasps. We will conduct experiments using four treatments: 1) aphids, 2) aphids and ants 3) aphids and parasitic wasps, and 4) aphids, ants and parasitic wasps and will be conducted on chrysanthemums. Aphid population data will be collected and we will make inferences about how the ant/ parasitic wasp interaction affects the aphid population. This research can provide data on how effective these parasitoids are in an area with ants and provide additional information on control of aphids in agricultural and urban settings with a focus on reducing the use of pesticides.

Synthesis of Silicon Nanoparticles with the Aid of Transitional Metal Seeds

Danielle E. Carter
Sponsor: Susan Kauzlarich, Ph.D.
Chemistry

Silicon nanoparticles have been the focus of research in recent years for their applications as bio-imaging markers, in electronic devices and for energy generation technologies. Silicon nanoparticles have been successfully synthesized with both an amorphous and crystalline structure by solution based synthesis routes. Recently, the synthesis of silicon nanoparticles by a reduction of a silicon precursor (SiI_4 or $SiCl_4$) with n-BuLi has proven effective as a faster, cleaner synthesis method where the nanoparticles can be precipitated out of solution. The resulting nanoparticles obtained from this method thus far have been amorphous in nature. This research is focused on a method to crystallize silicon nanoparticles by the addition of transitional metal salts (FE(III) (acac) and Cu(II) (acac)) with the silicon precursor (SiI_4) in a reduction-based solution synthesis route. We hypothesize that this method forms transition metal nanoparticles (Fe nps and Cu nps) in situ, which promotes the crystallization of the Si nps. The generation of Si nps with an already doped silicon precursor material (Na_4Si_4 with Fe) via a microwave assisted solution route will also be discussed to showcase the difference between the two different reaction routes for obraining crystalline silcon nanoparticles.

To Stop or Not to Stop? An Analysis of Cyclists' Compliance or Noncompliance with Stop Signs

Shannon R. Carter
Sponsor: Bill McCarthy, Ph.D.
Sociology

Why do people obey or not obey laws? Despite many efforts, sociologists and legal scholars have not found any unifying reasons behind either compliance or noncompliance with the law. Different contexts and locations cause people to behave differently in relation to the law. This study adds to the current body of legal research by examining the reasons behind cyclists' compliance or noncompliance with traffic laws. It uses data from a sample of university bicyclists who were asked about their cycling habits when approaching a stop sign. Preliminary interviews were conducted and analyzed with an interpretive approach to discover the reasons cyclists gave for their behavior. A self-reported survey was then distributed to a larger sample of cyclists to assess the extent to which survey data mirrored the interview responses. The results of this study will help identify why people do or do not obey cycling laws and will contribute to our understanding of legal compliance.

Comparison of CO_2 and N_2O Emissions From Vineyards with Different Soil Types: Sand vs. Clay

Hanna Casares
Sponsor: Connie Champagne, Ph.D.
Molecular and Cellular Biology

For a variety of reasons, global greenhouse gas (GHG) emissions are continuing to increase. Agriculture is a huge part of California's economy and is also a large contributor to its amount of GHG emissions. Vineyards are a growing part of California's agriculture, and as such, it is important to study the effects vineyards have on GHG emission. In this study the CO_2 and N_2O emissions from two different vineyards with different soil types was compared to investigate if soil type affects the production of GHGs. Soil type is described by its percentage of gravel, silt, sand, and clay. One vineyard in this experiment had a higher sand content while the other had higher clay content. My prediction was that the site with the higher clay soil would have an overall greater release of CO_2 and N_2O than the site with the sandier soil because of the greater moisture and nutrient availability for soil microbes there.

Drosophila Kinesin-5 Truncated Mutants Influence Mitotic Spindle Length

Perla G. Castaneda
Sponsor: Jonathan Scholey, Ph.D.
Molecular and Cellular Biology

The mitotic spindle functions to segregate genetic material. This is, in part, due to kinesin-5, a homotetrameric motor protein necessary for interpolar microtubule cross linking and sliding. Although much is known about the role of kinesin-5 in mitosis, the structural requirements for its function remain unclear. Our lab has identified the protein domain, the Bipolar ASSembly (BASS) domain, which directs formation of a bipolar tetramer in the *Drosophila* kinesin-5 homolog, KLP61F. Truncated constructs carrying deletions in the stalk, but retaining the BASS domain, form shorter, yet bipolar, tetrameric complexes. We have created *Drosophila* S2 cell lines expressing GFP-tagged, BASS-containing KLP61F truncations. Experiments in the presence of the endogenous protein show that BASS-containing KLP61F truncations localize to mitotic spindles. They cause shrinkage of the metaphase spindle, possibly by forming non-functional hybrid tetramers with the endogenous protein. I depleted the endogenous KLP61F protein by RNAi to determine the ability of the mutants to form functional tetramers able to slide spindle microtubules in mitotic cells. The truncated proteins were unable to rescue the function of the endogenous protein. Embryos from fly lines that express the truncated KLP61F are being imaged to study the localization of the truncated proteins.

Design and Implementation of a Photon Detector Test Bed for a Full Body Positron Emission Tomography (PET) Device

Santos I. Castillo
Sponsor: Ramsey D. Badawi, Ph.D.
Biomedical Engineering

Positron emission tomography (PET) is a molecular imaging technique with numerous applications including cancer detection and neuroimaging. Current commercial PET devices span approximately 15cm and have limited sensitivity. Our proposed full body PET (fbPET) device, spanning 2 meters, has the potential to substantially improve sensitivity over commercial PET technologies. This increased sensitivity will allow for earlier detection of diminutive cancer tissues as well as allowing for applications in in-vivo drug kinetics research. However, construction of an fbPET device of this scale will require thousands of photon detector units that must be calibrated to function in unison. Therefore we require a platform to develop reliable standards and tolerances to test and calibrate the photon detectors, which will allow efficient implementation of the full scale fbPET device. I will be designing and implementing a detector testing platform that robustly tests the detectors, streamlining the testing and calibration periods. At this stage in the design, I will be coding the data acquisition software responsible for acquiring signals from several detector types including photomultiplier tubes and avalanche photodiodes. Construction of a physical interface will follow immediately after software debugging.

Bridging the Disconnect: Understanding the Factors of Patient Satisfaction

Mandeep Chahal
Sponsor: Daniel Potter, Ph.D.
Plant Sciences

Nearly 40,000 female patients in the United States die from breast cancer every year. Many of the women who succumb to this disease are not able to diagnose and treat their disease early in the process, or receive proper health care during the harshest stages of the cancer. Breast cancer research is a multi-billion dollar industry, yet thousands of women continue to suffer every year due to certain variables that affect their relationships with their doctors. One of the main factors affecting their care is cultural differences between physicians and their patients. Research shows that women of color and women from disadvantaged backgrounds receive consistently inferior care to their white and wealthy counterparts. The purpose of this project is to conduct and use first person interviews to examine and address the disconnect between breast cancer patients and their physicians. We will research how various cultural, legal, and economic factors affect the quality of healthcare that women receive from their physicians. We hope to publish our findings along with facts and guidelines for patients, medical students, and physicians to help resolve this disconnect and how to provide culturally sensitive and informed care.

Effects of Allopregnanolone on Behavior in a Mouse Model Exhibiting Deficits of Fragile-X-Associated Tremor/Ataxia Syndrome

Carolyn Chang
Sponsor: Robert F. Berman, Ph.D.
Neurological Surgery

Fragile X-associated tremor/ataxia syndrome (FXTAS) is a neurodegenerative disorder caused by a trinucleotide expansion in the premutation range (55-200 CGG repeats) on the fragile X mental retardation (*FMR1*) gene. Core features of FXTAS include poor motor function, cognitive impairments, and increased anxiety. Transgenic mice with a human CGG98 repeat exhibit similar behavioral deficits, validating their use as a preclinical model of FXTAS and their use for the development of pharmacological treatments for the human disease. This study aims to determine whether the neurosteroid allopregnanolone can be used as an effective treatment to improve behavioral deficits in transgenic CGG98 mice. Transgenic and wildtype mice were treated with allopregnanolone for twelve weeks and tested for changes in motor, cognitive, and anxiety-like behaviors. Following exposure to allopregnanolone, transgenic mice showed reduced anxiety-like behaviors, including increased exploration in the elevated plus maze and reduced marble burying in the marble burying test. Moreover, locomotor deficits were restored to baseline, as observed in the open field test. Allopregnanolone treatment did not appear to have an effect in tests of cognitive function. This data suggests that allopregnanolone may be an affective treatment for motor impairments and anxiety seen in humans with FXTAS.

Polymeric Materials for Cell Culture Studies

Yow-Ren Chang
Sponsor: Christopher J. Murphy, D.V.M., Ph.D.
School of Medicine and Veterinary Medicine

Cellular behaviors *in vitro* are dramatically altered by their extracellular environment. However, inherent properties (stiffness and surface topography) of tissue culture plastic (TCP) simply do not mimic soft tissues *in vivo.* TCP is very stiff (stiffer than bone) and topographically flat unlike tissue components in the eye which are very soft and inherently rich in topographical features. In this study we compared mechanical properties of different yet increasingly used polymeric materials, specifically polyacrylamide hydrogels and polydimethylsiloxane (PDMS) that mimic native *in vivo* mechanical properties of ocular tissue. For initial studies, mechanical properties of these materials were characterized by determining the material's stiffness (elastic modulus) via (a) nano-indentation by atomic force microscopy (AFM) and (b) micropipette aspiration coupled with mathematical modeling with finite element methods. Results demonstrate positive correlation between elastic moduli determined for polyacrylamide and PDMS substrates (10 kPa) using both methods. For the stiffer substrates (≥25 kPa), AFM provided the best correlation between materials. Our data clearly demonstrates that the methodologies used to characterize the stiffness influences understanding of their mechanical properties. Preliminary data also suggests that cellular behaviors characterized by gene expression are differentially altered for same cell types cultured on different polymeric materials with similar stiffness.

Nonhomologous Chromosome Interactions During Meiosis in Budding Yeast

Sonia M. Chapiro
Sponsor: Sean M. Burgess, Ph.D.
Molecular and Cellular Biology

Meiosis is a specialized form of cell division in which diploid cells produce haploid gametes for sexual reproduction. In an early step of meiosis, chromosomes explore the genome to find and pair with their homologous partner. For the homology search to be efficient and accurate, homologous chromosomes must be brought into proximity with one another, and interactions between nonhomologous chromosomes must be limited. Failure to pair during the homology search can lead to gamete inviability, or severe defects in the offspring. Many meiosis-specific proteins and well-documented processes such as double-strand break repair are known to play a role in bringing together homologous chromosomes (Lui et al, 2006). However, only Rec8, a meiotic cohesin, has been specifically implicated in keeping nonhomologous chromosomes apart, and its mechanism of action is not clear (Cahoon and Lui, 2013). Using an assay that correlates the spatial proximity of nonhomologous chromosomes to the production of green fluorescent protein, we can screen through UV-mutagenized yeast to identify more factors involved in limiting interactions between nonhomologous chromosomes.

Spindle Assembly Checkpoint Component MAD2L1 Responds to Hydroxyurea-Induced DNA Damage

Thinh Chau
Sponsor: JoAnne Engebrecht, Ph.D.
Molecular and Cellular Biology

Progression through the cell cycle is tightly regulated by checkpoints to ensure genetic fidelity and genomic stability. Checkpoint activation results in cell cycle arrest to provide time for repair or induces programmed cell death. The DNA damage response (DDR) and the spindle assembly checkpoint (SAC) have been traditionally viewed as separate regulatory pathways but emerging evidence points to crosstalk between these checkpoints. The Engebrecht lab has found that both the DDR and SAC are required for cell cycle arrest in male *C. elegans* germline cells in response to hydroxyurea (HU)-induced DNA damage. MDF-2, the *C. elegans* ortholog of conserved SAC component MAD2, became enriched at germline nuclei in HU-treated worms. We hypothesize that MAD2L1, the mammalian homolog of MAD2, responds similarly to HU treatment in mammalian cells. We cultured COS-1 cells in the presence of HU and utilized immunofluorescence to detect changes in MAD2L1 localization. We found that MAD2L1 was significantly enriched at the nuclei of HU-treated cells compared to untreated cells. Further investigation of how MAD2 functionally mediates cell cycle arrest in response to DNA damage is needed since it does not appear to be through its canonical SAC function as shown in *C. elegans*.

Translesion Synthesis Polymerases Increase the Rate of Mutation in *Saccharomyces Cerevisiae*

Monique Chavez
Sponsor: Wolf-Dietrich Heyer, Ph.D.
Microbiology and Molecular Genetics

Translesion synthesis (TLS), a response to DNA damage, is associated with the accumulation of mutations due to its error prone mechanism. TLS utilizes specific nonessential DNA polymerases that can bypass lesions, which the replicative polymerases cannot. S. cerevisiae has four active TLS polymerases called Poleta, Polzeta, Pol4, and Rev1. I hypothesized that TLS DNA polymerases contribute significantly to mutation accumulation within yeast cells. Using homologous recombination I created single mutants in each TLS gene. The single and subsequent double mutants were mated to create the quadruple mutant. The *rev1rev3rad30pol4* mutant was grown and analyzed for mutation accumulation. This analysis used the *CAN1* forward mutation assay, to evaluate mutations within the *CAN1* gene. The mutation rate decreased 58% when all TLS polymerases were absent, supporting my hypothesis. CHEF gel analysis of the quadruple mutant demonstrated no major genome instability. The quadruple mutant is being grown for 500 mitoses and analyzed with whole genome sequencing. Through this project we can begin to understand how mutations at these genes can affect the accumulation of mutations in the human genome, and how this may affect the development of disease and tumor progression.

Improve Fatigue Resistance of Concrete Using Recycled Rubber

Patricia Chavez
Sponsor: Dawn Cheng, Ph.D.
Civil and Environmental Engineering

Every year, 290 million scrap tires are produced in the United States and 91% of this amount ends up in stock piles. These huge amounts of stockpiles are problematic and require proper and safe disposal that takes considerable amount of economic resources. In the last decade, researchers have looked into recycling tire rubber in materials such as plastic, landfill covers and concrete. Typical concrete is extremely stiff and strong in compression, but lacks ductility and tensile strength, which we hope to increase with the addition of rubber. This research will examine how concrete's fatigue performance is affected by the addition of rubber particles. In order to measure the effectiveness of adding rubber, standard fatigue tests will be performed on concrete beams containing different quantities and types of rubber. It is expected that utilizing rubber in concrete mixing will improve the behavioral aspects such as fatigue life and energy absorption ability. Incorporating scraps of tire rubber into concrete mixing could both strengthen concrete and divert a hazardous waste into a recycled material.

The Star Formation Histories of Galaxies in the SC1324 Supercluster

Nelson S. Cheung
Sponsor: Lori Lubin, Ph.D.
Physics

The star formation rates of galaxies provide a core indicator of evolution in the cluster galaxies population. We investigate the evolution of galaxies in dense environments in the early universe, quantifying the populations of passive, star forming, and starburst galaxies in the 346 spectroscopically confirmed members of the SC1324 supercluster at $z \sim .76$ as a part of the Observations of Redshift Evolution in Large Scale Environments (ORELSE) survey. With spectroscopic data taken with the Deep Imaging Multi-Object Spectrograph (DEIMOS) on Keck II, we are able to create a spectroscopic catalog featuring the Equivalent Widths (EW) of [OII] and Hδ of the supercluster's constituent galaxies. Using a spectral classification of star formation for galaxies, we create histograms showing the distribution of the different spectral types in the four clusters. Through these histograms, we are able to determine that the supercluster members are each in different parts of their evolutionary history that correlates with the star-formation rates of the galaxies.

Interactive Two Dimensional Surface

Jonathan C. Chia
Sponsor: André Knoesen, Ph.D.
Electrical and Computer Engineering

The purpose of this project is to create an interactive exhibit that attracts an audience of all ages to electronics and engineering as a whole. What is a better way to appeal to such an audience than to utilize not just the visuals but also sound and touch? Rather than build a grid board consisting of only tri-colored light emitting diodes that only presents visual appeal with no interaction, we combine the lights with proximity sensors to produce a stimulating response for the user. Set with a square matrix grid, the interactive two dimensional surface uses proximity sensors to respond to the user. As the user interacts with the surface, the proximity sensors react to the reflections in infrared light, sending signals to the microcontroller which then turns on the respective light emitting diode and sound device in the grid. We will make the interactive two dimensional surface of the table holding the printed circuit boards of individual components detachable, allowing users to learn and see how the parts are put together to make the system work. The table will also be programmed with simple games such as paint, puzzle blocks, and a music mode to encourage user interaction.

Interactive Two Dimensional Surface

Ryan Chiang
Sponsor: André Knoesen, Ph.D.
Electrical and Computer Engineering

The purpose of this project is to create an interactive exhibit that attracts an audience of all ages to electronics and engineering as a whole. What is a better way to appeal to such an audience than to utilize not just the visuals but also sound and touch? Rather than build a grid board consisting of only tri-colored light emitting diodes that only presents visual appeal with no interaction, we combine the lights with proximity sensors to produce a stimulating response for the user. Set with a square matrix grid, the interactive two dimensional surface uses proximity sensors to respond to the user. As the user interacts with the surface, the proximity sensors react to the reflections in infrared light, sending signals to the microcontroller which then turns on the respective light emitting diode and sound device in the grid. We will make the interactive two dimensional surface of the table holding the printed circuit boards of individual components detachable, allowing users to learn and see how the parts are put together to make the system work. The table will also be programmed with simple games such as paint, puzzle blocks, and a music mode to encourage user interaction.

Comparing the Environmental and Economic Disadvantages of Two Thin Film Solar Cells

Victoria F. Chin
Sponsor: Julie M. Schoenung, Ph.D.
Chemical Engineering and Materials Science

The study of thin film solar cells made of layers of either Copper Indium Gallium and Selenium (CIGS) or Copper Zinc Tin and Sulfur (CZTS) has been increasingly popular as the push for viable renewable energy technologies continues to advance. However, these two types of thin film solar cells both show the potential to be unsustainable due to the fabrication processes and/or the materials contained in the products. CZTS is generally promoted as being more environmentally responsible but with little justification. Thus, the purpose of this current work is to quantitatively compare these two technologies on the basis of hazard traits, life cycle impacts, process economics, recycling potential, and energy consumption/production. We will examine these endpoints using tools such as process flow diagrams, material/energy inventories, GreenScreen for Safer Chemicals, and Toxic Potential Indicator (TPI). Preliminary Results indicate that the two cells use similar materials even if those materials are not a part of the final product. On the other hand, CZTS does not use as many rare earth elements, which should positively affect its sustainability, materials availability, and economic feasibility.

Love and Laughter: Attachment Style and the Use of Humor When Emotionally Supporting a Relationship Partner

Jia Chong
Sponsor: Phillip Shaver, Ph.D.
Psychology

In romantic relationships it is important for partners to be able to support each other in times of need, which requires mastering a range of social skills. Yet attachment theory, one of the major frameworks for studying close relationships, has so far focused almost exclusively on reducing negative emotions, without considering how positive processes, including humor, might contribute to this goal. In the current study, I will test two hypotheses about the use of humor by analyzing videotaped couple interactions during which one partner discloses a personal problem and the other partner responds. First, I will determine whether dispositional attachment insecurity of two kinds, anxiety and avoidance, is associated with the frequency and type of humor used by the responding partner. Second, I will examine the effects of cognitive depletion (mental fatigue) and experimentally enhanced security on the use of humor. I predict that more securely attached individuals will use positive forms of humor and that an increase in cognitive depletion and decrease in security enhancement will result in more negative forms of humor.

Effects of Pectinolytic Yeasts in Olive Firmness of Pilot Fermentations

Elaine Chow
Sponsor: Maria Marco, Ph.D.
Food Science and Technology

Recent spoilage events that occurred at commercial olive processing facilities in California resulted in the degradation of the mesocarp (pectin-containing tissues) of Sicilian-style Sevillano table olives. In a previous pilot fermentation study, we found that pectinolytic strains of *Saccharomyces cerevisiae* and *Pichia manshurica* were associated with the softening of the olives. The addition of a strain of *Pichia kudriavzevii* to fermentations containing the pectinolytic *P. manshurica* strain inoculant appeared to be protected against extensive tissue degradation. To further investigate these interactions, eight different pilot-scale olive fermentations were initiated in October 2012. Thus far, we confirmed that *S. cerevisiae* is pectinolytic, and hence, detrimental to the structural integrity of olives. However, we have also observed that the presence of *P. kudriavzevii* can counteract the damage caused by pectinolytic *S. cerevisiae*. To better understand the roles of pectinolytic yeast in olive fermentations, individual yeast isolates are being measured for pectinolytic activity in a radial diffusion assay using polygalacturonic acid as a substrate. The yeasts will be identified by ribosomal sequencing. This project will provide fundamental knowledge on the diversity and functions of pectinolytic yeasts and result in applications of this knowledge to support the California olive industry.

Convergent Feeding Kinematics in Elongate Cichlids

Joshua S. Chow
Sponsor: Peter C. Wainwright, Ph.D.
Evolution and Ecology

We examined the feeding strike kinematics of *Crenicichla strigata* and *Rhamphochromis longiceps*; distantly related species from the Cichlid family. *Crenichla strigata* is a solitary Amazonian ambush predator, while *Rhamphochromis longiceps* is a pursuit predator in the open waters of Lake Malawi in Africa. Despite their dissimilar habitats, the two species have independently evolved elongate heads with large jaws. We tested whether these two fish evolved convergent feeding kinematics by filming five *C. strigata* and five *R. longiceps* with a high-speed camera. We used juvenile cyprinids as prey, releasing one at a time through a feeding tube. We took these videos and digitized them in MATLAB. We tracked eleven points through the duration of the strike and then generated six excursion variables and six time to peak moment variables for each individual. To analyze potential differences between the two species, we used mixed models in R, with species and size (head length) as fixed effects, and individual as a random effect. We found no significant differences in the excursions and timings of *C. strigata* and *R. longiceps*. This suggests that *Crenichla strigata* and *Rhamphochromis longiceps* have evolved convergent, feeding strikes despite their different evolutionary history, habitats, and predatory behaviors.

Expression of Colorless Non-Ripening (CNR) Provides Insight into Susceptibility of Tomato Fruit to Pathogens

William M. Christie
Sponsor: Ann L. Powell, Ph.D.
Plant Sciences

Fruit ripening is a developmental process associated with an increase in pathogen susceptibility. Unripe fruit show less susceptibility to infection, however susceptibility increases as fruit matures to the ripe stage. *COLORLESS NON-RIPENING (CNR)* is a transcription factor that has been identified as key regulator of ripening. Mutation in the *CNR* gene results in fruit that do not ripen normally and are highly susceptible to pathogen infection, particular to the fungus *Botrytis cinerea*, even at the unripe stage. We hypothesize that *CNR* expression is altered in wild type and mutant fruit upon fungal infection, and that this change in expression pattern has an impact on fruit susceptibility. To test this hypothesis, wild type and mutant fruit at unripe and ripe stages were inoculated with *B. cinerea* for analysis of *CNR* expression. Healthy fruit were used as control. Relative expression (i.e. qPCR) results showed that *CNR* increases in infected unripe fruit and declines in infected ripe fruit. These observations suggest that CNR might have a role in resistance of fruit before ripening begins. Understanding defense mechanisms in fruit, such as those controlled by CNR, could lead to the development of resistant crops, eliminating the need for pesticides and other harmful chemicals.

Analysis of MeCP2 Binding Sites Through Bioinformatics

Roy Chu
Sponsor: Janine LaSalle, Ph.D.
Medical Microbiology & Immunology

Rett syndrome is a neurodevelopmental disorder affecting one in every ten thousand births with symptoms including repetitive abnormal hand movement, cognitive disability, and impaired breathing. Mutations in the gene encoding methyl CpG binding protein 2 (*MECP2*) are found in over 95% of Rett syndrome cases. The protein MeCP2 binds throughout the genome with a high affinity to methylated DNA. Chromatin immunoprecipitation sequencing (ChIP-seq) is a commonly used technique to locate DNA binding protein sites but current ChIP-seq tools are inadequate to specifically determine MeCP2's preferred binding sites because of its high abundance in chromatin. To compare the MeCP2 data with other relevant genomic data, including DNA methylation and gene expression, Perl scripts were written to convert the ChIP-seq data to readily observed formats in the UCSC Genome Browser and allow tracks to be easily downloaded for analysis. Results from comparing the MeCP2 data with genes expressed in neuronal tissue and DNA methylation patterns are predicted to broaden understanding of MeCP2 binding sites. Improving knowledge of MeCP2 binding sites will be critical to understanding the mutations underlying Rett syndrome.

Aquatic Hypoxia and its Effect on Zinc Toxicity

Hannah Chung
Sponsor: Gary N. Cherr, Ph.D.
Environmental Toxicology

Metallothionein up-regulation is induced by hypoxia in prostate cancer cells and squamous carcinoma cells. However, the relationship between hypoxia and metallothionein up-regulation has not been studied outside of human cancer cells. The purpose of this study was to ultimately determine whether or not metallothionein proteins could be up-regulated due to hypoxia in the early life history stages of a marine invertebrate; and also the impact of hypoxia on metal toxicity. To investigate this, the effects of the xenobiotic, Zn^{2+}, coupled with hypoxia, was observed in the embryos of the purple sea urchin, *Strongylocentrotus purpuratus*. The embryos were cultured in normoxic and hypoxic water for a brief period during development. They were then allowed to recover, and exposed to a range of Zn^{2+} exposures. There appeared to be neither an additive nor diminutive effect when the two stressors were combined, as compared to the effects of hypoxia alone. While there seems to be no major relationship between aquatic hypoxia and metallothionein expression, hypoxia does lead to developmental delay in *S. purpuratus* embryos, suggesting that metallothionein proteins do not play a major role in combatting hypoxia.

How John Company Got Red Coats: Uniform Standardization in the East India Company

Gideon D. Cohn-Postar
Sponsor: Sudipta Sen, Ph.D.
History

An indelible symbol of the long rule of the British East India Company- the Red Coat was much more than a mere stylistic choice intended to echo the uniform of the regular British army. The standardization of the Company's uniform in the 17th century draws together three threads of history that are seldom connected: Europe's Revolution in Military Affairs, the new wave of colonialism and imperialism, and the cultural and aesthetic trends of the Indian subcontinent. While past analyses have treated the development of the Company's army as a physical example of the introduction of European modernity and aesthetics into Imperial India, the reality is far less clear cut. The army, as an agent of oppression, capitalism, imperialism and fashion, was both an outgrowth of organizational revolutions in Europe, and an acceptance of the political and cultural realities necessary for the piecemeal conquering of India. Influenced by India as much as they dominated it; the Company, the army, and its uniform provide a historical bridge between the Europe of Gustavus Adolphus and Cromwell and the India of Aurangzeb, Clive and the Wellesleys's.

Analysis of the Role of a Small Bacterial Protein in Triggering Rice Xa21-mediated Immunity

Jacob Conston
Sponsor: Pamela C. Ronald, Ph.D.
Plant Pathology

Bacterial blight is a significant disease in rice plants caused by the pathogen *Xanthomonas oryzae* pv. *oryzae* (*Xoo*). Rice strains containing the *Xa21* gene have immunity against *Xoo* strains with Ax21 (activator of Xa21-mediated immunity) activity. Previous research has identified four bacterial genes required for Ax21 activity. *raxA*, *raxB*, and *raxC* encode proteins similar to those found in bacterial type I secretion systems involved in secretion of double glycine-leader (GG-leader) peptides. *raxST* encodes a sulfotransferase-like protein involved in peptide processing. Sequencing and characterization of the genomic region containing *raxA*, *raxB*, and *raxST* in cells with Ax21 activity has identified an open reading frame, ORF 9, that encodes a putative GG-leader peptide. Using polymerase chain reaction and bacterial cloning techniques, we have generated a modified ORF 9 peptide carrying a histidine residue tag. The next step will be to sub-clone the modified ORF 9 gene into an expression vector that will be transformed into *Xoo*. Future experiments will determine if the tagged ORF 9 gene product is secreted through the type I system, if the candidate leader peptide is cleaved, and if ORF 9 plays a role in the virulence of *Xoo*.

Association of SNPs in Desiccation Resistance Genes of Malaria Vector, Anopheles Gambiae s.l. in Cameroon

Desirae Costello
Sponsor: Gregory Lanzaro, Ph.D.
Pathology, Microbiology and Immunology

Organisms that transmit but are not infected by disease agents are known as vectors. Previous research has indicated the existence of differential infection and transmission rates between the various forms and species of mosquitos that vector malaria. Throughout Africa, there are significant climate variations, resulting in areas that are incredibly arid and others that are humid. If a certain group of mosquitoes is more resistant to desiccation they will have increased survival rates in arid climates, increasing the vector population through which malaria could be transmitted. This project will provide an improved understanding of specific genes thought to be related to the differential survival of different species and forms of malaria vectors and thus provide clues as to how we can best approach the task of creating genetically modified mosquitoes that are incompatible vectors for the Plasmodium protozoans that cause malaria. The single nucleotide polymorphism(s) (SNP) in the gene(s) involved in desiccation resistance is responsible for adaptation of the African malaria mosquito, *Anopheles gambiae* in different ecological zones. Genomic DNA was extracted, amplified and sent out for sequencing to provide understanding of the relationships between species and molecular form, climate and genotype for each gene under investigation.

Investigation of Sulfur Dioxide Disappearance in Wine Under Anaerobic Conditions

Mara Couch
Sponsor: Andrew L. Waterhouse, Ph.D.
Viticulture & Enology

Found in "free" and "bound" forms, sulfur dioxide (SO_2) is the major enologically applied wine antioxidant. Because traditional bottle closures allow air from the environment to effuse into a bottle's head space, wine is slowly exposed to oxygen during the aging process. This results in the formation of oxidation products with undesirable sensory properties. Free sulfur dioxide slows this process by reacting with these oxidation products and effectively neutralizing their unpleasant properties. Thus, as the concentration of bound SO_2 increases, the concentration of free SO_2 decreases. Interestingly, decreases in free SO_2 have also been observed under anaerobic conditions where no chemical oxidation could be expected. The objective of my investigation is to identify compounds that are intrinsic to wine with which free sulfur dioxide could react under anaerobic conditions. Targeted compounds will be added with a source of SO_2 to model wine and sealed in glass ampoules in the absence of dissolved oxygen. Temperature and pH factors will also be tested for changes in the percent of free and bound SO_2. In the case that a compound having special reactivity with SO_2 is identified under experimental conditions, further structural characterization will be considered.

Evidence of *Frankia* Presence Indicates Nitrogen-fixing Root Nodule Symbiosis with the Endangered Species, *Ceanothus Ferrisiae*, on Serpentine Soil

Cristina Covblic
Sponsor: Alison M. Berry, Ph.D.
Plant Sciences

Molecular biology techniques are irreplaceable research tools in a wide range of studies from forensic to ecological sciences. Polymerase Chain Reaction (PCR) amplification and DNA sequencing were critical tools to investigate ecological factors affecting the survival of an endangered California native shrub species, *Ceanothus ferrisiae*. *C. ferrisiae* grows only on serpentine soil. These soils are high in iron and magnesium, contain heavy metals, and poor in essential nutrients such as nitrogen. *Ceanothus* species form root nodules, symbiotic relationships with nitrogen-fixing bacteria called *Frankia*. It is unknown whether *Frankia* can even survive on serpentine soil, or if *C. ferrisiae* can be nodulated successfully. A gene coding for glutamine synthetase (glnA), highly conserved in all organisms, was amplified, sequenced and analyzed. Results indicated the presence of *Frankia* in the soil samples, but only in soils where *C. ferrisiae* were present, strongly suggesting a potential symbiotic relationship. The nitrogen isotope abundance of plant leaf tissues in these sites was also measured, and was consistent with the PCR data. It is still unknown what triggers *Frankia* to only be found in soils with *C. ferrisiae* but it is possible that the shrub releases certain exudates to attract the bacteria.

Exploring Possibilities in Printmaking

Caitlin B. Crady
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Art Studio

Printmaking developed as a means of mass-producing images and documents, so the traditional expectation is that every print in an edition be perfectly identical. My recent work with intaglio etching and monoprinting has led me away from this tradition. Monoprinting involves painting and manipulating ink on a zinc plate before printing it onto paper. As a result, it is impossible to have an edition of more than one, because every print comes out unique. Even if I re-print the 'ghost' of an image, I can take the two prints in very different directions by painting over them with sumi ink, watercolor, gouache or acrylic. I treat my etchings similarly. In doing so, I have repurposed the printmaking process from one of replication to one of possibility. This blending of mediums has helped me improve both as a painter and a printmaker. My subject matter is often narrative and character-driven. Aside from this, I explore a range of ideas with my work, from gothic horror to cyberpunk.

Percent Root Colonization of Arbusular Mycorrhizal Fungi (AMF) on the Roots of Wheat Plants

Anna Ruth Crittenden
Sponsor: Kate M. Scow, Ph.D.
Land, Air and Water Resources

Arbuscular mycorrhizal fungi (AMF) serve important functions in plant growth, such as increasing phosphorus availability and reducing drought stress. Conventional agricultural practices, including tillage and fertilizer application, can hinder the effectiveness of AMF in aiding plant growth. The purpose of this study is to compare the percent root colonization by AMF on the roots of wheat plants grown under two different agricultural systems. Under the first, the wheat undergoes a one-year rotation with a cover crop. In the second system, the wheat has no inputs, and the field is left fallow in between wheat plantings. To measure the percent root colonization by AMF, a staining method will be used on a section of roots for each sample of wheat, the roots will be examined under a microscope, and a standardized method of counting mycorrhizal structures will be applied. I predict that the wheat plot with no inputs will have a higher AMF colonization percentage due to higher stress levels. This research will help to more fully characterize the two agricultural systems with regards to the presence of AMF, and will aid future decisions made based on the benefits and costs of each system.

Mama Love Papa: Establishing Gender in Gentlemen Prefer Blondes

Annika Cunningham
Sponsor: Matthew Stratton, Ph.D.
English

The ratification of the Nineteenth Amendment to the United States Constitution in 1920 not only allowed women a space in the U.S. body politic, but also acknowledged the changing roles for females in American society. For some, the Women's Vote signaled a new era of female progress wherein women were able to pursue careers and participate in public activities unchaperoned. For others, however, the new amendment simply confirmed a small change in female status that had already happened. In 1925 Anita Loos examined this new "equality" for American woman in her serial-novel *Gentlemen Prefer Blondes*. While many saw Loos' work as a comic spoof meant to amuse *Harper Bazaar's* middlebrow magazine audience, Loos' satire also challenged the paradoxical artificiality of traditional and contemporary gender codes. My research focuses on representations of women in *Blondes* because I want to find out how literature contributed to and challenged gender identities of American women in the 1920s. By examining new models of love and marriage, and the rise of mass consumerism in the 1920s, I wish to help readers understand how political, social and economic changes can determine, or un-determine, gender roles.

Investigation of the Ubiquitin Proteasome System in Type I Diabetic Mice

Gunitika Dandona
Sponsor: Aldrin Gomes, Ph.D.
Neurobiology, Physiology, and Behavior

Diabetes affects a staggering 25.8 million people in the United States, and about 65% of people with diabetes die from heart disease and stroke. The pathological changes in diabetic hearts are characterized by loss of cardiac muscle and degradation of connective tissue. High blood glucose in adults with diabetes increases the risk for heart disease and cardiac failure, which is the leading cause of death in diabetes. This study uses Akita mice for Type 1 diabetes experiments at two week (pre-diabetic), five week (recently diabetic), and twelve week time points. A few published reports suggest that the Ubiquitin Proteasome System (UPS) may play a role in heart disease in diabetics. The UPS is a system that is active in cardiac muscle and has been shown to mediate loss of muscle mass, including cardiac muscle mass. However, significant knowledge gaps still exist in the study of the proteasome in relation to diabetic cardiomyopathy. This project utilized fluorogenic proteasome degradation assays, immunoblot analysis, and quantitative PCR to investigate the activity of the UPS in type I diabetic mice. Results indicate a larger role for protein degradation than suppressed protein synthesis in the cardiac atrophy apparent in Type 1 diabetic Akita mice.

Determining the Hierarchy of Neutrino Masses Using Fourier Analysis and Matched-Filter Signal Processing

Daine L. Danielson
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Physics

Neutrinos are among the least understood elementary particles, with theorized properties capable of resolving major open problems in modern physics such as the disparity between matter and antimatter present in the observed universe. Determining the hierarchy of the three observed neutrino mass states would mark a major milestone in unlocking these particles' secrets. The sign of delta Δm^2_{32}, the difference between the second and third squared neutrino masses, is unknown; a positive value defines the "normal," and negative the "inverted," mass hierarchy. Analyzing simulated neutrino detector outputs, we implement a discrete Fourier transform of detection rate as a function of neutrino flight distance over neutrino energy. Using an unconventional matched-filter signal processing technique, we compare the transformed spectrum to the predicted normal and inverted hierarchy spectra to determine the hierarchy present in the detected data. Using this technique, an experimental determination of the sign of delta Δm^2_{32} may be possible, bringing resolution to the neutrino mass hierarchy problem.

A Comparison of Homogenization Methods for Proteomic Analysis of Human Skin

Naficeh Dastgheyb
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Pathology and Laboratory Medicine

Healthy skin is vital in preventing infection against pathogens. This study compares the efficiency and accuracy of four methods for the proteomic analysis of injured skin. Excess healthy and burned skin samples, from patients underdoing skin grafting surgery at UC Davis Firefighters Burn Institute Regional Burn Center, were analyzed. Standardized pre-minced skin pieces were homogenized using the following methods: tissue protein extraction reagent (T-PER), repeated freezing/thawing (RFT), stainless steel bead beating (SSBB), and mechanical pressure cycling technology shredder (PCTS). Protein lysates from each method were first analyzed by SDS-PAGE and then by 2D-gel for comparisons of various parameters. The results show that all methods were equally efficient, taking small amounts of time to complete, and equally accurate, yielding similar numbers of spots and spot map distributions on the 2D-gel. If cost is a concern, then T-PER and RFT are preferable methods; however, only SSBB and PCTS allow for the containment of infectious agent aerosols. The efficient and accurate proteomic analysis of injured skin for biomarker discovery will aid physicians in determining the most appropriate treatment(s) for patients.

Local Effects of Ovarian Steroid Hormones on Lactational Performance of Non-Pregnant Cows through Teat Infusion with or without Subcutaneous Injection

Albert R. Davalos
Sponsor: Russ C. Hovey, Ph.D.
Animal Science

Reproductive failure is detrimental to the dairy industry. By using ovarian steroid hormones, specifically estradiol (E) and progesterone (P), a non-pregnant cow can be induced to lactate, making her useful once again. This induced lactation experiment used the half-udder model to study the effect of intramammary infusions of E and P on half the udder of a non-pregnant cow. Eight non-pregnant Holstein cows received 10 mL intramammary infusions of E (5 ug/ml) and P (12.5 ug/ml) on one side of the udder via the teats. The control side of the udder received a 10 mL infusion of saline. Teat infusions were performed for 3 non-consecutive days. Additionally, four cows were chosen at random to receive subcutaneous injections of E and P in addition to their teat infusions. The sc. doses depended on the weight of the cow receiving the injection. After 18 and 19 days of treatment, all cows received injections of dexamethasone and milking commenced the next day. We hypothesized the udder half that received the hormone treatment would produce more milk than the side that had received the saline. Furthermore, we predicted that the four cows that had received subcutaneous injections would have the highest overall milk production.

Remote Surface Rupture Measurements of the 2010 El Mayor-Cucapah Earthquake

Jaime E. Delano
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Geology

Earthquake surface ruptures reveal mechanisms of earthquake occurrence and inform evaluation of seismic hazard. The 2010 El Mayor-Cucapah earthquake surface rupture in Baja California, Mexico, was one of the first to be comprehensively scanned with high resolution lidar topography. Using lidar point cloud data, I collected vertical and lateral offset measurements in a uniform, high-density fashion. Compared to traditional field methods, collecting offsets with lidar is efficient and allows for the study of inaccessible regions. Vertical offsets are calculated from topographic profiles across fault scarps, while lateral offsets are calculated by matching topographic features on either side of the fault with cross-correlation. These values are used to assess the distribution of fault slip as well as for comparison with data collected via traditional field methods. Lidar measurements are limited to regions with compatible terrain, and cannot resolve subtle offset markers that may be measured in the field. Findings thus far indicate that lidar offsets correlate well with existing field data, reveal additional deformation, and shed light on regions that were previously sparsely studied. This information, along with further implementation of this technique, can illuminate surface rupture trends and hazard.

Gene Therapy for Prader-Willi Syndrome

Peter Deng
Sponsor: David Segal, Ph.D.
Biochemistry and Molecular Medicine

Prader-Willi syndrome is under an umbrella of autism spectrum disorders that is caused by the deletion of the 15q11-13 region in chromosome 15 and is characterized by hypotonia, hyperphagia and numerous cognitive disabilities. Humans have two copies of chromosome 15 from their maternal and paternal parents respectively. However, due to genetic imprinting, only paternal genes affect PWS while the maternal genes are silent. Thus, the loss of paternal genes is enough to eliminate the only active copies of the genes in the individual. Our prospective method of addressing this issue is gene therapy via the use of novel proteins that will activate the silenced genes in PWS children before further developmental issues arise. Mouse models show that PWS-mice have a specific phenotype that is the inverse of human models-- lower body weight compared to wild-type mice. Over the next three months we will measure PWS-mice weight in relation to their wild-type siblings after biweekly treatments with our novel protein. If there is indeed a decrease in discrepancy between control and experimental weights between groups, then our novel protein is potentially activating the deleted paternal gene. This would be a significant step in developing treatment for PWS patients.

Increasing the Kinetic Activity of a Polyethylene Terephthalate Degrading Protein: A Rational Protein Engineering Approach

Colin K. Deniston
Sponsor: Marc Facciotti, Ph.D.
Biomedical Engineering

Current plastic recycling methods are unsustainable and economically unfriendly. In 2012 in a metagenomic analysis on leaf cut material an enzyme LC-cutinase was discovered, that could break down the commonly used plastic, polyethylene terephthalate. However, for commercial use the overall kinetic activity needed to be improved. Towards this goal I created a homology model and used the software FoldIT to rationally design potentially beneficial mutations. I primarily targeted the catalytic site and designed mutations that could increase its size and/or hydrophobicity. To date, I have constructed several of the mutants and purified these proteins by affinity chromatography. I am in the process of refining the kinetic assay. Though kinetic results with pure enzyme have not yet been obtained preliminary whole cell assays suggest possible increases in mutant enzyme activity. If this approach is successful it could open new bio-based recycling approaches for the cleanup and recycling of plastic waste. These "biocycling" approaches could divert much more plastic waste back into the production process than is currently possible, creating a completely new recycling avenue.

Eligibility Dynamics of the Earned Income Tax Credit

Aileen Devlin
Sponsor: Ann Stevens, Ph.D.
Economics

The earned income tax credit (EITC) is a federal program that offers a refundable tax credit to families with low earned income. I investigate whether the EITC could offer a long term source of income. I used Stata to analyze data from the 1986 to the 2001 surveys from the Panel Study of Income Dynamics to find the distribution of EITC spell lengths (consecutive years of eligibility) and the distribution of spell lengths of non-eligibility. I also used logistic regressions to find the probability of an EITC spell ending and the probability of returning to EITC eligibility. The mean spell length of eligibility was 2.3 years and the mean spell length of non-eligibility was 2.4 years. Distributions of spells of eligibility ranged from 1 year to more than 8 years, with 20 percent maintaining eligibility for more than 4 years. The probability of losing eligibility fell as the length of the spell increased. I concluded that for many people the EITC is short term income source lasting only a few years, but that others use it as a long-term income source.

A Screen for Determinants of β-lactam Induced Cell Lysis in *Escherichia Coli*

Karina Diaz
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Molecular and Cellular Biology

The bacterial cell wall consists of peptidoglycan synthesized by two main enzymes: Penicillin Binding Protein 1A and B (PBP1A and PBP1B). β-lactam antibiotics (i.e. Penicillin) inhibit PBPs, resulting in cell lysis by unknown mechanisms. There is speculation that lysis results from continued activity of cell wall hydrolases without peptidoglycan regeneration. Thus, I screened proteins to identify which confer resistance to lysis after treatment with the β-lactam cefsulodin, testing *my hypothesis that one of the proteins identified would be a hydrolase. I subjected a library of E. coli transp*oson mutants to cycles of cefsulodin treatment, selecting mutant(s) exhibiting increased survival compared to the wild type. All 64 transposon mutants treated with cefsulodin for 1 hour, and 4 of 8 mutants treated for 3 hours, had at least a 10-fold increase in survival compared to the wild type. These mutants contained insertions in members of the maltose utilization pathway and putative transporters, but not in any hydrolases. My results argue against my hypothesis that lysis is explainable solely by cell wall hydrolase activity since none were identified; however, they do suggest that factors not directly involved in cell wall synthesis or degradation are potentially important for the lethal action of β-lactams.

Effect of Dietary Nitrate Supplementation on Dairy Cattle Enteric Methane and Nitrous Oxide Emissions

Joseph F. Dorsch
Sponsor: Frank Mitloehner, Ph.D.
Animal Science

Nitrate acts as an alternative hydrogen sink in the fore-stomach (rumen) of cattle to reduce methanogenesis and therefore methane emissions, a greenhouse gas. However, nitrate in the rumen may be reduced to nitrous oxide, an even more potent greenhouse gas, which could offset the benefits of supplementing nitrate to reduce methane emissions. The present study investigated the effects of varying concentrations of nitrate supplementation (1, 2, and 3% nitrate) on enteric methane and nitrous oxide emissions with an in vitro gas production system. The *in vitro* systems were incubated for a period of 12h at 39°C. Gas samples were collected every 2h and analyzed for carbon dioxide, methane, and nitrous oxide concentrations. Nitrate vs. urea treatment at 2% and 3% decreased ($P<0.001$) methane production during the early and overall incubation period. Nitrous oxide production was observed only in the nitrate treatments. This study indicates that nitrate supplementation is an effective strategy to mitigate methane emissions from cattle, but the treatment induces nitrous oxide emissions. Further research is necessary to confirm these results *in vivo* and elucidate methane and nitrous oxide emission dynamics from rumen eructation.

Textural Changes and Moisture Absorption in Raw and Roasted Almonds During in Vitro Gastric Digestion

Krista C. Drechsler
Sponsor: R. Paul Singh, Ph.D.
Biological and Agricultural Engineering

It is crucial to understand the changes in food mechanical properties during gastric digestion due to their influence on food breakdown, gastric emptying, and ultimately nutrient release. The objective of this study was to examine texture and moisture changes in raw and roasted almonds during *in vitro* gastric digestion. Almonds were soaked in simulated saliva and gastric juice up to 24 hours at 37°C. A rapid decline in textural properties (peak force and compression work) and an increase in moisture content were observed during the first 5 minutes of digestion. The greatest changes in textural properties and moisture content occurred during the first hour of digestion and gradually decreased over 24 hours. Almond type, particle size, and digestion time significantly influenced peak force, compression work, and moisture content ($p < 0.01$). It is important to understand the role particle size and roasting conditions play in influencing almond satiation properties and nutrient absorption efficiency during gastric digestion.

Optimized Rapid LC/MS Method for the Detection, Identification,and Quantification of Carotenoids in Grape Berries

Geoffrey A. Dubrow
Sponsor: Susan E. Ebeler, Ph.D.
Viticulture & Enology

Carotenoids are a class of C_{40} terpenoid pigments responsible for the yellow and orange hues found in many fruits and vegetables. The breakdown of carotenoids in grape berries into norisoprenoid flavor compounds has been previously shown to play an important role in the development of wine aroma and flavor. Existing methods for sample preparation and High-Performance Liquid Chromatographic (HPLC) analysis of these important compounds in grapes are time consuming, difficult, or rely solely on a Diode Array Detector (DAD) for detection of compounds, rather than the superior compound identifying power of a mass spectrometer. In this project, a novel method using High-Performance Liquid Chromatography coupled to a Diode Array Detector and an Atmospheric-Pressure Chemical Ionization Mass Spectrometer (HPLC/DAD/APCI-MS) was developed to provide rapid and accurate detection, identification, and quantification of carotenoids in grape berries. This method can be used for further research on the development and effects of carotenoids in grapes and wine.

A Modified Gale-Shapley Algorithm For the TA-Classes Assignment Problem

Connor Duthie
Sponsor: Jesus De Loera, Ph.D.
Mathematics

In the past, administrators in the Mathematics Department spent upwards of eight hours constructing a feasible matching between graduate student teaching students and discussion sections by heuristics, which often led to a less than optimal pairing between the two. This led to a subsequent need for a more efficient and effective method of matching. We discuss an implementation of a program that generates an optimal matching between these two parties based on the theory of the Stable Marriage Problem, or more generally the Assignment Problem. This new method generates a solution on the order of one hour, which includes generating the input by hand. Although our problem could be formulated as an integer-programming problem, we instead present our matching problem using graph theory and utilizing the Gale-Shapley algorithm to generate a solution in polynomial time. Several constraints are considered, including a graduate student's availability, seniority, and the need to assign a single graduate student to multiple classes.

God and Godzilla: How an Atomic Metaphor Became a Modern Day Deity

Jonathan E. Dyer
Sponsor: Naomi Janowitz, Ph.D.
Religious Studies

Fields of religious study that attempt to identify and categorize syncretism between religions are confronted with the double fold problem of transmission and reinterpretation. For example, diffusionists like Bruce Lincoln are compelled to understand not only the recurrence of certain mythic tropes, but to explain how those tropes moved from one culture to another. One way to remedy this problem is to examine examples of mythic tropes that manifest themselves in modern popular culture. To this end, my paper examines the great monster of 20th century Japanese cinema, Godzilla. Godzilla starts out as a simple metaphor for the atomic bombing, but goes on to become a modern example of one of the most popular mythic archetypes, the Indo-Aryan storm god. My plan is to examine Godzilla's filmography and analyze how he shares characteristics with other Indo-Aryan storm gods, and show how he evolved into this role. In doing this, I hope to provide diffusionists scholars with a clear example of how certain mythic tropes recur within cultures.

Experimental Calibration of the Plagioclase Geothermometer for Magmatic Systems

Paul M. Edwards
Sponsor: Chip Lesher, Ph.D.
Geology

The mineral plagioclase ($NaAlSi_3O_8$-$CaAl_2Si_2O_8$) is ubiquitous in crustal igneous rocks and can be used to constrain magmatic conditions from its chemical composition and zoning profiles. A reliable calibration of plagioclase composition as a function of crystallization temperature (plagioclase geothermometry) is lacking due to difficulty crystallizing equilibrium plagioclase from a silicate melt in the laboratory. In this study, high-temperature dynamic crystallization experiments are conducted at one-atmosphere and controlled oxygen fugacity to obtain compositionally homogeneous plagioclase in equilibrium with basaltic liquid for electron microprobe analysis. Samples are melted 15°C above the liquidus (1153°C) for 12hrs, cooled to 1095°C to trigger plagioclase nucleation, and brought to dwell 10°C below the liquidus temperature. A second set of experiments underway cycles samples 5°C above and 10°C below the liquidus. Experiments are run at 6, 12, 24, and 50 hours prior to quenching in water. These experiments will enable evaluation of the effects of time and thermal cycling on the attainment of chemical equilibrium and the distribution of Na and Ca between plagioclase and silicate melt as a function of temperature. Results will be used to constrain the thermal evolution of Skaergaard intrusion of Greenland, among other layered mafic intrusions.

More Than a Religious Painting: The Untold Depth of Augustus Vincent Tack's *Mystical Crucifixion*

Maizy E. Enck
Sponsor: Katharine P. Burnett, Ph.D.
Art History

American artist Augustus Vincent Tack, 1870-1949, though well-regarded in the American artistic community during his lifetime, faded out of the public eye until about thirty years ago, when a 1972 exhibition gave rise to a new appreciation of his art. This exhibition saw the abstract landscapes of his later years as a foundational precursor to American Abstract expressionism. Though Tack's large body of early work has been derided as unoriginal stylistic experiments, close examination of it reveals a highly innovative artist. Of these early works, especially overlooked is *Mystical Crucifixion*, an example of Tack's religious paintings. Whereas previous scholarship found *Mystical Crucifixion* a simple emulation of contemporary styles, my research demonstrates that in this work Tack is not only declaring his artistic identity through an idiosyncratic transformation of formalistic styles, but also setting the foundation for his later revolutionary abstract landscapes Though largely ignored in previous scholarship, *Mystical Crucifixion* is significant because it marks the critical turning point in Tack's artistic identity.

Screening the Nightmare: Terror Management in Children's Media

Katie D. English
Sponsor: Frances E. Dolan, Ph.D.
English

This study focuses on *Adventure Time*, a Cartoon Network series, as a contemporary retelling of *Peter and Wendy* by J.M. Barrie, specifically analyzing how children's media handle moral and social concerns. I am particularly interested in the transformation of the distinctly violent *Peter and Wendy*, the stage play and then novel, into the subdued Disney animated film adaptation *Peter Pan*, and then into the whimsical yet ominous *Adventure Time* cartoon series. It is important to consider the intersection of *Adventure Time* with these prior variations of the Peter Pan story because all of these versions expose seemingly irresolvable conflicts. These include the conflict between surveillance of the individual for "society's protection" and the right to privacy and that between society's desire for continued growth and its exhaustion of the environment into a post-apocalyptic landscape. These conflicts portrayed in *Adventure Time* and its precursors exemplify trends in the utilization of children's media-including stage plays and novels, animated film, and cartoons-as a means to expose and negotiate fears present in parallel "adult" society.

Characterization of the Pathogenicity Island in *Helicobacter Pylori* From Naturally Infected Rhesus Monkeys

Hasan D. Entwistle
Sponsor: Jay V. Solnick, M.D.
Medical Microbiology & Immunology

The microaerophilic bacterium *Helicobacter pylori* colonizes the gastric mucosa and epithelial layer of the human stomach. Persistent infection can lead to development of peptic ulcers or gastric adenocarcinoma in individuals infected with a strain that carries the cytotoxin associated gene pathogenicity island (*cag*PAI), a virulence determinant. The *cag*PAI encodes a type IV secretion system (T4SS) that translocates the CagA oncoprotein into epithelial cells, and is required for the induction of the pro-inflammatory cytokine interleukin-8 (IL-8). CagY, an essential structural component of the T4SS, has been shown to be involved as a molecular switch that alters the function of the T4SS and "tunes" the host inflammatory response so as to maximize persistent infection. Socially housed rhesus monkeys are often naturally colonized with *H. pylori* that is very similar to that which infects humans, but little is known about the cagPAI of the *H. pylori* strains that naturally infect these animals. Here we present data showing the prevalence of the cagPAI in *H. pylori* strains isolated from captive rhesus macaques, and the ability of those strains to induce IL-8. We also determined the DNA sequence analysis of the *cag*PAI from one of these strains.

Genetic Variation in the Necrotrophic Pathogen, Botrytis Cinerea

Robert M. Eshbaugh
Sponsor: Daniel J. Kliebentstein, Ph.D.
Plant Sciences

Botrytis cinerea is a necrotrophic fungal pathogen that infects nearly all plants, including the vast majority of agricultural crops. We conducted experiments to determine whether or not the fungi's virulence is affected by the genotypes of the plant, the fungal isolate, or both. Individual leaves from the model plant, *Arabidopsis thaliana,* were infected with *Botrytis cinerea* of a known genotype. In total, fifteen genotypically-diverse isolates of *Botrytis cinerea* were individually tested for infectious growth on each of two host genotypes. The growth and development of the fungus were visualized at different time intervals via a trypan blue staining and imaging analysis. Differences and similarities in phenotype based on the structure and development of the fungal isolates have been qualitatively observed and are in the process of being quantified. Quantitative image analysis may prove useful for novel categorical purposes and to identify patterns of structural development and progression among fungal isolates. The experiments do not, however, quantify the degree to which genetic variation in any one phenotype contributes to the combined virulence of the fungus.

Examination of Pyruvate Lyase Activity in Chorismate-Utilizing Enzymes: An Interconvertion of Structurally Related, Functionally Divergent Enzymes

Eduardo Espiritu
Sponsor: Michael Toney, Ph.D.
Chemistry

Identification of residues responsible for functional specificity in enzymes is a challenging and important problem in protein chemistry. The elimination mechanism for Anthranilate Synthase (AS) has not been fully characterized. Other chorismate-utilizing enzymes initiate a similar S_N2" reaction but lack the pyruvyl elimination mechanism of AS. Site directed mutagenesis and multiple sequence alignment with crystallographic studies have not determined the residues necessary for the elimination mechanism in AS. Herein, a bioinformatics method (named "Janus") was used to identify and rank amino acid residues that specify differences in functionality between two structurally similar chorismate-utilizing enzymes. JANUS is used here to predict the mutations required to convert one enzyme (ADCS) into a structurally related one (AS) of different substrate specificity. Our goal is to use directed evolution and gene shuffling of the residues generated from JANUS to generat e "hits" that have gained pyruvyl elimination function. Hits are obtained through a knockout strain unable to produce anthranilate and are grown on minimal medium plates lacking a tryptophan or anthranilate source. The "hits" will only grow if we have mutated ADCS correctly to produce the necessary anthranilate. Once a sufficient number of sequences are cataloged, we will determine the statistically relevant mutants.

Observing Sex Differences in Substantia Nigra and Ventral Tegmental Area

Daniel Esquivel
Sponsor: Brian Trainor, Ph.D.
Psychology

Although depression is reported twice as frequently in women, the majority of animal depression studies male rodents. Female *Peromyscus californicus* are aggressive and can be tested under social defeat paradigms. This allows for the analysis of neurological sex differences with regards to dopamine activity in the ventral tegmental area (VTA) and substantia nigra (SN). Previous studies have shown that dopamine activity in the VTA is associated with social aversion in male mice. No studies have focused on females, however. A neurological component describing increased rates of depression in females could be associated with the VTA. In addition, dopamine activity in SN has never been measured in either males or females. I assayed sex differences using immunohistochemistry to detect proteins that are indirect markers of neuronal activity (cFos) and dopamine protein synthesis (tyrosine hydroxylase - TH). My data suggested that there is a significant difference in total number of positive TH neurons between males and females in the ventral SN. Interestingly, the ventral subdivision of the VTA also provides evidence for increased colocalizations in female mice. This sex differences suggests the VTA plays a role in increased female susceptibility to depression.

Is It Possible to Isolate and Characterize Y_3C_{102}?

Sahar Fakhri
Sponsor: Alan Balch, Ph.D.
Chemistry

Fullerenes are carbon allotropes. Endohedral fullerenes (cages of carbon atoms with metals trapped inside) are important to study because they have the possibility to be magnetic resonance imaging (MRI) contrasting agents. The goal of our experiment is to produce Y_3C_{102}, a fullerene that has not been isolated before. Yttrium is an interesting element for electron spin resonance because it is a simple spin ½ nucleus and 100% naturally abundant. The experiment includes a series of reactions and will start with yttrium oxide and a graphite rod co-vaporized to produce yttrium endohedral metallofullerenes (EMF) and empty cages. These compounds will be treated with $SnCl_4$ to get rid of the empty cages. The yttrium EMFs will then be treated with amino ethanol to isolate Y_3, Y_4, and Y_3N EMFs. These three compounds will be put through high pressure liquid chromatography (HPLC) to produce the final compound, Y_3C_{102}. A full characterization will be carried out on Y_3C_{102} using methods such as mass spectrometry, x-ray crystallography, and EPR.

Visual Communication: The Voice of Typography

Samantha Fannin
Sponsor: Gale Okumura, M.F.A.
Design

Characteristics of typefaces, formatting and composition are components of typography. I explore principles of legibility, visual hierarchy, rules and blocks, grids, and images as they relate to typography. Letterforms can voice an opinion, show direction, create brands, emphasize sounds and speak to an audience. The use of punctuation can emphasize or show importance to words and statements. Visual communication, focusing on letterforms and typography, is related to ways an audience receives information show to them. Visual communication is communication with the use of visual aids that show ideas and information. Information can be shown through print media, web-based media, information graphics, pictographs and more throughout everyday life. How can typography combined with information graphics be used to visually present information clearly? An integrated format between text and illustrations are tools, which are the basis of visual communication. Adobe Illustrator CS6 is used to present ideas of typography with information graphics.

Alteration of White Blood Cell Count with Amphetamine and Cocaine Use

Valeria V. Farias
Sponsor: John Richards, M.D.
Emergency Medicine

It is imperative to avoid unnecessary testing and misdiagnosis in the Emergency Department. This retrospective study aims to delineate if amphetamine and/or cocaine use results in alterations of white blood cell count (WBC). From January 2009 to December 2011 psychiatric patients who were not diagnosed with medical conditions that could alter WBC were identified. Data of 1,206 patients (40.2% females/59.8% males) was analyzed using an unpaired t-test and chi-squared test. Results showed 877 (72.7%) patients negative for both amphetamines and cocaine had a WBC of 8.4 ± 2.6 ($p<0.0001$). The average age of this control group was 38.7 ±14.0 years (39.9% females/60.1% males). The 240 (19.9%) patients positive for amphetamines and negative for cocaine had a WBC of 9.4 ± 3.3 ($p<0.0001$). Their average age was 36.6 ± 10.9 years (47.1% females/52.9% males). The 72 (6.0%) patients negative for amphetamines and positive for cocaine had a WBC of 7.1 ± 1.8. Their average age was 44.6 ± 11.8 years (22.2% females/77.8% males). The remaining 17 (1.4%) patients positive for both amphetamines and cocaine had a WBC of 10.0 ± 4.2 ($p=0.01$). Their average age was 37.1 ± 11.9 years (35.3% females/64.7% males). Based on these results, amphetamine but not cocaine use may be associated with higher WBC.

Electrophysiological Indices of Attention and Suppression of Attention to Threat in Anxiety

Jaclyn L. Farrens
Sponsor: Steven J. Luck, Ph.D.
Psychology

Previous research has shown that threatening stimuli capture and direct attention even when they are task irrelevant. In addition, this attentional bias to threat has been shown to be exaggerated in individuals with high levels of anxiety. It is unclear however, whether this heightened attention toward threat-related stimuli in anxious individuals reflects (1) a greater initial shift of attention toward threatening stimuli, (2) a failure to accurately suppress attention to threat, or (3) abnormalities in both attention and suppression of attention. The present study addressed this question by examining neural indices of attention and suppression of attention to threat as a function of individual variations in trait-level anxiety. We recorded the electroencephalogram (EEG) while participants completed a dot-probe task using threatening images from the International Affective Picture System (IAPS). We used event-related potential (ERP) measures to determine the initial allocation of attention to the threatening stimuli (using the N2pc component), and the subsequent suppression of attention to the threatening stimuli (using the Pd component). Trait-level anxiety was determined using the Mood and Anxious Symptom Questionnaire (MASQ) and State-Trait Anxiety Inventory (STAI). Preliminary results showing the relationship between neural measures of attention and suppression and trait-level anxiety will be presented.

Development of Biotechnological Control Tools for Crop Pathogen Vectors

Donna Farvard
Sponsor: Abhaya M. Dandekar, Ph.D.
Plant Sciences

The goal of this project is to develop alternative methods to pesticides by using volatile compounds naturally produced by plants. Floral volatiles are commonly associated with attracting insects to flowers for pollination, while volatiles produced in vegetative tissues have been implicated with the plant's defense mechanisms, for example by repelling herbivores that feed on plants. This project takes advantage of the defense-related function of volatile compounds to design control strategies against the psyllid *Diaphorina citri* (or Asian Citrus Psyllid) that carries the bacterial disease Huanglongbing (HLB), also known as citrus greening disease. This disease, caused by *Candidatus Liberibacter*, is extremely virulent and has spread to many areas of the United States. Currently there is no cure for this disease, and infection of a citrus tree remains asymptomatic for many months but eventually leads to death within two years. In an effort to eradicate this disease, growers spray excessively costly pesticides amounting to over 27 sprays a year. In Vietnam, where the HLB disease is also present, citrus growers plant guava trees in their orchards to repel the psyllid. A recent characterization of guava leaf volatile profile identified sulfur-containing compounds (dimethyl sulfide, DMS, and dimethyl disulfide, DMDS) as the likely repellent.

Combating Myocardial Infarctions Using MicroRNA Therapy

Kiran Fayyaz
Sponsor: Nipavan Chiamvimonvat, M.D.
Internal Medicine

Over 700,000 Americans will suffer a new coronary heart attack each year, claiming the life of one person every minute. Blockage of coronary arteries by atherosclerosis (hardening of arteries due to cholesterol buildup) and thrombosis (blood clots in arteries) results in a loss of blood flow to cardiac tissue, causing cell death and impairment of heart function. This myocardial infarction (MI) leads to chronic conditions such as hypertrophy, fibrosis, malignant arrhythmias, and heart failure. MI can be modeled in mice, allowing researchers to evaluate new and exciting therapies for combatting this debilitating disease. In our study, we tested microRNA (non-coding RNA) therapy in the MI mouse model and found a dramatic improvement in the hearts of treated mice. By employing RT-PCR techniques, we show that microRNA therapy protects against cardiac hypertrophy, fibrosis, and pro-arrhythmic electrical remodeling. We also observed, using echocardiography, a reversal of the progressive, deteriorating heart function caused by MI. These results provide proof of concept for microRNA therapy in MI and offer hope for future therapies that help save lives and improve patient care.

Spatial Perseverative Errors in an Object Discrimination Task in the Domestic Dog (*Canis Familiaris*)

Lynna C. Feng
Sponsor: Lisa Lit, Ph.D.
Animal Science

Although dogs have superior olfaction, human social cues or visual cues can override olfactory cues in discrimination tasks. However, studies have emphasized dogs' abilities to successfully complete tasks, rather than acquisition processes. Therefore our study asked what errors dogs make while learning a discrimination task, where the target object contained an olfactory cue, was visually distinct, and was known to humans observing the dogs. Dogs (n=22, age 0.5-12 years) participated in a study in which a brightly-colored red and white dish (TARGET) containing a small piece of food, and two empty stainless-steel bowls were equally spaced across one end of a room. TARGET position was randomly assigned for each trial, but consistent across dogs. Dogs were allowed to freely approach dishes during a maximum of 20 trials, and considered to reach criteria upon going directly to TARGET for three successive trials. The dependent variable was which dish dogs initially approached. There was a significant age effect; younger dogs required fewer trials to criteria. Dogs predominantly made perseverative errors during the learning phase ($p < .001$). Dogs spontaneously adopt a perseverative search strategy rather than utilizing alternative cues, and the ability to modify this search strategy declines with age.

Design and Synthesis of Antimicrobial Compounds to Identify Inhibitors of Gram-Negative Bacteria

Molly R. Fensterwald
Sponsor: Jared T. Shaw, Ph.D.
Chemistry

Antibiotic resistance is a serious public health concern, because bacterial infections are becoming untreatable with current antibiotics. The pharmaceutical industry has reduced antimicrobial research in recent years while academic laboratories have intensified the search for new pathways and targets that could lead to new drugs. A class of antimicrobial compounds, known as "gyramides", has been shown to specifically inhibit an essential bacterial enzyme called DNA Gyrase. Gyramides have been shown to effectively kill gram-positive and gram-negative bacteria when paired with an efflux pump inhibitor. The goal of this project is to find a more potent inhibitor of DNA Gyrase by using synthetic organic chemistry to make additional gyramide analogues. A library of 96 compounds was designed to exhibit pharmacological properties common to Gram-negative killing antibiotics. These properties include molecular weight, polar surface area, and cLogD (measures solubility). After preparation, these compounds undergo biochemical experiments, specifically, Minimum Inhibitory Concentration (MIC) assays which evaluate the growth inhibition of E.Coli. Identifying gyramide analogues that can induce death in wild type E.Coli could help develop promising antibiotic leads for multi drug resistant strains of bacteria.

Mathematical Measures of Sulcal Complexity in the Aging Brain

Devin Fenton
Sponsor: Owen Carmichael, Ph.D.
Neurology

The shape properties of the outer surface of the human brain gradually evolve over the lifespan, with the depth and curvature of its valley-like sulci changing dramatically over the course of childhood and old age. Mathematical measures of 3D open space curve complexity could help to capture age-related changes to the shape properties of sulci and thus help to clarify the biological processes that underlie brain development, aging, and disease. We characterized a set of 50 sulci quantitatively by tracing them as open curves from brain MRI of individuals enrolled in an epidemiological study. Three dimensional surface models of the brain were extracted from the MRI data, and 8 sulci previously identified as distinct, reproducible, and meaningful were traced according to a reliable pre-existing protocol. We calculated a set of measures of curve complexity for each sulcus. These included repulsive energy and writhe energy. Visual inspection suggested that variability in sulcal asymmetry (differences between corresponding curve energies between hemispheres) becomes greater with age. There is a trend-level association suggesting that this sulcus asymmetry increases with age ($p < .1$). The results facilitate the development of methods for capturing age-related changes to the shape properties of the brain over the lifespan.

Normal Weights Against All Odds: A Qualitative Analysis of the Healthy Weight Range of Mexican American Children in Firebaugh, California

Eli I. Figueroa
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Chicano Studies

Being overweight or obese disproportionately affects the lives of Mexican-origin children and presents a serious public health concern (Ogden and Carroll, 2010). This qualitative study investigates how some Mexican-origin families manage to maintain their children's weight at a normal range, despite the barriers and lack of resources in their community. This study takes place in the Central Valley city of Firebaugh, located in the state of California; where the Hispanic community is 80% Mexican-origin (California Department of Finance, 2010). The population of this study is a subsample of Mexican American mothers from Firebaugh whose children's weight was measured and recorded in a separate concurrent study. Some of these mothers also participated in preliminary focus groups conducted in the same concurrent study to discuss childhood obesity and identified childhood obesity factors like consumption of fast foods, lack of physical activity, time and stress. Through semi-structured interviews with 12 mothers, I examine how families are able to maintain their children's weight within normal range. I hypothesize that if parents lack discipline in their children's nutrition, the weight of these children will be over their normal BMI. This study can be informative for similar populations to maintain a healthy weight for their children.

The Communication Architecture of the Interactive Surface Project

John P. Flynn
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Electrical and Computer Engineering

The EE-Emerge program at UC Davis is currently designing an interactive surface consisting of a 10x10 square grid of LEDs and infrared sensors that will read and react to physical user input. The goal of the project is to successfully apply the team's knowledge gained in their respective fields of study and to engage young students in the fields of Electrical and Computer Engineering. On the surface, each infrared sensor must report a touch from a hand and each LED must light up in response to different inputs. This poses an important challenge of designing an efficient communication architecture between the sensors, microcontrollers and lights. Our discussion will go into detail on how the interactive surface will implement its message passing protocol between devices, particularly to and from the central microcontroller. The challenge lies in the scale of the physical architecture; one central processing unit must collect data from one hundred individual sensors and report the state of three hundred LEDs in a fraction of a second. The layout of each relevant device will be discussed, along with other architectures considered and justifications for including or not including them in the final design.

Hei10, a Putative E3 Ubiquitin Ligase, is Essential for Crossing Over

Jared Fong
Sponsor: Neil Hunter, Ph.D.
Microbiology and Molecular Genetics

Reproductive complications such as infertility, birth defects, and pregnancy miscarriage have significant clinical and societal impact. These complications are often associated with problems in meiosis, the cellular division that forms gametes (sperm and eggs). In the first stage of meiosis, the maternal and paternal copies of each chromosome must become connected by at least one crossover for the accurate distribution of one full set of chromosomes to each gamete cell. Defective crossing-over leads to chromosome missegregation and aneuploid gametes, causing diseases such as Down's Syndrome in zygotes. In mice, Human Enhancer of Invasion 10 (*Hei10*) is essential for crossover formation (Ward et al., 2007). This study analyzes the function of *Hei10* using genetic and cytological approaches. We aim to understand why crossing-over fails in *Hei10-/-* mutant mice and how HEI10 protein influences the localization of other crossover factors along meiotic chromosomes. We have shown that *Hei10* localizes to crossover sites and is required for a second crossover factor, RNF212, to do the same. Both HEI10 and RNF212 are involved in protein modification by ubiquitin-like molecules, revealing a central role for protein turnover in establishing crossover sites. These insights should help us understand the defects associated with meiosis in humans.

Fifth and Sixth Grade Strategies on Fraction-of-a-Fraction Story Problems

Trisha Forker
Sponsor: Rebecca Ambrose, Ph.D.
School of Education

Mathematics plays an important role throughout one's life and it is grade school where we learn the fundamentals. While in elementary school, students academic abilities are assessed through benchmarks, state examinations, and other tests, but students can still find themselves left behind. To help assess where teachers might need to improve and learn where students are having difficulty, we administered a two-step mathematics problems to fifth and sixth graders in the Robla School District at two points in time, in which students had to complete "Show Your Work" and "Explain Your Work" sections. Through a detailed analysis of each benchmark, we categorized the different types of strategies children used and the frequency of each strategy. We utilized this data to identify stellar examples so teachers could have a target in mind for all students. In addition, we found patterns in terms of students' complications and difficulties so teachers could address them.

Aggressive, Muscular Men in the Media and How They Affect Young Adult Males

Jhunehl T. Fortaleza
Sponsor: Laramie Taylor, Ph.D.
Communication

Male celebrities portrayed in the media display beauty and muscularity standards that are often unattainable, potentially contributing to lower self-esteem among male viewers. In addition, film and television have become increasingly violent, with protagonists that display aggressive tactics to "save the day." The combination of both muscular and violent protagonists may be psychologically detrimental to viewers. This study sought to explore the effects of aggressive, muscular men in the media on the average man's self-perception and self-esteem. Seventy-eight participants were exposed to one of four conditions-Violent/Muscular, Violent/Non-muscular, Non-violent/Muscular, and Non-violent/Non-muscular. They reviewed fake movie synopses that contained either violent or non-violent plots while viewing either muscular or non-muscular "actors." Results indicated that participants in the Violent condition exhibited more Body Anxiety-that is they saw themselves as significantly less attractive-than those in the Non-violent condition. Although our research yielded interesting results regarding the effects of aggression, it's also equally interesting that the effects of ideal-body muscularity-which is so easily reproduced in other studies-did not manifest in our results. The reasons as to why these results occurred are explored.

Social Reproduction in Education: The School of Nisibis and Christian Identity in Late Ancient Mesopotamia

Emily A. Fox
Sponsor: Catherine M. Chin, Ph.D.
Religious Studies

This paper focuses on the role played by East Syrian Christian schools, most notably the School of Nisibis, in the creation and perpetuation of a distinct East Syrian identity. Using Pierre Bourdieu and Jean-Claude Passeron's theory of social reproduction as laid out in their work, *Reproduction in Education, Society, and Culture*, as a lens through which to see the School of Nisibis and a tool by which to create a coherent framework for understanding the sources it left behind, this paper argues that the sixth and early seventh-century East Syrian schools functioned primarily as institutions of inculcation that served as a tool for the reproduction of a distinct East Syrian identity. This, I argue, is done in three ways: first, ideologically - through the use of teaching tools that work to enforce borders around theologically orthodox beliefs; second, bureaucratically-through legitimizing power relations of pedagogy; and third, literarily-through the literary tradition developed at the school, in which former students of the school become a part of the larger literary world that shapes East Syrian identity. Ultimately, this paper is an attempt to understand the role and functions of educational institutions within Late Ancient Mesopotamia.

The Search for Beauty and Escape from Duality

Daniel A. Friedman
Sponsor: Olga Y. Barmina, M.S.
Evolution and Ecology

In our earthly lives, we continually encounter apparent dualities, ranging from the mundane "yes/no," to the mystifying "good/evil." This overarching duality manifests physically as gender, emotionally as mood, and even chemically as proton/electron. Such binary distinctions alienate us from a multidimensional Reality and disrupt the Peace that pervades the universe. Humans have always sought an escape to this pressing hunger for something non-physical, this painfully constant metempsychosis of the perceived Self. Historically, this barrier has been surmounted by provocative behaviors such as fasting, meditation, using psychedelic substances, playing chess, and creating Art. I challenge the commonplace by exploring the characteristics of ink applied carefully to a white page. My patterns evoke a wide range of feelings, thoughts, colors, sounds, textures, and memories. Within each drawing there is a city that you have visited, a face that you have loved, a peace that aims towards an embryonic bliss, and a union with the act of Creation. I am inspired by crystallographic patterns, sacred geometry, biochemistry, and relationships with humans and animals. A finished drawing vibrates at an indescribable but eternal wavelength. Take a glimpse into the mind of another, and fear not when they gaze back.

The Voice of a Child: The Relationship Between Adult Readers and Child Narrators in Response to Trauma

Leanna M. Friedrich
Sponsor: Elizabeth Freeman, Ph.D.
English

Children in literature often express their immaturity and vulnerability through unfiltered, naïve interjections and whimsical fantasies. When authors employ child narrators in novels that feature traumatic events, their immature, childish voices provide a limited yet thought-provoking perspective on these tragic situations. The novels *The Adventures of Huckleberry Finn* by Mark Twain, *Extremely Loud and Incredibly Close* by Jonathan Safran Foer, and Room by Emma Donoghue, all feature a first-person child narrator who struggles to comprehend his new traumatic reality: Huck, age 14, vacillates between his racist Southern upbringing and his blooming friendship with the runaway slave Jim; Oskar, age 9, fights through his immense grief after his father dies in the 9/11 World Trader Center attacks; and Jack, age 5, cannot comprehend the actual world outside the room where he has been imprisoned his entire life. Because of the intimate first-person narration, these novels force the readers to endure the young narrators' trauma through the same immature lens and remain completely dependent on the children for information. This dependency ultimately creates tension throughout the reading experience, especially when the immature narrators have limited comprehension of their trauma and how to recover.

Characterization of Perovskite Metal-Oxide Superlattice Thin Films

Albert Frugoli
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Chemical Engineering and Materials Science

Advancements in Materials Science Engineering technology have resulted in the development of materials with tunable electrical, magnetic, and optical properties. Pulsed laser deposition (PLD) of heterostructures comprised of alternating layers such as $La_{0.7}Sr_{0.3}MnO_3$ (LSMO) and $La_{0.7}Sr_{0.3}CoO_3$ (LSCO) exhibit the previously stated properties. These synthetic heterostructure thin films combine the properties of each of their constituents into a single material. Additionally, the interfaces of LSMO and LSCO thin films typically exhibit properties which differ from those of the individual layers; therefore, the interfaces may provide a means of controlling the properties of the heterostructure. Atomic scale accuracy can be achieved with PLD synthesis, and layer thicknesses are routinely held to tens of unit cells. Consequently, accurate characterization of the material is of great importance, and can be accomplished by high resolution x-ray diffraction and reflectivity analysis. We show that reflectivity curves from the heterostructures can be accurately fit with modeling software which reveals the density, thickness, and the roughness of the alternating material layer interfaces. Combining a comprehensive knowledge of the composition of the heterostructure material and the dynamics of its interfaces facilitates the development of multifunctional materials with tunable electrical, magnetic and optical properties.

A Modified Gale-Shapley Algorithm for the TA-Class Assignment Problem

Victor K. Fuentes
Sponsor: Jesus De Loera, Ph.D.
Mathematics

In the past, administrators in the Mathematics Department spent upwards of eight hours constructing a feasible matching between graduate student teaching students and discussion sections by heuristics, which often led to a less than optimal pairing between the two. This led to a subsequent need for a more efficient and effective method of matching. We discuss an implementation of a program that generates an optimal matching between these two parties based on the theory of the Stable Marriage Problem, or more generally the Assignment Problem. This new method generates a solution on the order of one hour, which includes generating the input by hand. Although our problem could be formulated as an integer-programming problem, we instead present our matching problem using graph theory and utilizing the Gale-Shapley algorithm to generate a solution in polynomial time. Several constraints are considered, including a graduate student's availability, seniority, and the need to assign a single graduate student to multiple classes.

Evaluation of Serum Cortisol Levels as a Biomarker for the Early Diagnosis of Bovine Respiratory Disease (BRD)

Luis A. Gamboa
Sponsor: Alison Van Eenannaam, Ph.D.
Animal Science

Bovine respiratory disease (BRD) is an infectious disease complex and one of the most common causes of mortality in dairy cattle and feedlot cattle operations. It is associated with a variety of factors including stress and exposure to viral and bacterial pathogens. Because BRD has a quick clinical progression and high mortality rate, early diagnosis is crucial to an effective treatment plan. The objective of this research project was to evaluate the accuracy and practicality of using blood cortisol concentrations as a biomarker for the early diagnosis of BRD prior to the onset of clinical symptoms. Blood samples and rectal temperatures were taken daily from healthy steers, and from steers that had been challenged with the pathogens that are associated with BRD. Temperature was used as an indicator of infection status and severity of BRD. Blood serum samples were analyzed for cortisol level using a cortisol ELISA kit (Arbor Assays, Ann Arbor, Michigan). Cortisol levels will be compared between healthy and sick animals, with temperature as a covariate in the analysis as an indicator of disease severity. Results will be used to determine whether blood cortisol levels provide a useful biomarker for the early diagnosis of the onset of BRD.

Real-time Glucose Biosensor for Biofuel Production

Cassy Gardner
Sponsor: Tina Jeoh, Ph.D.
Biological and Agricultural Engineering

The advanced biofuels industry looks to harness the energy contained in plant biomass. Glucose released from cellulose of plant cell walls can be directly converted to transportation fuel. This conversion requires additional research before its processes can be economically competitive with fossil fuels. A critical factor in the investigation of the biomass conversion process (saccharification) is the researcher's ability to rapidly analyze solubilized sugars. Presently, most sugar analysis methods are laborious, costly, fail to provide real-time data, thereby slowing research progress. This project will address the design, construction, and testing of an amperometric glucose biosensor that will improve and expedite the glucose content analysis process. The amperometric glucose biosensor utilizes the electrochemical properties of a saccharification reaction, three electrodes, potentiostat circuitry, and a custom-designed user interface to measure the real-time glucose content in a single sample. This is made possible by the glucose oxidase enzymes immobilized on the probe tip that oxidize glucose present in a solution. This oxidation generates a current proportional to the glucose concentration. Thus the biosensor eliminates the need for additional sample preparation time and cost. By providing real-time concentration data, the amperometric glucose biosensor will maximize efficiency, minimize costs and facilitate biofuel research.

The Female Archetype as Portrayed in Japanese and Western Bildungsromane

Kelli L. Garrett
Sponsor: David J. Gundry, Ph.D.
East Asian Languages and Cultures

A study of female archetypes in Japanese literature by comparing the female characters seen in such texts as *The Tale of Genji, Life of an Amorous Woman, Masks,* and *The Pillow Book* to those in Western works such as *Dangerous Liaisons, Moll Flanders,* and *The Wanderings of the Heart and Mind*. The Japanese woman portrayed in these works is passionate and subtly sexual, but constrained by the limitations imposed by society from the Heian through Edo Periods (794-1868). Comparatively, the Western woman is clever and ambitious but limited by society, her sexuality masked by propriety. To further understand the female characters in these works, the texts selected also cover archetypes from both a male and female author's position. The women presented are not always central to the narrative, and their growth tends to evolve dramatically, usually in the form of an ultimate 'fall.' The reasons for this fall are seen in cultural ideologies such as Christianity, Buddhism, and class systems; these ideologies heavily influence the consequences of the fall. Regardless of gender or nationality, the authors express, through the fall, the limitations of the female archetype who seeks to operate outside the socially expected norms.

Reversal of Declines: An Analysis of Causes and Solutions for Six Native California Amphibians

Felicia Gary
Sponsor: Sharon Lawler, Ph.D.
Entomology

Amphibian populations in California and across the globe are under pressure from natural and anthropogenic forces that are driving up the extinction rate. It is estimated by the Global Amphibian Assessment that thirty two percent of amphibians are considered threatened with extinction (Stuart et. al, 2004). In order to prevent further declines and help currently declining populations to recover we must understand the causes and implement effective conservation strategies based on our findings. This review takes ideas from papers published within the last twenty years to put together a complete picture of regional amphibian decline causes, and then uses survey data collected from researchers, conservationists, policy makers, and wildlife managers to propose solutions that could work for California endangered amphibians such as the California Tiger Salamander and California Red-Legged Frog. The study's initial findings suggest that habitat loss, disease and invasive species are of the greatest concern for amphibians in California. Through education of the public, improved legislation, and increased funding to habitat conservation and restoration projects the impact of these causes will be lessened and many California species can be brought safely away from the threat of extinction.

Uncovering Novel Genes Related to Internode Elongation and Heightened Shade Avoidance Response in *Solanum Lycopersicum*

Natalie N. Gath
Sponsor: Julin N. Maloof, Ph.D.
Plant Biology

Understanding the genes and pathways behind the shade avoidance response is important for agricultural and theoretical applications. In this study, I investigated several mutant lines of domesticated tomato, *Solanum lycopersicum cv M82*, displaying overly elongated internodes, suggesting the presence of a mutation that may affect the shade avoidance response. To test this, I compared the hypocotyl length of seven day old simulated sun and shade grown plants. Only line n4674 appeared to have a heightened response to shade. I then measured the lines' internodes and petioles at four, five, and six weeks old in both light conditions. Line e2265 displayed significant elongation in internodes and line e2927 showed little shade avoidance response. Next, I measured each line's response to varied concentrations of giberellic acid (GA) and auxin as demonstrated by hypocotyl length at seven days old. Line e2927 showed reduced response to both hormones, while e2265 and n7097 had heightened response to GA. I determined line e2265 was the most promising and crossed it to Heinz to produce F1 seed. The F1 plants self-pollinated to produce a large population of F2s which are currently undergoing bulked segregant analysis and mapping of the mutations responsible for the elongated phenotype.

The Effects of Parathyroid Hormone on Scaffold-less Articular Chondrocyte-based Tissue Engineered Constructs

Courtney Gegg
Sponsor: Kyriacos Athanasiou, Ph.D.
Biomedical Engineering

Osteoarthritis, a disease characterized by cartilage degeneration, is a leading cause of disability in America. The avascular nature of cartilage limits its ability to self-repair. Thus, tissue engineering aims to provide a permanent solution to restore cartilage tissue function. Applying different mechanical and chemical stimuli in a scaffold-less approach can alter the mechanical, biochemical, and histological properties of tissue-engineered cartilage constructs. Parathyroid hormone (PTH) is important in developmental biology and influential in both cartilage and bone development. This study thus examined the effect of 10ng/mL PTH applied daily during week 1 or week 3 of a 4-week culture period on the properties of articular chondrocyte-based constructs. PTH increased the tensile properties of constructs. Glycosaminoglycan (GAG) and collagen content, evidenced by Safranin-O and Picrosirius Red staining, respectively, were higher in PTH-treated groups. Additionally, quantitative analysis showed an increase in collagen and cellular content for week 3 PTH-treated groups, but no significant change in GAG. These results suggest PTH can beneficially increase the mechanical and biochemical properties of tissue-engineered cartilage. Optimization of PTH concentration combined with optimization of PTH loading periods during construct culture will further elucidate the benefits of using PTH to improve tissue-engineered cartilage for clinical use.

Consumption of Milk from Human Lactoferrin Producing Transgenic Cows Effects Relative Numbers of Leukocytes Present in the GI Tract of Young Pigs

Danielle J. George
Sponsor: James D. Murray, Ph.D.
Animal Science

Lactoferrin is a part of the innate immune system that has antimicrobial and anti-inflammatory properties. Lactoferrin is naturally found in high concentrations in human breast milk and aids in the maturation of the infant's gastrointestinal (GI) tract. Supplemental lactoferrin was previously shown to have a positive effect on the health of both children and young animals. Genetically modified cattle that produce human lactoferrin in their milk (hLF-milk) were generated to provide a production system for supplemental hLF. Using young pigs as a model for young children, it was found that consumption of the transgenic hLF- milk compared with the consumption of control cow's milk had a positive effect on circulating white blood cell populations and gut morphology. To specifically investigate the effects of consumption of hLF-milk on eosinophil populations in the upper and lower small intestine, manual counts were performed on hematoxylin and eosin stained slides from the duodenum and ileum. We observed decreased eosinophils per micrometer area in the duodenum portion of the small intestine of pigs fed hLF-milk compared to pigs fed control cow milk ($p = 0.0256$).

Consumption of Milk from Human Lactoferrin Producing Transgenic Cows Effects Relative Numbers of Leukocytes Present in the GI Tract of Young Pigs

Miranda J. George
Sponsor: James D. Murray, Ph.D.
Animal Science

Lactoferrin is a part of the innate immune system that has antimicrobial and anti-inflammatory properties. Lactoferrin is naturally found in high concentrations in human breast milk and aids in the maturation of the infant's gastrointestinal (GI) tract. Supplemental lactoferrin was previously shown to have a positive effect on the health of both children and young animals. Genetically modified cattle that produce human lactoferrin in their milk (hLF-milk) were generated to provide a production system for supplemental hLF. Using young pigs as a model for young children, it was found that consumption of the transgenic hLF- milk compared with the consumption of control cow's milk had a positive effect on circulating white blood cell populations and gut morphology. To specifically investigate the effects of consumption of hLF-milk on eosinophil populations in the upper and lower small intestine, manual counts were performed on hematoxylin and eosin stained slides from the duodenum and ileum. We observed decreased eosinophils per micrometer area in the duodenum portion of the small intestine of pigs fed hLF-milk compared to pigs fed control cow milk ($p = 0.0256$).

Effects of IGF1 Ingestion on Expression of NFκB Regulated Immune Genes in the Malaria Vector Anopheles Stephensi

Martha Georgis
Sponsor: Shirley Luckhart, Ph.D.
Medical Microbiology & Immunology

Malaria is a disease of great public health importance, and efforts to control malaria parasite transmission by the mosquito are critical to stopping its spread. Insulin/insulin-like growth factor (IGF) signaling (IIS) regulates metabolism, development, lifespan and immunity across organisms, making it a promising target for malaria transmission control. Genetically enhancing this pathway shortens lifespan and blocks malaria parasite development in the malaria vector *Anopheles stephensi*. Conversely, ingested IGF1 stimulates IIS reducing parasite development but extending mosquito lifespan. Here, we examined whether IGF-1 might affect anti-parasite immunity via NFκB, a critical mediator of immune responsiveness. Using an *in vitro* luciferase reporter assay, we assessed the expression of NFκB regulated antimicrobial peptides in IGF1 treated cells following immune challenge. *In vivo*, we assessed the effects of IGF1 ingestion on expression of NFκB regulated immune genes in *A. stephensi* midguts. Preliminary results show that IGF1 does not enhance NFκB dependent immune gene expression, indicating that another mechanism contributes to IGF1-stimulated reductions in malaria parasites. These studies enhance our understanding of the effects of human blood factors on malaria parasite transmission and will ultimately support the development of novel strategies for malaria control.

Taking the Temperature: Public vs. Private High School Seniors' Knowledge of Climate Change

Tasslyn Gester
Sponsor: Joseph Dumit, Ph.D.
Anthropology

Today's teenagers will play a pivotal role in how the United States addresses climate change in the future, both in the decisions they will make in their personal lives, and how their voting will shape climate policy. This research examines what 59 California private and public high school seniors (aged 16-19) understand about the genesis, impacts, and implications of climate change. In addition to their knowledge of specific details, my survey of 103 questions also gauges the students' level of certainty, and identifies their major sources of information. For example, although the levels of confidence about their understanding is significantly higher in the private school group, both groups of students reflect a similar national level of misunderstanding of the connection between ozone depletion and the greenhouse effect. Comparisons of the underlying attitudes and knowledge of the two schools and a national survey by the Yale Climate Change Communication Project, provide insight into what overall trends remain pervasive, how to improve future education strategies, and the level of influence schools have on students' understanding of climate change.

Selective Grain Size Usage and Resulting Variances in Tube Strength by the Sandcastle Worm, Phragmatopoma californica

Josh S. Gevertz
Sponsor: Tessa M. Hill, Ph.D.
Geology

A wide diversity of adaptations has evolved in rocky intertidal communities to cope with abiotic stresses that impact every organism living in these ecosystems. One approach of particular interest is that of the sandcastle worm, *Phragmatopoma californica*, which finds refuge from wave shock in its masterfully crafted tube of individually selected sand grains and a secreted proteinaceous mucus. In this study I evaluated the selectivity of sand grains used by *P. californica* individuals in two natural treatments of varying wave stress and sediment size. The strongest tubes were built with a dominant majority of grains less than 0.5 mm in diameter, with a significant decline in strength evident with increased use of larger grains. Stronger tubes were required in conditions of greater wave stress, so smaller grains were used there regardless of local grain availability; in calmer regions, less tube strength was necessary, so more intermediate sized grains were used, resulting in faster tube building. In both circumstances, wave stress influenced the resulting grain selectivity by individual worms. This example of abiotic pressure directly affecting behavior of an intertidal organism demonstrates the vast influence that environmental stresses can have on adaptations and acclimatization of species living in intertidal communities.

Autonomous Vehicle Design Project - SOCAR

Hasan A. Ghadialy
Sponsor: André Knoesen, Ph.D.
Electrical and Computer Engineering

Unmanned building exploration in the event of disasters is a big problem due to the major safety concerns and monetary constraints involved. Resilient robots can alleviate some of the risk, replacing simple tasks such as room checks or difficult tasks such as hazard sensing, while maintaining high resistance to the harsh conditions of fire and chemical hazards. An autonomous vehicle is essentially one that can be driven by itself. These types of vehicles consist of controls, software and sensors in order to measure distance and avoid running into obstacles. One of the main tasks that it can perform is terrain-mapping where it uses sensors in order to "see" what objects are present in its surroundings and therefore can map out the region. Our goal is to design and build a small robotic vehicle (SOCAR) that will implement sonar-like ultrasonic technology and successfully map out an entire room by itself. An array of sensors will be used in order to map SOCAR's current position and process the data while also communicating the acquired information. SOCAR will perform proximity detection through the use of infrared and ultrasonic sensors.

Immune Responses in Dogs Treated with a Commercially Available Melanoma Vaccine

Sonia Ghandi
Sponsor: Ellen Sparger, D.V.M.
Medicine and Epidemiology

Oral Malignant Melanoma (OMM) has an aggressive biologic behavior and is the most common oral tumor in dogs. Because OMM is chemoresistant, immunotherapy has been explored as an adjuvant treatment. ONCEPT, a xenogeneic human tyrosinase DNA vaccine, received full licensure in 2009 from USDA for the adjuvant treatment of OMM in dogs. Several studies of ONCEPT suggest efficacy for OMM with improved patient survival time. However, many observed clinical responses have been disappointing. We hypothesize that dogs that develop a measurable immune response to ONCEPT vaccination will have improved survival outcome compared to the dogs that do not have a detectable immune response. As a result, we developed an assay using immunoprecipitation and Western blot analysis to detect anti-human tryosinase antibodies in the blood samples of dogs vaccinated with ONCEPT over the past three years. We are also retrospectively reviewing survival outcome of this cohort of dogs. Preliminary testing of plasma samples suggests a lack of detectable antibody despite expected results for our positive and negative controls. If we show that the vaccine is not as efficacious as previous studies suggest, we can either explore using the vaccine in combination with other therapies or investigate alternate adjunctive therapeutic strategies.

NAAG Peptidase Inhibitor Improves Motor Function and Reduces Cognitive Dysfunction in a Model of TBI with Secondary Hypoxia

Rahil T. Ghiasvand
Sponsor: Gene G. Gurkoff, Ph.D.
Neurological Surgery

Over 1.7 million people suffer from traumatic brain injury (TBI) annually in the United States. Hypoxia, a secondary injury, is frequently associated with TBI. TBI+hypoxia causes an excessive release of glutamate, cell dysfunction, cell death and ultimately poor motor and cognitive outcome. N-acetylaspartylglutamate (NAAG), a peptide neurotransmitter, is released with glutamate following injury and inhibits further glutamate release. However NAAG is rapidly hydrolyzed, reducing the protective capacity. We hypothesize that PGI-02776, a NAAG peptidase inhibitor, will prevent hydrolysis of NAAG, reduce excitotoxicity, and increases motor and cognitive performance in rats following TBI+hypoxia. We induced moderate TBI in rats followed immediately by 30 min of hypoxia. PGI-02776 (10 mg/kg) was administered intraperitoneally immediately after hypoxia. We observed a significant improvement in motor (rotorod) and cognitive (Morris water maze) performance in TBI+hypoxia rats treated with PGI-02776 as compared to injured animals receiving a vehicle treatment. Therefore, increasing NAAG concentration following TBI+hypoxia improved behavioral outcome. These data demonstrate the potential of NAAG peptidase inhibitors and indicate the need for further research into the utility of these drugs to improve functional outcome in TBI patients.

Differences in the Macronutrient Composition of Term Versus Preterm Human Milk

Deborah S. Gho
Sponsor: J. Bruce German, Ph.D.
Food Science and Technology

Background: Premature infants require substantially more protein than term infants to achieve comparable growth rates. However, the macronutrient composition of premature milk is highly variable and is still unable to meet the metabolic demands of the premature infant. *Primary Objective:* To examine the differences in the concentration of lactose, fat, protein and calculated energy of term (>37 weeks gestation) versus preterm (26-36 weeks gestation) human breast milk. *Secondary Objective:* To determine how maternal and infant health status affects the macronutrient composition of human milk. *Study Design:* One hundred and sixteen breast milk samples across lactation stages from women who delivered at term (n = 69) and preterm (n = 5) were analyzed using Fourier transform mid-Infrared (FTIR) spectroscopy. Ten of the samples were tested in replicate using the FT mid-IR spectroscope to determine repeatability. The results and relationships discussed in this presentation will have important implications in understanding neonatal nutrition and how it can be adjusted to improve infant health and development.

Imaging Alzheimer's Disease with Multimodal Probes Targeted to Activated Microglia

Jenny T. Giang
Sponsor: Angelique Y. Louie, Ph.D.
Biomedical Engineering

Neuro-inflammatory diseases such as Alzheimer's Disease affect millions of individuals worldwide. Currently, there is no reliable, non-invasive method to diagnose the early stages of AD; the only definitive indicator is severe brain damage found in advanced disease progression. Thus, there is a need to establish effective imaging techniques that reliably identify neuro-inflammation before irreversible symptoms arise. Class-A scavenger receptors of activated microglia, the immune cells of the brain, have been examined as biomarkers for Alzheimer's disease that are uniquely expressed in the presence of neuro-inflammation. We developed a multimodal imaging probe, mal-BSA-DOTA(Gd+3/64Cu), which averages 8-15nm in size and specifically binds to these scavenger receptors for use in PET (64Cu) and MRI (Gd3+). To study our probe's uptake in activated microglia cells, we modified it with varying degrees of maleylation (negative charge) and anticipate that a 60% maleylation will be optimal, based on previous studies using activated macrophage cells found in vascular inflammation. In the next stage of our project, we will perform in vitro tests by culturing BV-2 cells for cytotoxicity and cell uptake studies to demonstrate that the probe is nontoxic and exhibits different levels of uptake efficiency with different degrees of maleylation.

NMR Monitoring of Catalysts for the Transesterification of Oils to Biodiesel

Kate A. Gibson
Sponsor: Annaliese K. Franz, Ph.D.
Chemistry

Oils from plants are a highly desirable energy source as they are renewable and carbon-neutral. These oils can be converted into fatty acid methyl esters (FAMEs) for use as biodiesel by transesterification in the presence of a catalyst, alcohol, and heat. The catalyst triazabicyclodecene (TBD) has been proven to be effective for transesterification catalysis. Previously, it was shown that the presence of water negatively affects the yield of FAMEs. This study utilizes the TBD catalyst and is focused on determining the effects of water on this specific catalyst to increase the yield of conversion to biodiesel. Time arrays acquired by Nuclear Magnetic Resonance (NMR) spectroscopy were used to monitor the molecular interactions of the TBD catalyst and its environment. NMR monitoring allows the simultaneous analysis of the interactions of the reaction components while also observing the consumption of reagents and formation of products. The results of this study revealed that solvent interactions may reduce catalytic activity and a desirable yield of FAMEs is dependent on the type of solvent. Other potential solvents for TBD catalysis are being investigated, as well as NMR spectral monitoring of transesterification of other esters catalyzed by TBD.

Suppression of Verticillium Wilt of Tomato by Vermicompost

Jadey Monique G. Gonzalez
Sponsor: Thomas R. Gordon, Ph.D.
Plant Pathology

Vermicompost is produced by decomposition of organic waste by earthworms and is highly valued as a nutrient- and microbe-rich soil amendment. Several studies support the nutritional attributes of vermicompost, but less is known about possible disease-suppressing effects. We will be evaluating the potential for vermicompost to suppress Verticillium wilt, a disease caused by *Verticillium dahliae*. For this test, tomato plants of the susceptible cultivar 'Bonny Best' will be inoculated by immersing their roots in a suspension of *V. dahliae* spores. Inoculated plants will be transplanted into Sunshine potting mix amended with 0%, 20%, 40%, or 100 % vermicompost (v/v). The control will consist of plants treated in the same manner but with their roots immersed in sterile water instead of a spore suspension. The effects of vermicompost treatments will be evaluated by rating plants for symptoms of disease and measuring shoot and root dry weights at the end of the experiment. Each treatment will consist of three replicates with five plants each, and the trial will be repeated once. The results will provide an indication of the potential for vermicompost to contribute to management of Verticillium wilt in tomatoes.

Suction Feeding Kinematics of Paedophagous Victorian Cichlids

Aaron M. Goodman
Sponsor: Peter Wainwright, Ph.D.
Evolution and Ecology

Lake Victoria in Eastern Africa is one of the largest tropical lakes in the world. It contains over 300 species of haplochromine cichlid fish, many of which have evolved unusual feeding strategies. One of the most peculiar strategies is paedophagy, the consumption of fry via attacks on mouth-brooding females. This behavior has been quantitatively observed in aquariums and inferred via gut contents, but the kinematics of prey capture have never been studied in paedophages. We analyzed prey capture behavior in two paedophagous Victorian cichlids: *Haplochromis* sp 'matumbi hunter' and *Haplochromis parvidens*. Using a high-speed camera filming at 2000 frames per second our lab recorded at least ten videos each from five individuals of each species consuming larval fish. We then used the program Dltdv3 in MATLAB to track 10 landmarks along each fish's body to produce a set of 10 kinematic variables associated with prey capture. From analyzed data, *Haplochromis parvidens* strikes prey with a small highly protruded mouth with a high kinematic transmission coefficient, while *Haplochromis* 'matumbi hunter' strikes prey using a large gape and low jaw protrusion. Despite their shared use of a novel resource, each paedophage species exhibits different prey capture techniques.

Glomalin Production and Carbon Sequestration in Agronomic Systems

William L. Goss
Sponsor: Kate Scow, Ph.D.
Land, Air, and Water Resources

Identifying properties of arbuscular mycorrhizal fungi (AMF) that improve nutrient mobilization will lead to improved input management for sustainable agricultural systems. AMF play an important role in cycling carbon between the biosphere and the atmosphere, in part due to a fast turn over rate of live hyphae. A method of the AMF to build a soil organic carbon (SOC) pool is through the production of glycoproteins (glomalin) that also contribute to soil aggregate stability. The sequestration of carbon into glomalin relies primarily on primary production, which is closely associated with AMF activity and land management practices. In addition to enhancing agricultural sustainability, understanding carbon sequestration in soils is useful for forestry, land reclamation, and mitigating climate change. I have partnered with Russell Ranch, a unit of the Agricultural Sustainability Institute (ASI) and their ongoing experiment of Long Term Research on Agricultural Systems (LTRAS). This glomalin study is in collaboration with concurrent research on AMF colonization. Samples will be taken from 3, 1-acre plots, currently cultivating wheat: one with no fertilizers, the second with ammonium nitrate, and the third had a cover crop the previous year.

Analysis of Dog Provisioning and Subsistence in the Kotzebue Sound Region of Alaska Through Stable Isotopic Analysis

Shannon N. Green
Sponsor: Chistyann Darwent, Ph.D.
Anthropology

Dogs were essential to hunting and sledding in Inupiaq territory, and due to the work of J. L. Giddings, who undertook numerous excavations in the Kotzebue Sound region of Alaska from the late 1940s to early 1960s, we have a record of dog use through time and across space. These faunal collections include Cape Krusenstern and Choris Peninsula on the coast, and Onion Portage (Haffenreffer Museum of Anthropology) and Ahteut (Museum of the North) in the interior and span from ca. 2800 BC to AD 1700. Recent excavations at coastal sites such as Kotzebue, Deering (Northern Land Use Research) and Cape Espenberg (UC Davis) also yielded dog samples. C & N isotopic analysis was performed on a subsample of *Canis* remains from the above sites to assess differences in dog provisioning by the early Thule culture (ca. AD 1000-1500) across space. Domestic dogs have been used elsewhere as a proxy species for understanding past human subsistence patterns using stable isotopic analysis. Understanding the way in which the Thule provisioned their dogs provides a deeper understanding of diet among the humans associated with these dogs. Hence dogs provide another means of understanding a piece of the culture history of the Arctic.

This Product is so Scandalous

Lakisha Gregorio
Sponsor: Narine Yegiyan, Ph.D.
Communication

While celebrity endorsements have been studied widely, rarely focus is given to research on the effect of scandalous information associated with a celebrity on the perceptions of the products that they endorse. This study builds on propositions of Elaboration Likelihood Model (Petty & Cacioppo, 1980), suggesting that celebrity endorsers are powerful sources of information and can strongly influence evaluation of the product. So far the primary focus of the theory has been on source occupation (professional vs. non-professional) and popularity. This study will advance the model by focusing on the nature of the popularity of the endorser (scandalous vs. non-scandalous) in order to contribute to the understanding of the relationship between the source and the endorsed product. Participants will view images of 16 celebrities and 8 food items and will be asked to evaluate them on several attitudinal scales. Then they will be shown a series of specific products paired with celebrities, as the endorser, and will be asked to evaluate them again. The expectation is that people will respond to products endorsed by celebrities with scandalous backgrounds with more attention but will rate the products as less likeable and credible compared to those endorsed by celebrities with non-scandalous backgrounds.

Distributed, Parallel Evaluation of Regular Path Queries on Big Data

Eric Gribkoff
Sponsor: Bertram Ludaescher, Ph.D.
Computer Science

Finding and expressing complex relationships in large data sets, such as those generated by the social web or scientific data collection projects, is a hard computational problem. When the data scales out to a size where it cannot fit into the memory of a single computer, the problem becomes much more difficult. Regular path queries, or RPQs, are used to extract information from large data sets by searching for connections in the data matching user-specified patterns. While recent research has focused on techniques to evaluate RPQs using a single computer, there is much progress still to be made towards efficiently extracting such information from very large data sets. When the size of the data is beyond the capability of a single machine, a new algorithm, using networked computers working in parallel, is required. I have built an RPQ engine that uses a distributed network of computers to find user-defined patterns in large data sets. Additionally, this data querying engine has been tested on real-world and synthetic data sets, with the resulting runtimes recorded to provide performance benchmarks for future systems.

β Adrenergic Receptor Inhibits Gαq Protein Coupled Receptor Signaling of Protein Kinase D

Ashley K. Grise
Sponsor: Blake Nichols, Ph.D.
Pharmacology

Pathological cardiac hypertrophy is an element of heart failure. Protein Kinase D (PKD) signaling through Gαq protein coupled receptors leads to cardiac hypertrophy through activation of MEF2 gene expression. Translocation of PKD to the sarcolemma of cardiac myocytes is required for classical activation of PKD. We have found that stimulation of β-adrenergic receptors signals through Protein Kinase A (PKA) to inhibit PKD translocation and activation. However, the isoform dependent activation (β1 vs. β2) of the adrenergic receptor is the focus of my research. I hypothesize that it is the β1-adrenergic receptor stimulation that inhibits PKD translocation and signaling. I am utilizing total internal reflective fluorescence (TIRF), imaging only 100 nm from the cover glass, thereby isolating the cellular membrane. By using TIRF, PKD translocation to the membrane is measured. Selective β-adrenergic receptor antagonists are used to isolate β-adrenergic receptor (β-AR) isoforms and measure the ability of the activated receptor signaling to inhibit Gαq stimulated PKD translocation to the membrane. By identifying the β-AR isoform responsible for inhibiting PKD translocation, de novo treatment of heart failure can be identified.

An Upper Bound of the Double Lattice Covering Density of Regular Pentagons

Jiahui Guan
Sponsor: Greg Kuperberg, Ph.D.
Mathematics

This article shows and proves that the largest p-hexagon inscribed in a regular pentagon has area $\sqrt{(5+2\sqrt{5})/2} \approx 1.53884$, where the regular pentagon is sized and has unit side length. To prove this theorem, the author first proves the existence of the largest p-hexagon in the regular pentagon, and then uses four cases to prove the largest *p*-hexagon is unique and has area ≈ 1.53884. Since every *p*-hexagon tiles the plane, p-hexagon covering is one type of double-lattice covering. Using the theorem proved in this article, we can find the least density of a *p*-hexagon covering of regular pentagons, which is also an upper bound of the double-lattice covering. The least density of *p*-hexagon covering is, thus, $\sqrt{5}/2 \approx 1.11803$. Remark: A *p*-hexagon is a hexagon with a pair of parallel opposite sides of equal length (opposite means separated, in each direction of traversing the boundary, by two other sides).

Variance of Closure Oxygen Transfer Rate (OTR) and Its Impact on Color in Sauvignon Blanc Wine

Jillian R. Guernsey
Sponsor: Andrew L. Waterhouse, Ph.D.
Viticulture & Enology

Wine bottle closures affect the aging of wine by the amount of oxygen that seeps into the bottle during aging. Here we focused on three common closure types-natural cork, synthetic cork and screw cap-and their effect on Sauvignon blanc. In the first phase, both the natural and synthetic corks were analyzed using a Computed Tomography (CT) scan to determine if the oxidation rate is related to cork structure. The darkness of the wine is being measured spectrally to assess the variation in oxidation over time. In the second phase, nitrogen filled bottles have been sealed with the closures, and the appearance of oxygen over four weeks is measured by fluorescence. This allows us to estimate how the closure would behave in a filled bottle over time. Preliminary results indicate that screw caps have the lowest OTR and, that the natural corks have the highest level of variability in OTR. The results gleaned from this study could help winemakers select an appropriate closure to consistently deliver a wine with the desired flavors.

The Effects of Chronic Intranasal Oxytocin Administration During Juvenile Period in the Prairie Vole (*Microtus ochrogaster*)

Caleigh D. Guoynes
Sponsor: Karen L. Bales, Ph.D.
Psychology

Oxytocin (OT) is a hormone shown to have significant impact on social bonding in both human and animal models. We examined the long-term effects of intranasal OT in the prairie vole (*Microtus ochrogaster*), a socially monogamous rodent often used as an animal model to screen drugs with therapeutic potential for social disorders. A previous study we published found that a low dose of OT had the most significant changes in behavior and that voles with highest dose behaved most like the control animals—preserving partner pair preference andalloparental care. The purpose of this study was to examine OT and Vasopressin (V) expression in the Paraventricular nucleus (PVN) and the Supraoptic nucleus (SON) of the brain. Voles were treated once daily with one of three dosages of intranasal OT, or saline, from day 21 (weaning) through day 42 (sexual maturity). Brains were collected at approximately day 50 and fixed with paraformaldehyde and acrolein. Group sizes varied from 8 to 18 voles (n= 83 voles total). We will perform immunohistochemistry using an OT antibody with DAB staining. We hypothesized that voles given the low dose of OT would have the least amount of OT expression in both the PVN and SON.

The Analysis of Force-Dependent Zyxin Recruitment in Epithelial Cells

Rachel E. Gurlin
Sponsor: Soichiro Yamada, Ph.D.
Biomedical Engineering

During muscle contraction and lung respiration, cells experience and respond to mechanical stress, which is essential for their physiological function. While previous studies have shown that the actin cytoskeleton, a key cellular structural element, is involved in force sensing, how cells convert mechanical force to a chemical response remains unclear. To analyze this mechanotransduction, external forces were applied to cells using two different techniques. First, with a micromanipulator-controlled micropipette, I pulled the plasma membrane of GFP-tagged zyxin expressing cells and observed rapid accumulation of this focal adhesion protein along actin stress fibers. However, these results were often difficult to reproduce, most likely due to inconsistencies in force applications. To overcome this, I designed a second approach: a low-cost cyclic stretch device that applies a precise force magnitude and frequency to a PDMS substrate, thus enabling the analysis of force-dependent responses of multiple adherent cells in real time. As this custom instrument stretched cells, zyxin accumulated along the actin cytoskeleton and cell-cell contacts. These experiments will allow more consistent force application and analysis of dynamic re-localization of force-sensitive molecules, and may reveal the mechanisms underlying force responses of cells.

Environmental and Human Health Effects of Materials in Organic Photovoltaic Solar Cells

Yadira Gutierrez
Sponsor: Julie M. Schoenung, Ph.D.
Chemical Engineering and Materials Science

With recent environmental concerns, research on alternative energy sources has become increasingly popular. Renewable energy has been a goal for some time, but the low efficiencies and high production costs produce little incentive for manufacturers. In recent years there have been improvements in the production and efficiencies of solar cells as a renewable energy. The materials used in the layers of the solar cells greatly impact the performance. Fabrication can be accomplished using organic or inorganic compounds, as well as a hybrid mixture of these materials. The research focuses on organic photovoltaic solar cells (OPVs). The primary motivation for producing OPVs is that renewable energy is relatively environmentally friendly in comparison to non-renewable energy sources such as fossil fuels. However, the concern is whether or not the materials used in the fabrication processes can have negative environmental and/or human health effects. Using process methods developed by A. Moule's group as our basis, we have been able to analyze the environmental and toxicity effects of OPVs. Process flow diagrams have been developed, and are being used as the basis to conduct chemical hazard assessments using the following: Green Screen for Safer Chemicals and Toxic Potential Indicator (TPI).

The Role of Diacylglycerol in Determining Protein Kinase D Activation and Translocation

Derrick Ha
Sponsor: Julie Bossuyt, Ph.D.
Pharmacology

Protein Kinase D (PKD) is central to cardiac hypertrophy in heart failure but its activation mechanism is poorly understood. In other cell types, the classical mechanism for PKD activation involves Phospholipase C dependent diacylglycerol (DAG) production, which activates PKD in two ways: 1) DAG binds to PKD and relieves its auto-inhibition; 2) DAG activates Protein Kinase C (PKC), which phosphorylates PKD at its activation loop. To what extent this holds true in cardiac myocytes is currently unclear. Translocation of PKD to the membrane through DAG binding is used as an indicator of activation. To assess the role of DAG in PKD activation for cardiac myocytes, we will evaluate wild type and mutant PKD constructs. We will determine dependence of PKD activation on DAG binding as well as the role of the DAG binding domain. We will use confocal and total internal reflection florescence microscopy to evaluate PKD translocation *in situ* using GFP tagged PKD. We will use Western Blotting to monitor PKD activity by quantifying phosphorylation at the activation loop and at the serine 916 autophosphorylation site. These studies will aid in understanding the molecular mechanisms that regulate the spatial and temporal dynamics of PKD activation.

Fearful Temperament, Maternal Socialization, and Their Affect on Empathy and Prosocial Behaviors

Britney Haapanen
Sponsor: Paul Hastings, Ph.D.
Psychology

Young children who demonstrate higher levels of empathy and prosocial behaviors also are less likely to develop aggression and externalizing problems. Two factors that might affect children's empathic development are temperament, such as fearfulness, and parental socialization, such as maternal sensitivity and supportiveness. It is possible that children with different temperamental characteristics derive benefit from distinct aspects of socialization. I will examine whether different elements of maternal behavior predict that less versus more temperamentally fearful children will show higher levels of empathy and prosocial behaviors. In a sample of 70 families, mothers will report on children's temperamental fearfulness and on their socialization of children's prosocial behaviors using questionnaires. Children's empathy and prosocial behavior will be observed in their reactions to distress simulations performed by familiar and unfamiliar adults. Multiple hierarchical regression analyses will be used to determine whether different maternal socialization practices support the development of empathy and prosocial behavior in children who are low versus high in temperamental fearfulness. This research will aid in understanding how parental socialization can support the development of empathy and thereby prevent aggressive tendencies in children with varying temperaments.

Unprecedented Oligomeric Regulation of CTP Synthetase

Chris H. Habrian
Sponsor: Enoch P. Baldwin, Ph.D.
Molecular and Cellular Biology

Cytidine Triphosphate Synthetase (CTPS) is an enzyme that produces the essential nucleotide CTP and is found in most living things. CTP is vital in producing RNA, DNA, phospholipids and some sugars, making CTPS important for cellular metabolism and a target of some anticancer and antivirus drugs. CTPS produces CTP using UTP, ATP and glutamine as substrates. Many regulatory inputs have been recognized but the mechanisms are not fully understood. Like many enzymes, CTPS is regulated by small molecules (GTP) and phosphorylation. More unusually, ATP and UTP promote the formation of the active tetramer from inactive dimers, allowing protein concentration to contribute an additional regulatory input. At high protein concentrations, which favor tetramer formation, substrates should bind more easily, while at low ones, higher substrate concentrations are required to achieve maximal activity. In corollary, active tetramer formation depends on the nucleotide concentration, which has been well documented. My work demonstrates that CTPS specific activity depends on protein concentration, but surprisingly the concentration-dependence does not fit a dimer-tetramer equilibrium and does not depend on nucleotide concentrations. Thus, we have discovered a previously undocumented oligomeric form of the enzyme that is crucial to activity.

Photoperiod Sensitivity in Common Bean (*Phaseolus vulgaris*) and Its Headway to Sustainable Agriculture

Paige A. Hamilton-Conaty
Sponsor: Paul Gepts, Ph.D.
Plant Sciences

Photoperiod or day length sensitivity is a trait conditioning adaptation of plants to their environment. With this trait, plants flower and set seeds well before the beginning of a dry season or first autumn frost. Changes in photoperiod sensitivity have allowed crops to grow in a multitude of conditions outside their centers of origin in tropical areas. To examine this property more closely in common bean, the USDA has provided 416 representative common bean (*Phaseolus vulgaris*) varieties. These varieties were planted in greenhouses to record flowering time and to harvest seeds. Furthermore, genomic DNA from each of the plants was isolated and sent to a collaborating lab to perform analysis for over 6,000 SNP (Single Nucleotide Polymorphism) markers. SNPs have the ability to serve as genetic markers, where differences between individual genomes can be determined. After completion of the lab analysis, genetic relatedness among the 416 lines will be established and variation for a candidate gene controlling photoperiod sensitivity will be determined. Information about this trait will assist in introducing additional genetic diversity in the bean crop and, therefore, making it more sustainable.

Purification and Characterization of Liver Tripeptidyl Peptidase II

Parmveer S. Hansra
Sponsor: Aldrin V. Gomes, Ph.D.
Neurobiology, Physiology, and Behavior

Tripeptidyl peptidase II (TPPII) is a large cytosolic enzyme that works downstream of the Ubiquitin proteasome system (UPS). The role of TPPII in cellular physiology is not well understood but is known to partially substitute for some of the proteasome functions when the proteasome is inhibited with proteasome inhibitors. Purification of TPPII was conducted using gel filtration and ion-exchange chromatography. TPPII activity was monitored by a fluorescence assay using a specific TPPII inhibitor. Proteasome trypsin-like activity was also measured to allow separation of the proteasome from the TPPII activity. Gel filtration and subsequent ion-exchange chromatography was able to separate the TPPII from the proteasome. Further purification of the TPPII by high speed centrifugation (100,000xg for 6 hrs) both purified and concentrated the TPPII. Purified TPPII will be used for characterizing the effects of different compounds on TPPII activity. Gaining insight into the dynamic function of TPPII is imperative in understanding cellular homeostasis and survival.

Are DNA Repair Genes Conserved Between Worms and Plants?

May S. Hao
Sponsor: JoAnne Engebrecht, Ph.D.
Molecular and Cellular Biology

One way cells maintain genomic integrity is through their ability to repair potentially lethal DNA double strand breaks (DSBs), which can be caused by external agents such as irradiation. Without mechanisms to repair DSBs, cells will ultimately become cancerous or die. Although there are genes that have been shown to be required for DNA DSB repair such as the master checkpoint kinase *atm-1*, the full spectrum of genes required for DSB repair remain unknown. In the plant *Arabidopsis thaliana*, several hundred genes were shown to be upregulated in response to DSBs; however, the function of many of these genes is currently unknown. We used the nematode, *Caenorhabditis elegans* with a 3-day life cycle, and asked whether the genes identified in the plant that were upregulated in response to DSBs play a role in DNA repair in the worm. To that end, we examined the consequence of inactivating the corresponding worm genes by RNAi and monitoring sensitivity to methyl methanesulfonate (MMS), which induces DSBs. Initial findings reveal that RNAi treated worms are hypersensitive to MMS. Analysis of these unknown genes will bring us one step closer to determining the potential roles these genes play in maintaining the genomic integrity of cells.

Development of Highly Active Anti-Retroviral Therapy for Feline Immunodeficiency Virus-C

Leticia J. Harjono
Sponsor: Brian Murphy, D.V.M.
Pathology, Microbiology and Immunology

Feline immunodeficiency virus (FIV) is a retrovirus that causes Feline Acquired Immunodeficiency Syndrome (FAIDS) in domestic cats. The genomic and immunopathologic similarities between FIV and human immunodeficiency virus (HIV) make FIV infection a useful model of human AIDS. Thus, research into medical treatments to cure AIDS may be facilitated through FIV infection studies. Studies in human AIDS patients have shown that Highly Active Anti-Retroviral Therapy (HAART), a drug therapy that combines three anti-retroviral drugs from at least two different drug classes, is much more effective than monotherapy. To date, a study combining three anti-retroviral drugs to form an effective HAART protocol has not been reported in cats. The project reported here involves developing an effective *in vitro* feline HAART regimen against the FIV-C strain. Candidate anti-retroviral drugs will be tested for toxicity and ability to suppress viral replication in an *in vitro* culture system. Time course and dose response experiments will also be performed to determine the optimum drug dosage and treatment duration. The performance of the drugs will be measured using real time PCR, reverse transcriptase, and P24-ELISA assays. It is hoped that the HAART developed from this *in vitro* study will translate to FIV-infected cats *in vivo.*

Just in Case (Marking): An Investigation into the Potential Origins of Ergativity in Case-marking and Syntactic Alignment

Kaitlyn Harper
Sponsor: Raul Aranovich, Ph.D.
Linguistics

All languages distinguish between grammatical subjects, things that do, and grammatical objects, things which are done to. Furthermore, there is a distinction between constructions in which subjects occur alongside objects (transitive clauses) and those where they stand alone (intransitive). The vast majority of the worlds' languages choose to group these two sub-types of subject together, leaving the object as a separate unit within their grammars. However, there are a number of languages which choose instead to group the intransitive subject and the object together, separating out the transitive subject. This phenomenon is known as ergativity. Various origins of ergativity have been proposed, and are here outlined and reviewed. In particular, it is argued that an approach based on the language-specific interactions of lexical properties best captures the nuances of ergativity, in terms of its ability to explain the origins of the morphological/ syntactic phenomenon, and its ability to tackle the potentially-related occurrence of ergative-like patterning among the verbs of non-ergative languages.

The Role of UNC-84 in the Germline

Kevin C. Hart
Sponsor: Daniel A. Starr, Ph.D.
Molecular and Cellular Biology

Meiosis and Mitosis are vital cellular processes needed to create healthy gametes. Proteins in the nuclear envelope have been shown to have roles during these processes. My project focuses on discovering the role of an inner nuclear membrane SUN protein, UNC-84, during meiosis and mitosis in the C. elegans germline. Based on preliminary data, I hypothesize that UNC-84 plays a novel role in mitosis and meiosis in the germline. To test this hypothesis, I counted apoptotic nuclei, and found that *unc-84* mutants have elevated levels of apoptosis compared to wild type worms. To determine UNC-84's role in the apoptosis pathway I looked at both known pathways: the asynapsed chromosome pathway and the unrepaired recombination pathway. UNC-84 is working through both pathways and our hypothesis is that UNC-84 has a role in chromosome pairing. UNC-84 also has a role in mitosis and the DNA damage response because *unc-84* mutants have only a partial cell cycle arrest in response to damage. My research aims to characterize the mechanism of UNC-84 in chromosome pairing and determine UNC-84's role in the cell cycle in response to DNA damage. This research will further our understanding of how SUN proteins function in germ cells.

Interactive Control Systems for a Tilting Ball Maze

Mohab O. Hassan
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Electrical and Computer Engineering

With the current shortage of science and engineering graduates, this project is aimed to encourage and inspire incoming students to pursue a degree in the field of Computer and Electrical engineering. This interactive exhibit displays the practical applications of concepts learned in class. Our project takes the traditional titling table marble maze and infuses it with computer imaging and accelerometer technologies. The user will be able to control the angle of the maze by either moving a piece of paper with a pre programmed image under a camera, or by using a balance board with an embedded accelerometer. From this information, a tilt angle and direction is calculated, and information is sent to the controller and motors to cause the board to tilt. Using careful software integration techniques, we run our system with two control devices as a single entity. An elegant and streamlined solution here is paramount to success in integrating the physical and digital worlds. Not only does this project excite and inspire, it demonstrates the boundless creativity that will be evident in tomorrow's computer and electrical systems.

Excel-Based Tools for City-Level Emissions Reduction

Tracy Heidersbach
Sponsor: Deb Niemeier, Ph.D.
Civil and Environmental Engineering

The current global warming trend is projected to lead to increases in global temperature between 2.0°F to 11.5°F by 2100 if emissions continue as they have in the past. This is why the Sustainable Design Academy (SDA) has developed various excel-based tools that cities can utilize to quantify and reduce emissions in a user-friendly manner. One of these tools includes an emissions reduction-strategy optimization modeling program. The program helps city officials chose between appropriate strategies with quantified per-unit emissions reductions. This model defines total emissions benefits in terms of the number of affected units (i.e. number of households or vehicles modified) to get specific user-defined emission reduction quantities. These outputs are also grouped by strategy-type and presented graphically so that users can instantaneously tell which strategies potentially yield the most returns. These models were developed as supplements for the cities of Woodland and Winters Climate Action Plans. Similarly, the SDA is currently developing a spreadsheet tool that will help smaller cities, like Davis, develop parking management systems to reduce emissions associated with trolling for parking spaces. This tool will include the outlining of potential technologies, implementation issues, and project benefits and costs associated with developing a robust system.

The Psychological Effects of Immigration Raids on Second Generation Mexican-American Adolescents with Undocumented Parents

Nancy M. Hernandez
Sponsor: Rand Conger, Ph.D.
Human and Community Development

According to U.S. Immigration and Customs Enforcement (ICE) records, ICE deported nearly 400,000 individuals during fiscal 2011, the largest in the agency's history. As heated debates regarding immigration reform take place in Capitol Hill, one important factor lacks in priority: the psychological effects of U.S. citizen children affected by mass raids/deportations. Such group is unique because deportees are parents of children who are entitled to all benefits that fall under U.S. citizenship but are powerless when faced with separation and displacement of their families. My research objective entails exploring the psychological impact of ICE raids on U.S. citizen youth with undocumented parents but I will specifically focus on the mental well-being of Mexican-American adolescents. I will investigate anxiety and depression in such youth whose (1) parent(s) has/have been deported and (2) those whose parent(s) live with the prospect of deportation. My research involves surveying approximately 500 high school adolescents utilizing scales that measure mental well-being. My research is currently in progress, I await to find a correlation between adolescent mental well-being and fear of parental separation. Research within this realm is rare and I hope to bring awareness to an issue that's overshadowed by politics.

Lac Operator as a Tool to Track Meiotic Chromosomes

Veronica Hernandez
Sponsor: Francis McNally, Ph.D.
Molecular and Cellular Biology

During female meiosis 3/4 of the chromosomes in the developing oocyte are segregated into meiotic byproducts called polar bodies. The segregation process for selecting which chromosomes are expelled from the oocyte and placed into the polar body is not fully understood. Here we are examining the *Escherichia coli* lactose (lac) operator as a possible tool to visualize and keep track of chromosomes. The ease of manipulation, observation, and short generation times, make *Caenorhabditis elegans* an ideal model for research in developmental biology. In this project, 17 strains of *C. elegans* with lacO insertions in various positions of their genome were crossed with a strain in which a green fluorescent protein-lac repressor (GFP-lacI) was present in its genome. The first generation of the successful crosses was then screened under a microscope to see whether their meiotic chromosomes were tagged with the green fluorescent protein. Analysis of the F1 generation's chromosomes is underway. The development of a tool that keeps track of meiotic chromosomes may be used in future experiments in order to observe whether the segregation process of the chromosomes during meiosis is random or selective against damaged chromosomes.

Controlled Modification of Porosity in Nanoporous Gold Films

Ashley C. Hettick
Sponsor: Erkin Seker, Ph.D.
Electrical and Computer Engineering

Nanoporous gold is desirable in electrochemical biosensing applications due to its high surface-area-to-volume ratio compared to traditional planar gold electrodes. Porosity and surface area play an important role in sensitivity in these applications, therefore optimization of these parameters is necessary. Current fabrication processes utilize thermal annealing for control of pore size and morphology. However, these methods typically cause pore and ligament coarsening, which can reduce the sensitivity of these electrodes. Here, we present a complementary technique that uses wet chemical etching with iodine/iodide solutions to gain finer control over pore size and morphology. To fabricate and modify gold nanopores, a dealloying process using a gold and silver alloy is first used to form the base nanoporous gold electrode. Dealloying, a chemical process, takes advantage of high etch selectivity of silver over gold as well as high surface diffusivity of gold atoms to form nanopores out of a bulk alloy. Pore morphology is then modified, either through aforementioned thermal techniques, the iodine/iodide etch, or a combination. We plan to use these electrodes for future experiments in DNA surface functionalization, where ability to control pore geometry will allow tuning of electrode performance.

Design of a Novel Plastid Transformation Vector Containing an Inducible Recombinase Enzyme for Marker Removal

Derrick R. Hicks
Sponsor: Karen A. McDonald, Ph.D.
Chemical Engineering and Materials Science

Plastid transformation presents a way, whereby plants can be engineered to express multiple genes, novel pathways, or high levels of medically or industrially relevant proteins and metabolites. Currently, selection for successful plastid transformation generally involves the use of antibiotic resistance genes. Environmental safety regulations require the removal of these genes in order for transgenic plants to be grown outdoors. This is currently accomplished by homology-based recombination events or cotransformation of the nucleus with an inducible, plastid-targeted recombinase enzyme. We plan to demonstrate that a single transformation event may be used to transform the plastid genome with a selectable marker fused to red fluorescent protein (RFP), a gene of interest (GOI), and an inducible phiC31 recombinase. The recombinase is controlled by a translationally-active, theophylline-responsive riboswitch, which should allow for effective selection and subsequent removal of selectable marker genes. Furthermore, RFP will allow both selection and marker removal to be visually monitored. If successful, this should speed the process of generating marker-free, transplastomic plants that are suitable for large-scale, outdoor growth.

Functional Characterization of Two Novel Membrane Proteins Involved in SYP61 Trafficking

Shawn M. Higdon
Sponsor: Georgia Drakakaki, Ph.D.
Plant Sciences

The endomembrane system of eukaryotic plant cells is an intricate trafficking system that utilizes vesicles to transport proteins and other soluble products. Vesicles decorated with the SYP61 protein were isolated with affinity purification techniques by Drakakaki et al., 2012. A study of the 145 proteins comprising the SYP61 vesicle proteome suggested that the SYP61 compartment is involved in the trafficking of cell wall components. Within the SYP61 proteome, two trans-membrane proteins of unknown function were identified and have displayed highly conserved homologies within their polypeptide sequences with proteins involved cell wall bioprocesses. Fusion protein constructs were created using DNA coding sequences of both the unknown and fluorescent proteins. The fusion protein constructs were then transformed in *Arabadopsis thaliana* with *Agrobacterium tumefaciens*. Using Confocal Scanning Laser Microscopy, the sub-cellular co-localization of the SYP61-vesicles and the fusion proteins was confirmed. We will conduct further research with these unknown proteins by taking a reverse genetics approach to characterize their sub-cellular function. Conclusions from this study will provide tangible material for understanding the molecular mechanisms associated with SYP61 mediated trafficking.

Analysis of Faunal Remains from a Prehistoric Iñupiat House in Northwest Alaska

Katheryn A. Hill
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Anthropology

Cape Espenberg is a thin peninsula that juts into the southern edge of Kotzebue Sound in Northwest Alaska. For the past 1000 years, ancestors of the modern Iñupiat people have inhabited this wind-swept sand dune in order to take advantage of migrating caribou herds and abundant marine resources. Houses were constructed of driftwood logs and cut sod blocks. To prevent heat loss, long tunnels were constructed that led to the houses interior. These sod houses provide an excellent platform for investigating questions of prehistoric subsistence and activity areas within the structure because organic remains are well-preserved. House feature 68B at site KTZ-87 (ca. AD 1420-1630) was excavated in 2011. For my research, animal-bone remains from two activity areas, the house interior and the tunnel, were analyzed. The interior area is characterized by considerably more burned and fragmented bone than the tunnel, which suggests this was a hearth or cooking area. Small seals, most of which are ringed seals, dominate the assemblage, followed by caribou (heavily processed for marrow), birds and fish, the latter of which are small and likely caught by jigging through the sea ice.

Scandium(III)-Catalyzed Asymmetric Pi-nucleophile Additions to Protected Alkylidenes: Synthesis of 3,3'-oxindoles

Brent Hiramoto
Sponsor: Annaliese Franz, Ph.D.
Chemistry

Enantioselective pi-nucleophile additions to protected α, β-unsaturated alkylidenes have been explored as a new synthetic route to access oxindole scaffolds found in many biologically active natural products. These pi-nucleophile (indoles,pyrroles,anilines)conjugateaddition/asymmetric protonations are catalyzed by chiral scandium(III)-complexes in high yield (> 99%), high enantioselectivity (up to 94:6 er), and good diastereoselectivity (up to 86:14 dr). Sodium tetrakis[(3,5-trifluoromethyl)phenyl] borate (NaBArF), a bulky counter-ion, appears to facilitate these additions, improving yields and enantioselectivity. One primary aspect that future work will be attempting to optimize is increasing the diasterioselectivity. We are also investigating the use of β-disubstituted symmetric alkylidenes to provide access to relevant compounds with a single stereocenter. This poster will discuss the scope of the reaction, and the effect of various chiral metal-ligand complexes, nucleophiles, ligands (e.g. pybox and box), counter-ions (NaBArF, $NaSbF_6$), and proton sources (e.g. water, BINOL, chiral phosphoric acids, alcohols, triflic acid) on reactivity and selectivity.

The Correlation Between Diabetes Mellitus and Hypertension: Which Pediatric Patients are at Risk

Scott D. Hirsch
Sponsor: Stephanie Nguyen, M.D.
Pediatrics

Pediatric hypertension can alter long-term cardiovascular and renal morbidity and mortality. The aim of the presented study is to describe the relationship between diabetes mellitus and pediatric hypertension. This is a report on a current work in progress. Pediatric patients with diabetes mellitus were recruited from the pediatric endocrinology clinic at the UC Davis Medical Center. We measured baseline weight, height, and blood pressure. We interviewed subjects to obtain demographics and a medical history. Ambulatory blood pressure monitoring was used to classify subjects in the following categories: normal, stage 1, stage 2, or stage 3 hypertension. We estimate a minimum of 140 subjects would be required to detect a statistically meaningful difference in the prevalence of ambulatory hypertension based on demographic and clinical predictors. Currently, 145 subjects have been consented, 120 subjects completed the study and 25 subjects withdrew. There are a total of 60 female and 60 male subjects of which there are 61% Caucasians, 7% African Americans, 12% Hispanics, 5% Asians, and 15% were listed as Other for race/ethnicity. Subjects' ages ranged from 6 to 21 years old. Based on our current recruitment efforts, we expect to complete recruitment in the next 3-6 months.

The Resource Curse and the Quality of Education Channel

Natalie H. Ho
Sponsor: Giovanni Peri, Ph.D.
Economics

Contrary to economic intuition, resource-abundant countries today seem to be growing much slower than their resource-poor counterparts. They are lagging behind rich countries as a result of their slow growth, and therefore the income gap between the rich and poor countries is widening. Scholars have identified the lack of investment in education as a crucial channel among the various mechanisms proposed to explain the slow growth performance. Previous research has primarily focused on years of education obtained, despite the clear difference in skills gained from one year of education in one country versus another. Using a two-stage least squares model and various robustness checks, this study examines whether governments in resource-rich countries are using revenues to seriously invest in high-quality education and subsequently, in long-term growth. Among the indicators for serious commitment to quality education are education inputs, like classroom sizes, teachers' salaries, and expenditures, as well as outputs, like dropout and repetition rates. Conclusions from this research will contribute to understanding the relationship between natural resource abundance and growth, which is vital for producing poverty-alleviating policy.

Yeast Species Differ in Their Ability to Survive in the *Drosophila melanogaster* Gut

Don Q. Hoang
Sponsor: Artyom Kopp, Ph.D.
Evolution and Ecology

Microbial research often focuses on pathogens; however it has become evident that commensal microbes are important in their hosts' physiology, ecology, and evolution. Due to the extensive knowledge of its biology *Drosophila melanogaster* serves as a good model for studying host-microbe interactions. Often, *Saccharomyces cerevisiae*, baker's yeast, is used for convenience when studying *Drosophila*-yeast relationships. However, *S. cerevisiae* is rarely found with *Drosophila* in nature. Therefore, assessments of *Drosophila*-yeast relationships may require using yeasts found naturally with *Drosophila*. Eleven different specie of yeast that are naturally associated with *D. melanogaster* were used to define the *Drosophila*-yeast relationship. *D. melanogaster* adults were fed one species of yeast at a time, then fly digestive tracts were removed after specific time periods and surviving yeast were quantified. Yeast species persist for different amounts of time. For example, *Hanseniaspora uvarum* does not persist, while *Hanseniaspora occidentalis* persists for at least 72 hours. These survival rate differences suggest that *S. cerevisiae* may not necessarily be the best model for *Drosophila*-yeast interactions and that other yeasts may be worth investigating to understand their role in *Drosophila* physiology, ecology, and evolution.

Hella Stigmatized: A Linguistic Analysis of the Word and an Exploration into its Divisiveness

Erin Hollander
Sponsor: Patrick Farrell, Ph.D.
Linguistics

The term *hella* is a distinct element of northern Californian culture, but little linguistic research has been conducted on the word. Though geographically-specific colloquialisms, or *slang*, are neither new nor uncommon, *hella* is unique in multiple ways. Most colloquialisms are considered interesting, endearing, or even funny by those who don't use them, but *hella* serves as a point of bitter contention between its northern Californian users and the many southern Californians who express an outright contempt for the word. Additionally, *hella* is distinctive by virtue of its semantic makeup; *hella* occupies more grammatical categories than any other specifier, or qualifier, in English, and can even be used to denote truth value, or confirmation. I use existing academic research on *hella* and its unique grammar, supplemented with surveys of both northern and southern Californians on their own *hella* usage and understanding, to explore possible explanations for the widespread *hella* hatred. Research indicates a sociolinguistic aspect, coupled with a possible disfavor for words that violate a person's deeper cognitive understanding of how language should work. In exploring this phenomenon in new ways, we add to our existing knowledge of how and why language interacts with society.

Using X-ray Crystallography to Solve the Structure of a Novel Archaea Protein of Unknown Function

Danna Hong
Sponsor: Andrew J. Fisher, Ph.D.
Chemistry

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All living organisms require sulfur to thrive. Most organisms use conserved proteins called the sulfur activation pathway to convert sulfate into metabolically useful intermediates. This pathway is absent in some Archaea, in particular the methanogens, organisms that produce methane as a primary source of cellular energy. MJ0066 from *Methanocaldococcus jannaschii* that is annotated as a protein from the sulfur activation pathway. Current research in the Fisher lab suggests that this annotation is incorrect. This study hopes to solve the structure of MJ0066, to guide future hypotheses about its enzymatic function. MJ0066 possesses an iron-sulfur cluster and a zinc binding site, each located in separate domains of the protein. We have crystallized the full-length protein and collected structural data to 3.0 Angstroms. We hope to collect higher resolution data, so two truncated forms of the protein were generated to isolate the domains. This study focuses on the iron-sulfur containing domain. The DNA sequence of the truncated protein was engineered into *Escherichia coli* cells. Test growths were conducted to determine the best conditions for overexpression and purification. Future work will focus on crystallizing the iron-sulfur domain and conducting activity assays to test enzymatic function at this metal site.

Protein Tyrosine Phosphatase 1B Deficiency Potentiates PERK/eIF2α Signaling in Brown Adipocytes

Ellen Hosein
Sponsor: Ahmed Bettaieb, Ph.D.
Nutrition

Proteintyrosine phosphatase is a physiological regulator of glucose homeostasis and body mass, and has been implicated in endoplasmic reticulum stress. Herein, we assess the role of PTP1B in ER stress in brown adipocytes (BA), which are key regulators of thermogenesis and metabolic response. To determine the role of PTP1B in ER stress, we utilized BA from mice with adipose-specific PTP1B deletion, and BA deficient in PTP1B and reconstituted withPTP1B wild type or the substrate-trapping PTP1B D181A mutant. PTP1B deficiency led to upregulation of PERK-eIF2α phosphorylation and IRE1α/XBP1 sub-arms of the unfolded protein response. In addition, PTP1B deficiency sensitized differentiated BA to chemical-induced ER stress. Moreover, PERK activation andtyrosine phosphorylation was increased in BAT and adipocytes lacking PTP1B. Increased PERK activity resulted in the induction of eIF2α phosphorylation and better translatability of ATF4 mRNA in response to ER stress. At the molecular level, we demonstrate direct interaction between PTP1B and PERK and identify PERK Tyr615 as a mediator of this association. Our findings demonstrate that PTP1B is a physiologically-relevant modulator of ER stress in brown adipocytes and that PTP1B deficiency modulates PERK/ eIF2α phosphorylation and protein synthesis.

CTC Project: Detection of Tumor Cells by Observing Elastic Light Scatter

Lawrence K. Hou
Sponsor: Suzanne Miyamoto, Ph.D.
Internal Medicine

Cancer is the leading cause of death worldwide with most cancer deaths due to secondary tumors arising from metastases. Early detection of circulating tumor cells (CTCs) may prolong patients' lives by allowing more time to treat and inhibit growth of metastasized cells. Current methods for CTC detection require the use of antibodies which are expensive to produce and can only bind to specific biomarkers. In a collaborative project with the Center for Biophotonics Science and Technology (CBST), and UC Davis Medical Center, we are developing a new detection system to identify CTCs in a more sensitive and efficient process. Our method involves imaging CTCs and observing the elastic light scattering (Mie scatter) of the cells. Certain organelles (nuclei, mitochondria) are known to produce distinct and specific light-scattering spectra. We will be examining and characterizing the light scattering signatures of various cancer cells, in relationship to normal blood cells. So far we modeled and characterized different cells based on cancer type, nuclei vs. whole-cell extract, and observed the elastic light scattering of each. In theory we should distinguish one type of cell from another by this new detection system and understand the main/majority cellular components that contribute to light scatter.

A Game of Domino's: Insight into African American Women's Companion Selection Process While in College

Jhamere Howard
Sponsor: Bruce Haynes, Ph.D.
Sociology

African American women outpace African American men in graduating from college at a rate of 1.67 to 1 woman to man ratio. This discrepancy leaves a large percentage of African American women isolated from intimate or romantic relationships with men. Studies show that the dilemma for African American women is they seek well-educated, financially stable, monogamous, reliable and affluent partners yet have the smallest and least diverse dating pool compared to their counterparts from other ethnic backgrounds. This narrow pool of candidates has been attributed to African American women's nonconformity to the hegemonic standard of beauty, along with negative stereotypes of them as unfeminine, hyper-sexual, and emasculating. Seeking to gain more insight into the dating trends of African American women in higher education this study will explore the African American women's perspectives on dating, their process when selecting a partner, and coping strategies for dating in college. Through qualitative interviews with African American women at UC Davis I hope to more closely analyze women's subjective explanations, expectations, and companion selection process that may abate the number of African American women in significant relationships.

The Effects of Parent Education Combined with Coaching on Parenting Qualities Among Parents in Substance Abuse Recovery

Amy Hu
Sponsor: Holly Hatton, Ph.D.
Human and Community Development

Parent education is one of the most commonly used interventions for parents involved in the child welfare system to provide them with the knowledge and skills to become more nurturing parents. However, for parents who are struggling with multiple issues in addition to substance abuse, this task can be especially challenging. The present study aims to determine how certain risk factors (parental depression, child disability, and parent disability) relate to qualities of parenting (nurturing skills, parental empathy, and parent responsiveness) in 57 parents with young children and substance abuse issues. All parents have completed a modified 16-week Nurturing Parenting Program that incorporates both parent education and coaching; they have also completed pre- and post-measures of parents' use of nurturing skills, parent empathy, and responsiveness towards children's needs. Additionally, the study examines certain risk and resilience factors as modifiers of the impact of the Nurturing Parenting Program on various self-reported parenting qualities within a subset of 20 parents with depression. Preliminary results using a repeated measures analysis of variance (ANOVA) conducted for each parenting quality revealed that parents with substance abuse issues benefit when receiving parent education combined with coaching at improving their parenting qualities.

Rett Syndrome: Developing a Cell System to Measure MeCP2 Isoform Stability

Daniel J. Hu
Sponsor: Janine M. LaSalle, Ph.D.
Medical Microbiology & Immunology

Rett Syndrome is a neurodevelopmental disorder affecting 1/10,000 females. Phenotypic characteristics include reduced head growth, regression in speech, seizures, hand stereotypies, and cognitive decline early in development. About 90% of all Rett Syndrome cases are caused by mutations in a gene coding the DNA binding protein Methyl CpG Binding Protein 2 (MeCP2). MeCP2 is required to control gene expression during brain development via interactions with other regulatory proteins. MeCP2 exists as two isoforms: MeCP2e1 and MeCP2e2. They differ at the start of their coding region where a 12 amino acid region in MeCP2e1 is replaced by a shorter 4 amino acid region in MeCP2e2. The remaining 95% of their coding sequence is identical. It is unclear if the differences between the isoforms have any effects on MeCP2 function or stability. To examine potential differences in protein stability, we are currently engineering stable, mammalian SH-SY5Y neuroblastoma cell lines, which can be induced to overexpress specific MeCP2 isoforms. These cell lines will be used to measure the degradation rate of each isoform and determine any differences in protein stability between MeCP2e1 and MeCP2e2.

Ca^{2+}/Calmodulin-Dependent Protein Kinase δ; II Regulation of the Cardiac Voltage-Gated Sodium Channel $Na_v1.5$

Margaret Huang
Sponsor: Julie Bossuyt, Ph.D.
Pharmacology

Cardiac disease, which includes rhythm disorders, remains the most prevalent cause of death in the developed world. In the heart, the principal voltage-gated sodium channel isoform, $Na_v1.5$, starts key electrical activity for action potential (AP) generation. Several rhythm disorders, such as long QT syndrome (LQTS) and Brugada syndrome (BRS), have been linked to genetic mutations in $Na_v1.5$. The serine/threonine kinase Ca^{2+}/calmodulin-dependent protein kinase δ II (CaMKδII) has also been associated with arrhythmogenesis and its expression and activity are increased in heart failure. CaMKIIδC, activated by intracellular calcium complexed with calmodulin (CaM), is known to phosphorylate multiple proteins important in cardiac excitation-contraction coupling, including ion channels and calcium handling proteins. Recently, CaMKIIδC was found to co-localize with and phosphorylate $Na_v1.5$ thereby altering its ion channel biophysics. Here we assess how CaMKδII phosphorylation of $Na_v1.5$ affects channel expression in human embryonic kidney (HEK) cells and native cardiomyocytes. These types of alterations in $Na_v1.5$ could be particularly relevant for arrhythmogenesis in cardiac disease.

"Burning Away All Structure:" Rhythmic Perception and the Music of Meshuggah

Stephen S. Hudson
Sponsor: Sam Nichols, Ph.D.
Music

The music of the Swedish heavy metal band Meshuggah is unique in its rhythmic complexity and incessant, long-winded experimentation, but remains paradoxically popular. One of their most unconventional releases to date is the 2004 EP I, consisting of a single 21-minute long track. Critical reactions to this work were sharply divided, with some writers praising it as the pinnacle of Meshuggah's "math metal" style, and others denigrating it as repetitive and tedious trash. Drawing from sources as diverse as musician interviews, gesture analysis of live recordings, and reception history, my research draws on Prof. Petr Janata's theory of musical groove to reconstruct how Meshuggah's music is heard, felt, and embodied by listeners. I also place my investigations within the framework of somaesthetics proposed by philosopher Richard Shusterman, examining the musicological implications of his ideas and suggesting routes for further study. My conclusions present a model of understanding listener experience with applications in popular and classical traditions far beyond the music of Meshuggah.

Thermal Discrimination of Innocuous and Noxious Temperatures in Rats

Patrick D. Huebner
Sponsor: Earl Carstens, Ph.D.
Neurobiology, Physiology, and Behavior

Our understanding of the ability to discriminate differences in skin temperatures was recently advanced by the identification of thermosensitive TRP channels. Genetic knockout of TRPM8 and TRPV3 in mice reduced cold and warm temperature discrimination, respectively. However, the thermal discrimination capabilities across the entire temperature range have not yet been established in normal rodents. We therefore examined the ability of rats to discriminate between small temperature differences using a two-temperature preference test. We additionally investigated if a gender difference exists in thermal sensitivity. Rats were free to occupy either of two adjacent thermoelectric plates whose temperatures were equal or different by 3°C. We measured the duration of time that the animal spent on each plate and the number of crossings between the two plates over a 20 min period. Males were indifferent to temperature differences in the thermoneutral range (30-33°C) but significantly avoided warmer or colder temperatures above and below thermoneutral (except for 36-39°C). Ovariectomized females exhibited no temperature preference except at hot and cold extremes. Experiments are continuing with normal females. These studies indicate that male rats can readily discriminate between innocuous warm and cool temperatures.

Accessory Sex Gland Maturity Potential Marker of Accessory Sex Gland Maturity: Cell Junctions

Trent M. Ichiuji
Sponsor: Trish Berger, Ph.D.
Animal Science

Productivity of an intact boar is measured by the ability to produce a large amount of semen. The accessory sex glands, including the seminal vesicles, produce fluid that interacts with the sperm after ejaculation. This project studies the effects of two treatments on boar seminal vesicles: hemicastration, and reducing estrogen by blocking synthesis with Letrozole. Hemi-castration, the removal of one testis, and Letrozole, an aromatase inhibitor, may affect the maturation of seminal vesicles, which are important to semen production. Neither treatment is expected to decrease the production of testosterone. Replicates include littermates treated with either vehicle control Letrozole, hemi-castrated control, or hemi-castrated plus treatment with Letrozole. The experiment begins with 6-micrometer thick sections of 6.5-week old boar seminal vesicles fixed in paraffin. Each sample then undergoes immunohistochemistry, a process that rehydrates and stains for the protein Occludin in the fixed tissue. Occludin is a junctional protein, meaning its presence allows junctions to form between cells. The formation of tight junctions is a marker of maturation within seminal vesicles which is encouraged by testosterone. Results from four litters, find no differences in the labeling intensity among the different treatments suggesting that neither treatment affects this characteristic at this age.

The Economics of Anti-Aging Products

Irtqa Ilyas
Sponsor: Raja Sivamani, M.D.
Dermatology

Social expectations coupled with media portrayals have placed greater importance on the ability to look younger than one's age. As a result of this phenomenon, a new subset of beauty products has emerged within the beauty industry: Anti-Aging Agents. The purpose of our study was to examine what vitamins and botanical extracts are commonly used, as well as analyze how the economic burden varies with the number of vitamins and/or botanical extracts in the product. We collected our data through five online retailers and calculated the average price per ounce while noting the number of vitamins and the number of botanical extracts listed in the inactive ingredients for each product. After analyzing 145 products, the following results were obtained. Vitamin E and C were the most common used vitamins with use in 66.9% and 51.0% of products, respectively. The three most common botanical extracts were from grapes, sunflower, and shea butter. The data show that as the number of botanical extracts and vitamins increase the normalized price per ounce per natural ingredient decreases.

An Approach to Completely Integrable Systems Preserving Bi-Hamiltonian Structure

Maxine Imura
Sponsor: John Hunter, Ph.D.
Mathematics

We studied completely integrable systems by looking at bi-Hamiltonian structures of partial differential equations such as the KdV equation. Given a Hamiltonian operator, $J(u)$, we verified that this is a Poisson bracket by checking the following properties: skew symmetry and Jacobi identity. An application to this is looking at the KdV equation where we found lower order terms other than u_{xxx}. So, our equation looks like $u_t = (u\partial_x + \partial_x u + L)[u]$ which only satisfies the Jacobi identity if $L(u) = \alpha(\partial_x)^3 + \beta(\partial_x)$, where α and β are constants. Also, we studied the Hunter-Saxton equation, $(u_t + uu_x)_x = \frac{1}{2}u_x^2$ with the Hamiltonian operator $J(u) = u_x\partial_x^{-2} - \partial_x^{-2}u_x$. Ultimately, we found lower order terms, L, that are compatible with $J(u)$: $L = a\partial x^{-1} + b\partial x^{-3}$ where a,b are constants. In the future, we use the same operations in hopes to find a simpler bi-Hamiltonian structure to the Ostrovsky-Hunter equation, which is known to be integrable.

Jane Austen's Spinsters

Corrie Jacobs
Sponsor: Alessa Johns, Ph.D.
English

Jane Austen's works are famous for their marriage plots. As reminders of marital failure, how do spinsters (i.e. women who have never been married) fit into Austen's matrimonial success stories? As a spinster herself, does Austen pity her unmarried female characters, or does she mock them? While twenty-three widows fill Austen's works, only four characters can be confidently classified as spinsters. Generally these women are kind-hearted, motherly characters, but they are also comically nervous, always fearful of appearing useless and becoming forgotten. Britain's long eighteenth century saw depictions of spinsters fluctuate between the hideous old maid and the devoted maiden aunt. Although Austen does not necessarily continue this abuse of spinsters, she does not ignore it completely. For instance, *Emma*'s heroine perceives the amiable spinster Miss Bates as "so silly – so satisfied – so smiling – so prosing – so undistinguishing and unfastidious." Drawing on social history and Austen's biography, I look at spinsters, characters facing the possibility of spinsterhood, and other probable spinsters in Austen's juvenilia and novels. Despite their labels as failures, like real contemporary single women and Austen herself, these fictional spinsters effectively contribute to society, albeit in alternative ways.

Education, Democracy, Tolerance and Peace

Sana Jafri
Sponsor: Jamal Abedi, Ph.D.
School of Education

In 2011, United States and Pakistan relations started deteriorating due to the differences in goals each leader had. The secret US mission to kill Bin Laden, and the succeeding Drone Attacks in Pakistan led to finger pointing and hostility; this also led to questions of why the US had spent immense amounts of money in strengthening the Pakistani military. The US justified this action by reminding people that Pakistan was and is an ally, and having them prepared for war is essential. It can be considered more progressive and rational to spend half of the aid on education in order to help create a stronger base for political and logical solution; while creating a stronger ally. Over the years many wars have taken place due to miscommunication and misinterpretation, which take place due to lack of cultural insight, tolerance and at lack of democracy. There is a dire need for more educated leaders, who will evaluate the problems at hand oppose to conflicts. If we invest more in education and democracy, while gaining insight in cultural and religious values then peace may be easier to achieve.

Differentially Expressed Genes in the Parasitic Plant Genome Project

Sagar B. Jain
Sponsor: John I. Yoder, Ph.D.
Plant Sciences

Parasitic weeds are a major obstacle in agriculture throughout much of the developing world because they deplete plants of their nutrients. Determining which parasite genes are necessary for infection will help identify the genome-wide changes over evolutionary time resulting from the parasitic lifestyle. The Parasitic Plant Genome Project examines the transcriptomes of three parasitic Orobanchaceae: Triphysaria, a non-weed California native, Striga and Orobanche, two exceptionally devastating parasitic weeds. Sequence data of each of these genera have been obtained by Next Generation Sequencing and the data stored at the PPGP database at Penn State University (http://ppgp.huck.psu.edu/). My project is to cluster transcripts that are differentially expressed genes in parasitic development of haustoria host invasion. Genes homologous to severally differentially expressed transcripts were found using the BLAST algorithm and aligned using Geneious software to visualize sequence overlaps and to construct contigs. I will discover which genes have abnormal expression levels during parasitic development by conducting statistical multivariate analysis using R. The results will identify gene expression levels which deviate from patterns in non-parasitic plants and allow us to discover genes responsible for parasitic weed success, and identify candidates to target in genetically engineered crops for parasite resistance.

Improving Particle Integration Efficiency in Mantle Convection Simulation by Combining Numerical Integration Techniques

Emily M. Javan
Sponsor: Eric M. Heien, Ph.D.
Geology

Tracer particles are often used in simulations of mantle convection and similar phenomenon to track material properties on a fine scale. Particle flow techniques generally use a single high-accuracy numerical integration method, possibly with an adaptive time step. However, convection simulations have strong heterogeneity in the types and linearity of flows. To improve efficiency we investigate exploiting this heterogeneity by using different integration methods depending on the flow pattern near each particle. The optimal integration method and time step is based on a measure of flow curvature in a given vector field, and a user specified acceptable level of error. Particles in low curvature flow tend to use Euler's method of integration, while higher curvature requires the use of second or fourth order Runge-Kutta. Our method analyzes a particle's surroundings quickly and responds with the most efficient integration method to maintain an acceptable level of error. We implement this method in the mantle convection simulation code ASPECT and find significant improvement in overall simulation performance while maintaining the same level of accuracy. We also demonstrate how this method allows a tradeoff between accuracy and speed in these simulations and how it may be applicable to other areas.

Effects of Vineyard Management on Metal Content of Wine Grapes

Christopher A. Jenkins
Sponsor: Susan E. Ebeler, Ph.D.
Viticulture & Enology

Very little data is available comparing metal content of California wine grapes with vineyard soil, likely due to technological limitations and lack of scientific research into many metals' significance in winemaking. It is apparent that some metals, like copper, catalyze the oxidation of wine and may promote aroma characteristics. Recent studies have measured the effects of trace metals on the color and aroma in wine (Pohl, 2007; Ibanez et al., 2008), but few studies have systematically compared metal content of grapes and their corresponding vineyard soils. By analyzing berry and soil samples, this study will determine if vineyard management plays a role in the metal content of grapes. Samples will be obtained from a research vineyard using several different management practices, and data will be collected at two time points, before and after veraison (the onset of berry ripening). Using state-of-the-art technology, Inductively Coupled Plasma Mass Spectrometry (ICP-MS), it will be possible to detect trace metals that may have implications in winemaking on a part per billion scale. The results of this study will lead to a better understanding of how vineyard practices effect the metal composition of wine grapes, and may help establish the basis for further studies.

Stress-Whitening within Bone Matrix is Correlated with Strain

Kimberly J. Jenks
Sponsor: David Fyhrie, Ph.D.
Biomedical Engineering

Bone has remarkable mechanical properties because of its composite structure, a mineralized (stiff), organic (tough) amalgamation. Bone has previously been observed to visually whiten (stress-whiten) immediately before failure; this whitening process may serve as a toughening mechanism in bone. We hypothesized that stress-whitening was related to strain. Furthermore, we investigated the whitening-strain relationship in demineralized cortical bone from the third metacarpal bone of necropsied thoroughbred horses. Specimens were loaded in tension by a servohydraulic system, while high-speed stereo cameras captured the deformation of the sample and corresponding stress-whitening. Digital image correlation was used to calculate strain and the displacement fields throughout the loading procedure, using subset registration of the original and deformed images. Stress-whitening and strain were both spatially distributed in a similar manner and statistically correlated (R^2=0.61, $p<0.05$). Understanding the cause of stress-whitening may help explain what makes bone vulnerable to fracture during various pathologies, which may ultimately lead to new therapeutic options.

Who Gets Their Way: Legislative Behaviors in the Appropriations Process

Jesse A. Jensen-Neuens
Sponsor: Daniel Y. Kono, Ph.D.
Political Science

In the United States republicans and democrats constantly fight over what legislation should be passed in The House of Representatives; determining whether the direction of our country will be more liberal or conservative. Theories within Political Science, such as median voter theory and procedural cartel theory have arisen as an attempt to explain how representatives vote and gear legislation towards the benefit of one party over the other. This study observes these strategies within the appropriations process from 1990-2009 and determines through statistical analysis the effectiveness and frequency of their use. Findings reveal that procedural cartel theory is more effective at producing more radical legislation than median voter theory, and that unlike democrats, the Republican Party has historically been unable to engage in this more effective method. These results contradict common assumptions that republicans are the stronger party in the U.S and conclude that republicans are less efficient than democrats at passing appropriations legislation that advance the goals of their party.

Storytelling: Exploration, Empowerment, and Transformation

Jacklyn M. Joanino
Sponsor: Lynette Hunter, Ph.D.
Theatre and Dance

Our bodies navigate our world according to hegemonic rules of what is public and what is private. Sometimes a story or performance may deconstruct the realms of "private" and "public" for those who participate in it. As the director of *Walang Kapalit* (written by Dale Magdalang and Alex Deng) I examined the process of a peer written historical play written primarily for the Pilipin@ American diasporic community go from ideas to rehearsal and to the stage for hundreds of people. I asked: where does our need to perform the stories and the traditions of our ancestor's culture come from? What is the relevance of this telling of Pilipin@ American hystory for the particular group of people in my rehearsal room? Does this culture night contribute to multiculturalism rather than the betterment of the Pilipin@/Pilipino American community? Through active discussion and journaling by myself and the cast, I hypothesize how the process of developing *Walang Kapalit* and it's performance resulted in an environment for participants to face their private traumas, foster greater empathy, and critically engage with their ethnic identities and apply their life experiences toward becoming agents of change in their community.

Rebuilding Community: Japanese Americans and Resettlement in Sacramento County, 1945-1960

Bianca S. Johnson
Sponsor: Cecilia Tsu, Ph.D.
History

In 1942 President Franklin D. Roosevelt's Executive Order 9066 resulted in the mass removal of 120,000 Japanese Americans from the Pacific coast. This order shook the communal foundations of the predominately agricultural and interdependent communities of Issei (first-generation Japanese) and Nisei (second-generation American-born Japanese). At the end of World War II, their return was scattered and communities struggled to rebuild their lives. Although academic inquiry into Japanese American internment is wide-ranging and copious, little research has been done to document their experience after release from internment camps. Sacramento County had a large Japanese American community, both before and after WWII, and still has an active community today, making it a distinct area for examining the process of resettlement. Focusing on the period from 1945 to 1960, this study documents the post-war community changes in Sacramento County. I argue that through my examination of oral histories, community documents, and government reports there is a transition from Issei to Nisei leadership as a result of the changed agricultural economy and social climate that transformed their political and social institutions.

PQQ-Dependant Enzyme Application in Real-time Glucose Biosensor for Biofuel Production

Kara L. Johnson
Sponsor: Tina Jeoh, Ph.D.
Biological and Agricultural Engineering

The advanced biofuels industry looks to harness the energy contained in plant biomass. Glucose released from cellulose in plant cell walls can be directly converted to transportation fuel. This conversion requires additional research before its processes can be economically competitive with fossil fuels. A critical factor in the investigation of the biomass conversion process (saccharification) is the researcher's ability to rapidly analyze solubilized sugars. Presently, most sugar analysis methods are laborious, costly, fail to provide real-time data, and thereby impede the research process. This project will address the design, construction, and testing of an amperometric glucose biosensor (AGB) that will improve and expedite the glucose content analysis process. The AGB utilizes a glucose dehydrogenase (GDH) enzyme dependant on pyrroloquinoline quinone (PQQ) to harness the electrochemical properties of a sacharrification reaction. GDH oxidizes glucose and releases electrons to PQQ. PQQ is an electron mediator that then interfaces this biological current with a carbon probe, allowing for the continuous measurement of the glucose content in a single sample. The AGB eliminates the need for additional sample preparation time and cost, maximizing efficiency and minimizing costs.

Standardization of pNPP Assay to Detect Microcystin-LR Toxicity in Through Protein Phosphatase Inhibition

Jeanette Juan
Sponsor: Birgit Puschner, Ph.D.
Molecular Biosciences

Harmful algal blooms suffocate aquatic inhabitants with decreasing oxygen levels and can release various toxins into drinking and recreational water. Rapid growth of blue-green algae (cyanobacteria) may lead to massive blooms with production of hepatotoxic microcystins (MCs). MC-LR, one of the predominant MC congeners, is a cyclic heptapeptide with arginine and leucine in the variable positions. Recent studies suggest MC-LR may be neurotoxic due to MCs established mechanism of action, inhibition of protein phosphatases (PP) PP1 and PP2A, which are needed to regulate neuron growth and function. Using a colorimetric assay with p-nitrophenyl phosphate (pNPP) as a substrate, a concentration range of 0.0625nM to 2nM of MC-LR was used to demonstrate the inhibition of PP1 alpha-isoform from rabbit muscle. Protein phosphatase inhibitor 2 (I_2) was used as a positive control as it primarily inhibits PP1. Okadaic acid was used as a negative control to demonstrate the lack of PP1 inhibition as it inhibits primarily PP2A. We present here optimization results of the pNPP assay to be used with tissues from nematodes exposed to MC-LR, which may lead to novel MC-LR toxicity detection in whole animal tissue.

R-loop Formation Enhances the Efficiency of DNA Demethylation Mediated by the AID Enzyme

Jesus E. Juarez
Sponsor: Frederic L. Chedin, Ph.D.
Molecular and Cellular Biology

Cytosine methylation in CpG dinucleotides is a frequent and essential epigenetic modification in mammalian genomes. While most CpG sites are methylated, a group of CpG-rich sequences called CpG islands (CGIs) tend to remain unmethylated. Because CGIs function as promoters for a majority of mammalian genes and methylation at promoters is associated with gene silencing, it is essential that CGIs be protected from methylation. The mechanisms that underlie this protection have yet to be fully understood. My project investigated the possibility that CGIs maintain their unmethylated state by recruiting DNA demethylation complexes. The hypothesis that we tested was that AID protein is involved in a DNA demethylation pathway that is enhanced by R-loop formation. The AID enzymatic activity is thought to trigger a repair pathway leading to the conversion of a methyl-cytosine back to cytosine. For this, AID is thought to require single-stranded DNA, which is generated by R-loop structures. To test this, I transfected human cells with an episome containing a methylated CGI capable of R-loop formation together with an expression vector for AID. I recovered episomal DNA and assessed demethylation by Southern blotting and bisulfite methylation sequencing. Preliminary results support my hypothesis that R-loop formation enhances AID-mediated DNA demethylation.

Exploring Archean Microbial Ecology Through Comparison of Ancient and Modern Microbial Mat Structures

Marisol Juarez Rivera
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Geology

Microbially influenced rocks (microbialites) provide insights into the organization of ancient microbial mats. 2521±3 Ma fenestrate microbialites from South Africa contain fossil remnants of ancient microbial communities. They are made of calcite with traces of organic matter preserved as inclusions in crystals. These inclusions define surfaces that are interpreted as remains of ancient microbial mats. Rock specimens were serial sectioned (Stevens et al. 2011); in 130μm increments and scanned to yield an image stack, which was rendered into a 3D representation of the microbialite. To delineate the 3D geometry of these surfaces, we explored the 3D microbialite with 3D visualization software (http://keckcaves.org). Using this method we documented several microbial mat growth structures with different geometries. These include mm-cm scale planar features that converge to a point and mm-cm long tubes. This is the first record of tube-like structures which connect 3.5-5.4 mm-thick surfaces defined by organic inclusions. Future work will compare these structures with those created by modern Antarctic microbial communities. Comparing analogous microbial mat growth forms provides a starting point for evaluating microbial processes associated with specific mat surface geometries. By comparing ancient structures and modern microbial mats, we hope to better understand the ecology of the ancient structures.

Influences in Governmental Scientific Peer Review Programs and Recommendations for Potential Improvement

Gregory G. Justice
Sponsor: Alan H. Gordon, J.D.
Political Science

My research will focus on the non-scientific influences (obstructions) of scientific peer review programs in the California regulatory process, and identify potential corrective actions. Influences can include external actors-Legislature, administration (executive), interest groups, public opinion, and internal actors-executive offices, senior managers, as well as their motivations: time, money, staffing, lack of expertise, etc. After identifying sources of influence, the paper will conclude with preliminary recommendations for addressing and minimizing influence, as well as providing a rudimentary framework developing less influenced programs. Research will come from academic journals, scientific publications by U.S. EPA, the National Academies of Sciences, and related governmental entities; independent research institutions and think tanks; as well as, participant observation and confidential interviews with affiliated programs in the California Environmental Protection Agency (Cal/EPA). Argument: To reduce internal and external influences, all science-based regulations-not just those promulgated by Cal/EPA-with major scientific implications should be peer reviewed in congruence with Health & Safety Code section 57004, and should be administered by an independent entity within the executive branch-much like the Bureau of the State Auditor-with programmatic and budgetary independence, yet maintaining some administrative and legislative oversight.

Visualizing Three Dimensional Subsurface Data of a Geothermal System

Amanda B. Kahn
Sponsor: James S. McClain, Ph.D.
Geology

Significant gaps exist when modeling three-dimensional subsurface data in a geothermal system. In order to fill these gaps, a collaborative effort has been made to enhance how subsurface data can be used to plan, carry out, and evaluate an ongoing effort to improve geothermal productivity at a site in central Oregon. Currently, in this phase of the investigation, we are constructing ten meter resolution digital elevation models which are being overlain by five meter resolution satellite imagery and displaying them in a three-dimensional environment. Using the elevation and image data as a backdrop, we have inserted time-dependent earthquake hypocenters and well trajectories into the model. Thus far, initial findings from analyzing the model created indicate that this method is successful. By viewing this data spatially at depth and in real-time it leads to enhanced interpretations of the geothermal potential of the area. By continuing to model data from this study advanced interpretations can continue to be made from subsurface data.

Asian American Representation in U.S. Politics

Natasha Kang
Sponsor: Ethan Scheiner, Ph.D.
Political Science

Over the years, Asian Americans have progressed to be called the most educated, most successful, and fastest-growing racial group. However, this success seems not to extend to the political realm in terms of number of representatives in legislature. It is unclear whether the low level of Asian American representation is due to the group's general minority status, particular voting behavior, or a type of glass ceiling barring Asian Americans from elected positions. To investigate this phenomenon, I intend to research some of the potential causes of the low levels of Asian American representation. I will begin by comparing the share of legislative seats held by Asian Americans to the size of their respective constituent groups nationally and in California using news articles and information obtained from Asian legal support groups. The results of this research will allow us to better understand the barriers to the Asian American minority in obtaining seats in the legislature and may explain why minorities generally find it hard to get represented in government.

Optimization of a Cell-Based Assay That Screens One-Bead One-Compound (OBOC) Libraries

Mohammad M. Karimzada
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Biochemistry and Molecular Medicine

Jared Townsend and colleagues introduced an organized and high throughput manner to perform cell-based assays in combination with releasable one-bead-one-compound libraries. However, the time and financial investment in preparation, as well as the subjective and qualitative nature of the assay itself, are limitations for regular use. Through extensive trial and error, the process used to produce the microfabricated molds that are casted with polydimethylsiloxane (PDMS) to produce the microbead cassettes in Townsend et al.'s assay is nearly quadrupled in efficiency and have observed a marked increase in integrity. In addition, using a methylcellulose overlay has shown promise of being effective in restricting diffusion of compounds released from the beads loaded in the cassette and is suspected to facilitate in cell toxicity identification when using the MTT reporter assay in comparison to Matrigel, which was used by Townsend et al. Compared to Matrigel, methylcellulose will be much cheaper and the formed cover layer more stable. The increased feasibility of cassette molds and sensitivity of the modified assay can make it a more reasonable and expedited approach to drug discovery and other receptor-ligand studies.

The Environmental Implications of Supplementing Nitrate Versus Urea on Rumen Ammonium Production

Neena Kashyap
Sponsor: Frank Mitloehner, Ph.D.
Animal Science

Ruminant animals have microbes in the fore-stomach (rumen) that can metabolize non-protein nitrogen sources (NPN). This NPN is commonly fed to ruminants as urea. Urea causes the rapid release of ammonium (NH_4^+) in the rumen, with excess NH_4^+ being excreted as urea in urine. Urinary N excretion is a major contributor to air and water quality issues that requires mitigation to reduce the environmental impact of ruminant agriculture. Supplementing nitrate (NO_3^-) versus urea as a NPN source to ruminants may improve NH_4^+ uptake by rumen microbes by slowing the release of NH_4^+ in the rumen. The present study evaluated the metabolism of NO_3^- versus urea (1, 2, and 3% NO_3^- or urea) utilizing an in vitro fermentation system. The in vitro systems fermented ground hay and associated treatments over 12h at 39°C and liquid samples were collected at 0, 3, 6, and 12 h and analyzed for NO_3^-, nitrite, and NH_4^+ concentrations. Ammonium concentrations in rumen fluid were higher ($P<0.05$) in urea versus NO_3^- treatments over the 0, 3, and 6h but not 12h sampling times. These results indicate the NO_3^- versus urea supplementation may improve microbial NH_4^+ uptake and reduce N excretion to the environment.

Importance of Homogenization Buffer in Measuring Tripeptidyl peptidase II Activity

Ethan Katznelson
Sponsor: Aldrin V. Gomes, Ph.D.
Neurobiology, Physiology, and Behavior

The proteasome is a multi-catalytic protease complex that degrades more than 60% of protein in eukaryotic cells. Tripeptidyl peptidase II (TPPII) is a vital component of the peptidase pathway that acts downstream of the proteasome and trims peptides for antigen processing. In order to study the TPPII pathway, it is crucial to have efficient methods for preparing and analyzing protease samples in order to obtain accurate and useful information. This project examines different methods of homogenizing heart and liver tissue samples from rats with an emphasis on developing an optimal protocol for measuring TPPII activity. By homogenizing and assaying samples in several buffers that include different combinations of Tris base, sodium chloride, EDTA, magnesium chloride, sucrose, glucose, ATP, and DTT, we found that the highest TPPII activity is detected when samples were both homogenized and assayed in a Tris buffer containing $MgCl_2$ and sucrose. Both sucrose and $MgCl_2$ were found to be important for maximal activity. The activity in the absence of sucrose or $MgCl_2$ was less than 50% of the activity in the presence of either of these compounds. This suggests that buffer conditions are important in measuring crude TPPII activity.

Screening and Analysis of New Arabidopsis Mutants to Identify Genes Involved in the Regulation of Ovule Development

Bryan D. Kelleher
Sponsor: Charles Gasser, Ph.D.
Molecular and Cellular Biology

Arabidopsis thaliana is currently the most popular plant model organism used in research, as there are large amounts of genetic resources for *Arabidopsis* and it has a rapid generation time. Using *Arabidopsis*, this study focuses on finding genes involved in the regulation of ovule development. Ovules are the precursors to seeds and will grow outer and inner integuments to cover the embryo sac and eventually form the seed coat. One gene that acts on ovule development is the INNER NO OUTER (*INO*) gene, and when this gene is mutated the outer integument fails to grow. A partial loss of function allele, *ino-4*, has reduced outer integument growth but does not produce seeds. To further understand genetic regulation of ovule development, the Gasser lab is interested in finding other mutations that affect integument growth. Using mutagenized seeds of the *ino-4* allele, an enhancer/suppressor screen can be used to search for new mutations that result in more or less outer integument growth. New mutants were then backcrossed with wildtype plants and their segregation in the F2 generation was assessed. Mutants were then crossed to each other and other *ino* alleles to yield more information about their role in ovule development.

The President and Peacekeeping: What Does the Public Think?

Daniel Kent
Sponsor: Heather E. Mckibben, Ph.D.
Political Science

Within U.S. foreign policy it is debated whether or not the public is aware of foreign policy decisions and if the public's preferences are consistent in regards to these decisions. To examine these questions I use regression analysis to test if endorsing NATO or United Nations Security Council (UNSC) peacekeeping operations has a significant directional effect on presidential job approval ratings. For either organization to implement a peacekeeping operation there needs to be support or a lack of disapproval from the United States government. My test examines if the public is aware of major NATO and UNSC peacekeeping operations, and if the public consistently supports or disapproves of United States involvement in these operations. My results show that working through the UNSC and NATO to implement peacekeeping operations has no significant effect on the public's perception of the president. This is important in regards to policy because it shows that by working through NATO and the UNSC the president can address issues of international instability while avoiding possible domestic consequences.

Portable Patient Monitoring Device

Varn Khanna
Sponsor: André Knoesen, Ph.D.
Electrical and Computer Engineering

As society moves forward into the 21st century, we are faced with a scarcity in affordable quality healthcare. Imagine if you could assess your medical health from the comfort of your own home before going to the hospital, saving both time and money. Our project aims to address this need with a portable, non-invasive medical monitoring device that patients can use at home to monitor their health around the clock. Our goal is to capture heart rate, temperature, and EKG data. With these three measurements, patients can detect a variety of conditions including fevers and abnormal heart rates and rhythms. Using ultrasonic communications the device transmits medical data on demand to a computer for analysis. This device can also supplement or replace bulky, expensive medical equipment in remote locations where hospital quality care may not be available. With our device we hope to provide an all-in-one device that can give patients back their freedom and gives medical professionals an easy way to monitor their patients.

The Role of Alpha Helix Three of Cardiac Myosin Binding Protein C on Actomyosin Interactions

Jaskiran K. Khosa
Sponsor: Samantha Harris, Ph.D.
Neurobiology, Physiology, and Behavior

Cardiac myosin binding protein C (cMyBP-C) is a sacromeric protein that regulates the force and rate of cardiac muscle contraction and is required for normal cardiac function. Mutations in the cMyBP-C gene cause hypertrophic cardiomyopathy, a disease that affects millions worldwide. Previous studies have shown that the M-domain of cMyBP-C is important for its regulatory function and that it can inhibit interactions between actin and myosin, the main proteins in cardiac muscle contraction. Recent studies revealed the presence of three alpha helices within the M-domain. The third helix (H3) has been proposed to bind to actin because of its similarity to other actin binding proteins. Here we tested whether H3 was necessary for effects of cMyBP-C to inhibit actomyosin interactions by deleting the H3 sequence from a recombinant cMyBP-C (H3KO). Effects of the deletion were assessed in an *in vitro* motility assay. Surprisingly, the ability of cMyBP-C to inhibit actomyosin interactions was not altered by the H3 deletion. Thus, these data suggest that H3 is not necessary to inhibit actomyosin interactions. Future experiments will analyze effects of H3KO in a more physiological system to elucidate the potential regulatory role of H3 on cMyBP-C function.

Ball Bearing Arpeggiator

David Killeen
Sponsor: André Knoesen, Ph.D.
Electrical and Computer Engineering

Music is innate to humans and there are infinite ways to combine sounds into music. We wanted to create an interactive way to make music that would utilize fundamental concepts of electrical engineering while being engaging to all audiences. Our project was to make an arpeggiator, or note sequencer, using ball bearings. To operate, the user places metal ball bearings in receptacles which are sequentially scanned and illuminated. The arpeggiator will then produce a note sound or chord of notes based on the location of the ball bearings. This allows for the creation of complex rhythms and musical sequences as multiple sounds can be simultaneously played depending on where the bearings are placed. In addition to the receptacles, there are also buttons which can be used to change the instrument being replicated and knobs that allow the user to change the speed the notes are played and volume of the notes being produced.

Mimicking the Surface of Earth

Bomi Kim
Sponsor: Annabeth Rosen, M.F.A.
Art Studio

My sculptures are remnants of extinct creatures from a vague world of my imagination. In my mind, these beings were humanistic. I romanticize them into something greater than what they might have been. This imagined past reflects on my childhood longing for a perfect world. I make objects that function as evidence of this utopia once existed. I attempt to create work that looks organic as if formed from the inside out. My investigation has led me to pour liquid clay onto a bed of dry sand. This method replicates the geological processes of how the earth is shaped. Once the clay fully dries, I brush away the remaining sand from its surface. The clay forms a unique shape from the way it moves in its liquid state. The final products are small, brown ceramic fragments, pocked like the moon's surface is cratered. I imagine that these ceramic parts are these creatures' skin and shells, animating the textures of Earth into my allegory. By not using the traditional hand building techniques, I remove the touch of hand from the process of my work. The end results in producing objects that contributes to my narrative.

Invisibility and Worth

Sadalia King
Sponsor: Lalia H. Kiburi, Ph.D.
Sociology

How does the American society determine innocence and whether an individual is worthy of sympathy? I propose race is a factor in determining innocence and sympathy, despite gender difference. To this day, society places value to a specific ideal of innocence and to sympathy which focuses on race. If a potential victim does not fit the ideal, neither innocence nor sympathy will be given. I analyze and compare the social reactions of surrounding Trayvon Martin's death to the social reactions to the theatrical film The Hunger Games (2012) using social media websites Twitter, Tumblr, YouTube, and news articles covering blog posts. Posts on Twitter, and Tumblr provide evidence that society views the Black characters in Games without sympathy and highly prejudicial due to race. Posts on YouTube and articles covering posts on the internet concerning the murder of Trayvon Martin are highly prejudicial due to his race, labeling him as a criminal. Race is the primary factor when society determines innocence and whether or not sympathy is deserved when concerning people of color.

Lost in Translation

Rosa A. Klein-Baer
Sponsor: Ann E. Savageau, M.F.A.
Design

In this quilt I combine traditional American quilting styles with classic Middle Eastern design elements to reflect upon my 16-month stay in Egypt. Curves and circles emphasize the feelings of fluidity and continuity across time and space engendered by traveling, while contrasting colors and themes are meant to illustrate the conflict in ideas and ways of living that one necessarily encounters when immersed in a different culture. In addition to incorporating what I learned about history, culture, and religion, this quilt reflects on the major emotions of faith, love, comfort, confusion, communication, fear, and uncertainty that I felt while I was in Egypt. The quilt contains four pairs of individual blocks with the same word or phrase written in Arabic -- "dream," "love," "once upon a time," and "God wills it." Through the manipulation of various traditional patterns and styles, attaching the same word or phrase to different images, and creating a unified pattern from smaller elements, I hope to convey the message that the truth is complicated, things aren't always what they seem, and that our best hope of understanding anything is to look at it closely and thoughtfully, from multiple perspectives.

Identification of the Chemoreceptor Used by *Pseudomonas putida* F1 to Sense and Respond to Vanillate

Joshua Kootstra
Sponsor: Rebecca Parales, Ph.D.
Microbiology and Molecular Genetics

Pseudomonas putida F1 is a Gram-negative, motile soil bacterium. It can grow on a wide range of carbon sources including aromatic compounds, making it an excellent organism to use in studying the degradation of toxic aromatic pollutants. *P. putida* F1 is also able to detect these chemicals as attractants. The ability to move towards specific chemicals, also known as chemotaxis, relies on cell surface receptors called methyl-accepting chemotaxis proteins (MCPs) and a phosphorylation cascade to bias the swimming behavior of the cells in the direction of increasing attractant concentration. Multiple assays were used to show that *P. putida* F1 is chemotactic toward vanillate. To determine which of the 27 putative MCPs encoded in its genome is responsible for the detection of vanillate, mutants with single MCP gene deletions were assayed and the responses to vanillate were compared with that of the wild-type strain. Results showed that the MCP responsible is the product of the gene *Pput_2149*. Additional experiments will be carried out to determine whether vanillate or an intermediate in vanillate degradation is the actual attractant being detected. We are currently in the process of generating mutants that are blocked at specific steps in vanillate degradation to address this question.

Heat Dissipation from the Sail of Spinosaurus

Courtney Korff
Sponsor: Sandra Carlson, Ph.D.
Geology

One constraint to the hypothesis that dinosaurs could have been endothermic, or "warm-blooded," is that the resultant heat production combined with the animals' large size would have caused extreme and debilitating body temperatures. The neural spines of the dinosaur *Spinosaurus aegyptiacus* demonstrate the presence of a large, dorsal sail in this predator. This sail could have functioned in thermoregulation by allowing the animal to dissipate a greater degree of heat through the increased surface area. The aim of this study was to examine the effectiveness of the sail of *Spinosaurus* as a biological heat exchanger, and to further use the results obtained to evaluate the metabolic strategy of this dinosaur. To quantify the difference in heat transfer allowed by the sail, and thus evaluate the structure's role in thermoregulation, heat loss across three areas was calculated using Newton's Law of Cooling: (1) the complete *Spinosaurus* body, (2) the *Spinosaurus* body without the sail, and (3) the sail alone. Finally, total volume and surface area calculations for the three mentioned areas were performed to further examine the structure's effect on the surface area to volume ratio of the organism.

Reparations Require International Agency and Universal Standards

Alissa P. Kubochi
Sponsor: Charles Walker, Ph.D.
History

This research examines how state reparation programs administered monetary compensation to victims of human rights violations in Argentina and Chile. International laws impose a duty on individual states to make reparations. Yet each state dictates the mandate and the scope of their reparation program. Argentina's and Chile's reparation programs failed to fulfill the international goals of compensation because both states crafted domestic laws to minimize the monetary damages sought by those who had suffered harms by state agents. By examining the mandates of Argentina's and Chile's reparation programs, my findings support the need for an international agency to address human rights violations through an independent judiciary responsible for upholding universal reparation standards that safeguard future victims' access to a fair trial. An international judiciary functions to provide equal access to a neutral forum, universal reparation guidelines, and autonomy from state power in civil litigation. Given that individual human rights violation cases stemming from reparation programs are increasing, civil court proceedings require the application of international law to ensure that constitutional rights are upheld.

Interactive Control Systems for a Tilting Ball Maze

Jeffrey Kung
Sponsor: André Knoesen, Ph.D.
Electrical and Computer Engineering

With the current shortage of science and engineering graduates, this project is aimed to encourage and inspire incoming students to pursue a degree in the field of Computer and Electrical engineering. This interactive exhibit displays the practical applications of concepts learned in class. Our project takes the traditional titling table marble maze and infuses it with computer imaging and accelerometer technologies. The user will be able to control the angle of the maze by either moving a piece of paper with a pre programmed image under a camera or by using a balance board with an embedded accelerometer. From this information, a tilt angle and direction is calculated, and information is sent to the controller and motors to cause the board to tilt. Using careful software integration techniques, we run our system with two control devices as a single entity. An elegant and streamlined solution here is paramount to success in integrating the physical and digital worlds. Not only does this project excite and inspire, it demonstrates the boundless creativity that will be evident in tomorrow's computer and electrical systems.

Shifa Community Clinic's Healthy Breast Program: Promoting Breast Health and Overcoming Barriers in South Asian and Middle Eastern Women

Jessica Kung
Sponsor: Raja Sivamani, M.D.
Dermatology

According to the American Cancer Society, one in eight women in the United States will develop breast cancer. Shifa Community Clinic's Healthy Breast Program, supported by the Susan G. Komen Foundation, aims to increase breast cancer awareness among low-income and minority women. To better understand the disparities in breast cancer screening and to learn the financial and cultural barriers that prevent patients from seeking women's health services, questionnaires were distributed to 260 South Asian and Middle Eastern women. Subjects disclosed socio-demographic and economic status, personal knowledge about breast cancer risk factors, and attitudes regarding breast cancer screening. Of the women surveyed, the average age of the respondents ranged from 40 to 50 years old. Data showed that 66% of the study population have received mammograms. As a result, South Asian and Middle Eastern women demonstrated a lower rate of mammography screening compared to the statewide average of 78.4% measured by the Centers for Disease Control and Prevention. For women who have never received a mammogram, 41.2% faced language barriers while communicating with health professionals, preventing them from obtaining mammograms. With such barriers identified, better resources can be developed for appropriate preventative breast cancer care.

Effects of Mild Acid with Combined Heat Treatments on Fiber in Tomato Pomace

Tara T. Kurihara
Sponsor: Annie J. King, Ph.D.
Animal Science

Production of processing tomatoes produces up to 30% of waste product as tomato peels, cores, seeds, and culls. This waste product is considered a by-product, tomato pomace (TP), a good source of protein which can be used for non-ruminant animal feeds. In addition to protein, TP has high fiber from lignin, cellulose, and hemicellulose that can limit consumption of the by-product and reduce absorption of protein and other nutrients. Autoclaving (AC) for 10 minutes decreased cellulose content of TP by 25.2% while microwaving (MW) for 15 minutes reduced cellulose and lignin content of TP by 24.1% and 21.3%, respectively. This reduction in undigested plant materials makes it possible for non-ruminants like poultry to increase consumption of TP. Varying combinations of MW and AC treatments with mild acids of 5% H2SO4 and 0.5M Ca(OH)2 were analyzed for their reduction in cellulose, lignin, hemicellulose, and protein content. Analysis of data from these investigations is underway. Ultimately, reducing the fibrous components in TP can serve as a guideline for use of other agricultural waste products, thereby removing their possible adverse environmental impact and at the same time increasing their use in non-ruminant feeds.

SNP (Single Nucleotide Polymorphism) Genetic Analysis: A Method for Evaluating Breeding Compatibility in Common Bean

Saarah N. Kuzay
Sponsor: Paul Gepts, Ph.D.
Plant Sciences

For decades, scientific advances have allowed agricultural output to more than meet the needs of an expanding global population. To meet the rising demand for food, plant breeders need new tools to efficiently incorporate beneficial traits from different cultivars into a single crop. One such tool is the SNP (Single Nucleotide Polymorphism) marker: single nucleotide base pair mutations that occur at specific loci across the genome. More importantly, SNPs are the most abundant marker type, and can be adapted to high-throughput analyses. In this project, I will determine SNP differences in a sample of 416 bean varieties that constitute the USDA Core Collection for common bean. So far, each of these beans has been grown into fully mature plants for seed and leaf tissue collection. From the leaves, genomic DNA was isolated and sent off to a collaborating lab to perform the laboratory analysis for 6,000 SNPs. Once the lab analysis is complete, the genetic relatedness among the 416 lines can be determined. This information is useful to breeders to help them design their crosses. Upon completion of this project, the common bean SNP results will be released to the community for collaborative use.

Genetic Analysis of Delta Smelt Spawning Strategies

Melanie LaCava
Sponsor: Bernie May, Ph.D.
Animal Science

The Delta smelt, *Hypomesus transpacificus*, is a threatened fish native to the upper San Francisco Estuary whose management conflicts with water diversion projects that supply water to over 25 million people in California. Conservation efforts for this fragile species depend in part on poorly understood biological functions, such as reproduction. To this end, we are investigating the reproductive strategies of Delta smelt through a natural spawning experiment and the application of genetic techniques. This work is in collaboration with the Fish Culture and Conservation Lab, a conservation hatchery designed for the propagation of Delta smelt in the event of their extinction in the wild. Adult Delta smelt were placed in four tanks over two spawning seasons and allowed to spawn naturally (without artificial stimulation). Using DNA from spawning adults and their offspring, we used microsatellite markers and parentage analysis to investigate reproductive patterns. These analyses will help inform basic questions including the number of times each adult mated in a season, relative contribution of each adult to the next generation, and whether adults are broadcast spawning or choosing mates. This study improves our understanding of Delta smelt spawning strategies, which will aid in future conservation actions for this species.

Taphonomic Analysis of a Thule Sod House in Northwest Greenland

Susan E. Lagle
Sponsor: Christyann Darwent, Ph.D.
Anthropology

Cape Grinnell, located in central Inglefield Land in northwest Greenland, is the site of a series of beach terraces containing over 100 archaeological features. In 2008, the Inglefield Land Archaeological Project excavated seven of these features, revealing a long pattern of occupation of this area over the past 4000 years by Paleoeskimo, Dorset, and Thule peoples, respectively. These groups represented cultures that migrated eastward into Greenland from Arctic regions in Alaska and Canada, and each exhibits a distinct style of dwelling construction. Feature 16, an early Thule (A.D. 1200-1400) winter house, was damaged by extensive slumping and solufluction from the steep slope behind the house, thereby resulting in difficulties detecting clear margins for the feature's structural arrangement. By undertaking a detailed spatial analysis using faunal remains, these margins were clarified, and comparisons made with similar, but less damaged, houses at the site to determine how closely this house follows expected spatial patterning. In addition, these remains revealed patterns of prehistoric subsistence, with small seals dominating the diet, followed by caribou, birds, small terrestrial mammals, and the only evidence for dog at Cape Grinnell.

Effects of Inoculant Blends on Emissions of Volatile Organic Compounds, Oxides of Nitrogen, Carbon Dioxide, Ammonia, and Dry Matter Losses in Alfalfa

Ellen Lai
Sponsor: Frank Mitloehner, Ph.D.
Animal Science

The San Joaquin Valley (SJV) in California exhibits high ground-level ozone pollution that may affect human, animal, and plant health. Silage was identified as a potential source of Volatile Organic Compounds (VOCs) and Nitrogen Oxides (NO_x), which might contribute to ozone formation in this area. In addition to VOCs and NO_x, silage also emits carbon dioxide (CO_2) and ammonia (NH_3), and all four gaseous losses lead to 20-30% of dry matter (DM) losses in the SJV. Microbial inoculants are utilized to promote effective fermentation, and thus could affect the amount and species of gases emitted, dry matter losses, and animal performance. This study quantified VOCs, NO_x, (CO_2), (NH_3), and DM losses after microbial inoculation for 60 days. Twenty-five mini-silos were assigned to 5 treatments: (X) control, (A) heterofermentative, (B) homofermentative 1, (C) a mix of homofermentative and heterofermentative microbes, and (D) homofermentative 2. High concentrations of NO_x, predominantly nitric oxide (84.01±18.9 μL kg silage/day) on treatment C were measured. Ethanol and methanol were also detected in high concentrations. Further quantification of these emissions is needed to assess and alleviate the impact of silage on the air quality in the SJV.

Exploring Animal Social Networks: A Comparison Between the Behavior of Orphan *Rhesus Macaques* with Non-Orphan *Rhesus Macaques*

Eric C. Lal
Sponsor: Brenda McCowan, Ph.D.
Population Health and Reproduction

Many primate species are characterized for having a dominance structure in their societies. Multiple theories have been proposed to explain how these dominance relationships arise and are kept in these societies. It has been observed in most species of female-bonded hierarchical primates that females inherit their social ranking from their mother, ranking just below them. No studies have been made on how orphan primates inherit their position, but it is observed in captivity that they are part of the hierarchy. How well they form part of the hierarchy is not known, which is why this study will focus on comparing the behavior of orphan and non-orphan *Rhesus macaques* to determine if orphan individuals have a stable position. I hypothesize that individuals in a colony of *Rhesus macaques*that are orphans will have a different behavior when compared to non-orphans, suggesting an unstable position in their colony. Data collection took place at the California National Primate Research Center outdoor colonies. Data suggests that there might not be a significant difference between orphan and non-orphan behavior. Whatever the outcome, this research could improve the welfare of primates in captivity by assessing how stable the position of orphan individuals is in the colony.

Feasibility of a Novel Thermomodulation Container to Protect Point-of-Care (POC) Reagents and Instruments in Dynamic Cold Weather Conditions

Mandy H. Lam
Sponsor: Gerald J. Kost, M.D., Ph.D.
Pathology

To demonstrate the feasibility of a prototype thermomodulation container that maintains test reagent and device storage temperatures in simulated dynamic cold weather conditions. In complex emergencies and disasters, POC test devices are exposed to extreme temperatures during transport and field use. Weather conditions exceeding storage and operating limits can lead to impaired function. The performance of the container is being evaluated using three cold weather profiles: two disasters, Hurricane Sandy 2012 and Japan Earthquake/Tsunami 2011; and a typical US northeastern winter. The container is placed in a Tenney T2RC environmental chamber for weather simulation. Calibrated temperature and humidity dataloggers are placed inside and outside the container to monitor changes. The container is stressed during each weather profile up to 72 hours. With the northeastern winter profile, the container was able to maintain conditions between 13.7 to 22.5°C (56.7 to 72.5 °F) for 6 hours and 10 minutes, while the environmental conditions were between -11.8 to -14.5°C (10.8 to 5.9°F). Preliminary results suggest that the thermomodulation container can provide short-term protection from dynamic cold conditions. Further adjustments should be made to support a longer duration of protection.

Whole Exome Sequencing Detection and Analysis of Two Untranslated GFPT1 Mutations in a Family with Limb-Girdle Myasthenia

Marian Lara
Sponsor: Ricardo Maselli, M.D.
Neurology

The application of whole exome sequencing has opened new gateways into the analysis of muscular dystrophy and has potential in modern medicine. In a family with limb-girdle myasthenia (LGM), whole exome analysis was performed and revealed several candidate genes linked to proximal limb weakness. However, analysis showed that that the only mutations that expressed the LGM phenotype were a previously reported 3' untranslated mutation and a novel intronic mutation in GFPT1. GFPT1 is an enzyme of the hexosamine pathway that plays a fundamental role in the glycosylation of proteins of the neuromuscular junction (NMJ). Mutations in genes encoding enzymes of the hexosamine pathway are known to cause defects at the NMJ, which is a synapse that relays messages from motor neurons to skeletal muscle fibers that lead to muscle contractions. This newly identified splicing variant activates an alternate splice acceptor that retains the last seven nucleotides of intron 7 and a frameshift leading to an early termination codon downstream from the new splice site. Using a mini-gene construct of exons 7 and 8 and applying PCR and sequencing provide evidence that the mutations may reduce the gene expression of GFPT1, and result in LGM.

Effects of Media Perfusion on Engineered Bone Growth

Nandor Laszik
Sponsor: Kent Leach, Ph.D.
Biomedical Engineering

Tissue engineering seeks to provide an alternative to autologous bone grafts as a tissue source for replacement of lost bone. The growth of bone tissue in vitro is commonly pursued by ncorporating various stem cell populations. Specifically, bone marrow-derived mesenchymal stem cells (MSCs) can be induced toward the osteoblastic lineage when seeded onto 3D constructs and exposed to osteogenic culture conditions in vitro. Under static culture conditions, nutrients and oxygen cannot diffuse in sufficient concentrations to cells located in the center of 3D constructs. Thus, the application of convection to enhance nutrient transport, frequently by one-directional media perfusion, has consistently enhanced in vitro formation of bone with MSCs in 3D constructs. In these studies, bidirectional perfusion of constructs, which more closely mimics transport and mechanotransduction patterns present in vivo, was explored as an alternative to unidirectional flow. A prototype bioreactor was developed to accommodate for bidirectional perfusion of constructs and was shown to maintain perfusion of poly(lactic-co-glycolic) acid/hydroxyapatite (PLG-HA) composite scaffolds for two days. Further work will explore the osteoinductivity of bidirectional flow compared to unidirectional flow, as well as exposing MSCs to other proven methods of osteogenic differentiation in the bioreactor.

Expressway Disaster Prevention Monitoring Using Soil-Water Characteristic Curve

Felicia Y. Lau
Sponsor: Kenneth Loh, Ph.D.
Civil and Environmental Engineering

Around the world, society safety and economy depends on the functionality of expressways. In Japan, a country prone to natural disasters, expressways serve as a main lifeline during disasters. Many expressways are constructed on cut-slopes, hence susceptible to heavy rain induced shallow landslide. Currently, expressway operators base their operation standards on rainfall. However, shallow landslides can occur suddenly with varying relation to rain volume. The purpose of this study is to incorporate unsaturated strength to evaluate slope stability by using soil-water characteristic curve (SWCC). By using each site∂Åfs unique SWCC, effective deregulation and regulation standards can be set to prevent disasters. A wireless mesh network (WMN) of battery powered volume water content (VWC) sensors and a monitoring station are installed on potential landslide slopes. Volume and void ratio controlled drying and wetting tests are performed using a suction sensor and a VWC senor on field samples to obtain the SWCC. VWC, suction and grain size is compared to predict suction force strength in the field. The results of our tests show that the SWCC is a stable characteristic of the soil, thus is an effective predictor of shallow slope stability. Further research is conducted in Indonesia for deep landslides.

Designing a UC Davis Smartphone App for Student Mental Health Resources

Sarah Laudenslayer
Sponsor: Susan Verba, M.F.A.
Design

According to the American Psychological Association, suicide is the second leading cause of death for college students. Counseling provides an essential resource in suicide prevention by helping students manage stress, depression and mental illness. There are numerous barriers that prevent students from accessing counseling services. While some barriers, such as social stigma and poor awareness, can be addressed through interventions in the campus climate, others cannot. At the moment, the student demand for counseling services exceeds the service capacity of the UC Davis Counseling & Psychological Services (CAPS) staff. In the absence of resources to expand the capacity of CAPS, alternatives should be considered. I propose that a smartphone app provides a viable solution as a means of making contact information, resources and tools accessible to students and first-responders. This proposal aims to minimize anxiety during crisis situations and simplify the process of navigating campus resources. The creation and testing of a proposed app will be guided by an analysis of existing designs and data provided by surveys, interviews, card sorting, observation, and prototyping. This will allow me to better understand existing needs as well as students' perspectives in parsing information and responding to outreach.

Pre-Selective Anti-HIV Vectors for Improved HIV Gene Therapy

JeTai Lawson
Sponsor: Joseph Anderson, Ph.D.
Internal Medicine

There are more than 34 million people worldwide infected with HIV. Currently, antiretroviral drugs can suppress infection however, these drugs can become toxic and patients develop resistant viral strains. Due to these limitations, alternative treatments such as gene therapy are being explored. Previous HIV gene therapy approaches using gene modified cells have demonstrated safety but lacked efficacy due to the transplantation of nontransduced and transduced cells. Therefore, methods to purify HIV-resistant cells prior to transplantation may improve efficacy. I tested the hypothesis that anti-HIV gene modified cells purified prior to transplantation are safe and more efficacious then a mixed population of cells. To test this, we generated lentiviral vectors expressing a fusion protein consisting of an anti-HIV TRIM5alpha gene and a truncated human CD25 connected by a P2A protease cleavage site. This pre-selective anti-HIV vector was generated in 293T cells and concentrated by ultra-filtration. HIV-susceptible Ghost-X/R/R cells were transduced with the vector and evaluated for expression of the pre-selective molecule, CD25. Cells were challenged with HIV and analyzed for viral resistance. The Ghost-X/R/R cells were successfully transduced with the vector, expressed CD25, and displayed potent protection from HIV infection.

Inhibition of Soluble Epoxide Hydrolase Reduces Cardiac Amylin Accumulation in Diabetic Rats

Bach T. Le
Sponsor: Sanda Despa, Ph.D.
Pharmacology

Type-2 diabetes mellitus, which is characterized by hyperglycemia and insulin resistance, is a risk factor for developing heart failure (HF). Hyperglycemia promotes the oversecretion of amylin by the pancreatic β-cells, leading to amylin-oligomerization and amyloid deposition in pancreatic islets. Our lab has shown that amylin oligomers also accumulate in diabetic and obese human failing hearts but not in failing and nonfailing hearts from lean, nondiabetic individuals. Using diabetic rats transgenic for amyloidogenic human amylin (HIP rats), we found that cardiac amylin deposition contributes to progressive HF. Here we tested the hypothesis that elevating the level of epoxyeicosatrienoic acids (EETs), molecules with anti-aggregation properties, limits cardiac amylin accumulation. EETs level was increased by inhibiting soluble epoxide hydrolase (sEH) with 1-(1-acetypiperidin-4-yl)-3-adamantanylurea(APAU). Treated rats received 1ml APAU per liter of drinking water for 13 weeks, starting from the onset of prediabetes. After treatment period, age-matched treated, untreated HIP rats and wildtype controls were euthanized for cardiac myocyte isolation. Westernblot analysis shows amylin oligomers of various sizes in ventricular myocyte lysates from untreated HIP rats. In contrast, treated HIP rats present a significantly lower level, suggesting that sEH inhibition greatly reduced the interaction of oligomerized amylin with cardiac myocytes.

Isolation and Characterization of *Arabidopsis* Mutants Resistant to the Cytokinesis Inhibitor Endosidin 7

Thu M. Le
Sponsor: Georgia Drakakaki, Ph.D.
Plant Sciences

Plant cell division is crucial in their growth and development. During plant cell division, late cytokinesis is a very rapid process, requiring the timely delivery of membrane material to the newly formed cell wall (cell plate) between the two divided cells. During cell division the endomembrane system orchestrates the delivery of Golgi-derived vesicles carrying cell wall and cell membrane components to the newly formed cell plate. However, the nature of these vesicles and their membrane composition still remains largely unknown. To better understand mechanisms of cell plate maturation in *Arabidopsis*, we use a chemical genomic approach. A synthetic chemical, Endosidin 7 (ES7), has been identified to inhibit cell plate formation specifically, resulting in "split cell plate" subcellular phenotype causing root growth inhibition. To further investigate (a) target protein(s) of the ES7, a mutagen, EMS, is used to induce random mutations in *Arabidopsis*. We isolated four ES7 resistant mutants and their responsible genes will be identified by whole genome sequencings. Further characterization of these mutants will give us knowledge on a detail mechanism of plant cell cytokinesis.

Data Acquisition of a Compton Suppression System for Measuring Radioactive Decays

Jonathan Leaf
Sponsor: Mani Tripathi, Ph.D.
Physics

To measure the spectrum of gamma particles emitted from a radioactive isotope, clear signals are necessary for accuracy. In a process called "Compton Scattering," light has a chance of bouncing off the surface of a detector and giving only a portion of its energy to the detector. This creates "noise" in the measurements that one receives from the detector. We can determine which gamma rays scatter off the detector by measuring the scintillation of the reflected part in a surrounding sodium iodide crystal with additional detectors attached to the crystal. In my research, I implement the electronics for the detectors, as well as acquiring and analyzing the data. Implementation of the electronics includes setting up the bases for the photomultiplier tube detectors, programming digitizing hardware to enable it to receive the signal, and finally tweaking the system until it maximally accepts good signals. By throwing out low-intensity pulses due to scattering, I can significantly reduce the noise in the data received.

Localization and Quantification of Silver Nanoparticles in Sprague-Dawley Rat Lungs

Danielle E. Lee
Sponsor: Laura Van Winkle, Ph.D.
Anatomy, Physiology and Cell Biology

Silver nanoparticles are widely used throughout industry and consumer products due to their antimicrobial properties. Although the uses of silver nanoparticles and the population exposure to silver nanoparticles is increasing, the retention of silver nanoparticles in lung tissue has not been thoroughly determined. The goal of this study was to identify the target sites for silver nanoparticle retention in lung tissue and distinguish where the silver nanoparticles concentrate over time after exposure. Rats were exposed to 20 nm silver nanoparticles in citrate buffer solution via intratracheal instillation. To study dose response effects and nanoparticle persistence, rats were exposed to 1 mg/kg, 0.5 mg/kg, or 0.1 mg/kg doses of silver nanoparticles over 1 day, 7 day, or 21 day intervals. The left lobe of the lung was embedded, sectioned, and stained to visualize the location and density of silver nanoparticles in the tissue. The novel staining method developed and used allowed us to visualize the silver nanoparticles in sectioned lung tissue. We conclude 1) that silver nanoparticles localize in the terminal bronchoalveolar regions and 2) while significant silver remains at 7 days, clearance of silver nanoparticles was seen at 21 days.

A Comparison of Solid and Liquid Matrix Arrays to Monitor the Virus Antibody Status of Nonhuman Primates

Andrew Lehman
Sponsor: Dallas Hyde, Ph.D.
Anatomy, Physiology and Cell Biology

Animals used in experimental research should have their pathogen exposure and health closely monitored. Non-human primates, due to their physiological similarities to humans, are often used as models for human studies. Chronic low-level infections often lead to atypical cytokine profiles and pathogen responses, which can skew collected data. Many chronic infections can also lead to immunosuppression, which can not only invalidate experimental results, but put the animal's life at risk. To minimize financial cost, risk to animal and human health, and potential confounding variables, proper and routine animal immunosurveillance is paramount. At the California National Primate Research Center (CNPRC), antibody screening to determine viral profile of potential study animals can be conducted with both solid and liquid matrix arrays. This study will compare and present performance (sensitivity and specificity) data for both types of assays. In addition, the technical/operational and cost efficiencies for both types of assay will be discussed.

Difficulties in Determining Supraglacial Stream Bed Roughnesses and Channel Geometry Factors on the Llewellyn Glacier, Alaska

Sasha Leidman
Sponsor: Fabian A. Bombardelli, Ph.D.
Civil and Environmental Engineering

The Llewellyn Glacier, a temperate glacier fifty miles north-east of Juneau, AK, is host to a number of supraglacial streams (streams that flow on the ice surface) during the melt season. These streams are rapidly changing and incising channels that are not fully understood. A better understanding of these streams and their geometries is important in determining the stability of the glacier as well as their similarities to rivers on bedrock and sediment. The discharge rates and channel geometries of four different streams within a basin were measured and compared to local air temperatures to determine the roughness of the bed, channel geometry responses to increased input, ablation rates, and sinuosity. The results of the data collected found abnormally high values for bed roughness, high peak temperature to discharge correlations, rapid increases in flow velocities in response to discharge increases, and highly variable sinuosity values. While channel form roughness was unexpectedly high, it does not account for the large roughness values calculated and errors may have arisen from non-uniform discharge rates, a small length of measurement, and other factors to be explored in future research.

The Modern Counterculture

Faye L. Lessler
Sponsor: Susan T. Avila, M.F.A.
Design

Fashion today is a fast-paced, trend-based industry that relies on cheap materials and quick labor. Our clothing is frequently made from synthetic and toxic materials resulting in low quality garments, while harming the environment. My fashion collection pushes for change in this industry, and consequently, in our society as a whole. I have drawn inspiration from social revolutions of the past such as the French Revolution, the flappers of the 1920s, the 60's hippies, and the anti-establishment punks of the 1970s. Just as these youth-led movements were able to inspire social change through fashion, my collection aims to motivate a similar, modern shift towards ecological responsibility. In my research I have explored methods of up-cycling old clothing to make new textiles, opted for organic and natural fibers and created dyes out of kitchen-safe plants. My fashion collection presents alternative methods to the toxic practices of today. Through the unique beauty of "The Modern Counterculture" I hope to inspire consumers to realize that quality is more valuable than quantity and that our clothing can truly have and impact on our world.

A Novel Approach: Using Nanolipoproteins to Visualize the HIV's Envelope Protein through Cryo-Electron Microscopy

Duke A. LeTran
Sponsor: R. Holland Cheng, Ph.D.
Molecular and Cellular Biology

The Human immunodeficiency virus' (HIV) genome encodes for nine proteins, one of which is the trimeric envelope protein Env, which is comprised of gp120 and gp41 subunits. The protein mediates membrane fusion through interaction with host CD4 receptors, which results in a conformational change, exposing cryptic epitopes that may be viable for vaccine development. We, therefore, aim to characterize the structure of membrane-embedded Env in nanolipoproteins (NLPs), which are membrane discs corralled with apolipoproteins. Previously, small transmembrane proteins have been characterized in NLPs, but this will be the first large ectodomain protein incorporated into NLPs and characterized. In order to generate large quantities of Env, we constitutively expressed wild-type Env in previously transfected Chinese hamster ovary (CHO) cells. Env complexes, displayed on the surface of CHO cells, will be extracted by detergent and incorporated into NLPs. Purified fractions of NLPs containing Env will be imaged by cryo-electron microscopy, and the resultant density maps will be comparatively analyzed with density maps of soluble Env complexes such as gp140, to ascertain the structural role of the transmembrane region. Further work will include conjugating NLP-incorporated Env with mCD4 to study and compare the ligand-elicited conformational transitions undergone by soluble and membrane-embedded Env constructs.

Cryohydrogels for Stem Cell Therapeutic Applications

Wayne F. Leu
Sponsor: Eduardo A. Silva, Ph.D.
Biomedical Engineering

Cell based therapies are widespread in regenerative medicine, but clinical trials of stem cell transplantation have not resulted in consistent benefit. Tissue engineering approaches involving delivery of cells on sophisticated material carriers that directly promote tissue formation offer a great opportunity for bypassing some of the current limitations of stem cell based therapies. However these strategies rely on several weeks of parallel and complementary in vitro work, including synchronization of cell culture and material carrier formulation. We propose a radically different approach that provides a microenvironment enhancing cell survival that is appropriately stored and ready to be used for any clinical approach. My project aims to develop and validate a cryohydrogel that enables one to encase viable cells and cryopreserve them for long periods. A natural polymer, alginate, formulated with dimethyl sulfoxide or ethylene glycol was explored to create a microenvironment capable to maintain the viability of resident cells under cryopreservation conditions. The feasibility of this approach was examined using human endothelial cells. The cryohydrogels approach described in these studies may be broadly useful to solve some of the fundamental problems associated with current cell-based therapies, as it will directly avoid any waiting time for the patient.

Subsurface 3D Visualization of Enhanced Geothermal System, Newberry Caldera, Oregon

Katherine Lewis
Sponsor: James McClain, Ph.D.
Geology

Newberry Caldera (43°N 121°W) is an active volcano in the Cascade Range in eastern Oregon. The caldera and surrounding area exhibits surface expression of geothermal activity and is thus probable candidate for geothermal energy development. Efforts have been made to enhance geothermal productivity of this field through various technologies including hydro-shearing, or breaking of the deep subsurface rock using water. The goal of this project was to collaboratively develop and improve current methods of visualizing subsurface data for complex geothermal systems. The Newberry geothermal field was used as the primary example. Data used for modeling induced seismicity produced by hydro-shearing was provided by Altarock in collaboration with the Newberry Geothermal EGS Demonstration. We undertook three-dimensional interpolation of subsurface temperature gradients using data from various sources. For initial observations of the data trends we used Matlab, followed by 3D visualizer for viewing in the UC Davis KeckCAVES. Thus far, visualization shows lateral and vertical temperature variation depending on proximity to the Newberry Caldera. Induced seismic events were common and defined a clear fracture orientation when plotted in 3D space. These results have been compared to surface facture data and forward modeling in attempt to determine relationships.

Clinal Variation of Aggressive Behaviors in *Drosophila melanogaster*

Amy Li
Sponsor: David J. Begun, Ph.D.
Evolution and Ecology

The genetic basis of aggressive behavior can be studied in model systems. In *Drosophila melanogaster* multiple genes control aggression. Population genomic data suggest that different alleles of these genes may have risen due to latitudinal adaptation of the species over time, a pattern called clinal variation. However, there is no evidence supporting the idea that aggressive behavior varies between natural populations. Therefore, I will be investigating whether northern and southern *D. melanogaster* populations from a North American cline differ in aggression levels. The study will consist of a phenotypic assay that measures the frequency of fighting within each population. Fighting will be measured in coliseums in which two males contend for food and a female. If there is a difference in the level of aggression between populations, I will test the hypothesis that variation in a candidate aggression gene explains population differences. After introducing each population's version of the gene into a genetically null line of *D. melanogaster*, I will repeat the phenotypic assay and conclude whether the gene is sufficient in replicating the natural populations' aggression frequencies. This study is important because it addresses the genetic and evolutionary mechanisms of the divergence in aggressive behavior between regional populations.

ACL Injury Risk Reduction Training and Its Effects on Knee Biomechanics During Landing in Female High School Volleyball and Basketball Players

Kevin Li
Sponsor: Gretchen Casazza, Ph.D.
Neurobiology, Physiology, and Behavior

The Anterior Cruciate Ligament (ACL) is one of four major ligaments of your knee that provide stability. ACL tears will commonly sideline athletes up to a year or more. ACL injuries are more prevalent in females, likely due to sex linked factors such as decreased hip flexor and hamstring muscle strength, as well as a wider pelvis that result in larger quadriceps angles (the angle at which the femur meets the tibia). To reduce the risk of injury, a 30 minute training regimen was created to incorporate strengthening exercises and development of proper landing and cutting mechanics for female high school athletes ages 14-18 years. For 6-8 weeks, this conditioning protocol, utilizing balance, coordination, agility and lower body strength exercises, was implemented and supervised by study personnel. Force of landing, knee flexion angles and degree of valgus/varus collapse (a determination of knee alignment) were measured at the start and end of the competitive season using a force plate and video data. Findings so far have indicated that the designed training program significantly improved those measurements. These improved biomechanics may contribute to a reduced risk of ACL injury as we had no knee injuries in all the teams studied.

Imaging Alzheimer's Disease with Multimodal Probes Targeted to Activated Microglia

Yiran Li
Sponsor: Angelique Y. Louie, Ph.D.
Biomedical Engineering

Alzheimer's disease afflicts millions of people worldwide and is a common cause of tension and grief within families. With growing realization of the pervasiveness of Alzheimer's, methods to effectively identify it at earlier stages of disease progression are necessary to provide patients with sufficient time and information to seek treatment options. Class A scavenger receptors are biomarkers expressed by activated microglia in neuroinflammatory diseases including Alzheimer's. We have developed a multimodal probe that specifically targets SR-A to visually locate diseased cells through radionuclides in positron emission tomography and to enhance the appearance using contrast agents for magnetic resonance imaging. The design of this probe involves conjugating said contrast agents and uptake-inducing groups to a scavenger receptor-derived ligand. Limited amines on the probe required us to investigate the balance between improving uptake of the probe (by increasing negative charge) and the quantifiable contrast effects of the probe (by increasing contrast agents). We will soon confirm the probe to be non-toxic and specific to activated microglia with *in vitro* tests using BV-2 cells. Once the final hurdle of deliverance through the blood-brain barrier is passed, effective early diagnosis of AD with our probe will be feasible.

Directed Localization of Xylella fastidiosa Serine Protease PD0218 to the Outer Membrane of Escherichia coli

Edmond W. Liang
Sponsor: Michele M. Igo, Ph.D.
Microbiology and Molecular Genetics

Pierce's Disease, caused by the bacterium *Xylella fastidiosa*, displays blight-like symptoms on grapevines. In the strain *Xylella fastidiosa* Temecula 1, three serine proteases, similar in structure and sequence, have been identified as autotransporter proteins, which are proteins localized to the outer membrane. These proteases have been shown to govern the degree of virulence of *X. fastidiosa*, indicating potential targets for disease control. One way to study them is to express them in a heterologous host such as *E.coli* by amplifying the proteases, cloning them into plasmid, and transforming into an *E.coli* strain. One such protease, encoded by PD0218, confers lipase activity when expressed in *E.coli*. This project aims to maximize the localization of PD0218 protease to the *E.coli* outer membrane by re-engineering sequences within PD0218 thought to be important in protein localization, and then using lipase activity to monitor progress. The means by which PD0218 is directed to the *E.coli* outer membrane can then be applied to the other two proteases, which have not yet been found to display observable phenotypes when transformed into *E.coli*. The ultimate goal is to discover ways to combat Pierce's Disease by manipulating or inhibiting these proteases.

How Thick is Your Grape Skin?

Rebecca Lim
Sponsor: Ken Shackel, Ph.D.
Plant Sciences

The skin of grapes and many other fruits is an important barrier against damage caused by pests and diseases. The berry skin can be anatomically defined based on the differentiation of the ovary wall into exocarp and the mesocarp. The exocarp, the dermal system or "skin," contains a cuticle-covered single layer of thin-walled cells called the epidermis and underlying thick-walled collenchyma cells called the hypodermis. Below the exocarp is the mesocarp flesh" or "pulp") of the fruit with many layers of parenchyma cells. Unfortunately, there is no general consensus for measuring skin thickness. In this experiment, it was attempted to find a quantitative anatomical boundary between the skin and the flesh of the table grape. Cell Profiler was used to quantify various aspects of cell size and shape including cell area, perimeter, and eccentricity (the elliptical shape of a cell), and these were graphed as a function of cell depth. Cell size increased and elliptical shape decreased with depth, but there was no clear boundary between the hypodermis and the mesocarp. Tentatively, we found no quantified anatomical marker differentiating berry skin from flesh other than the pigment bodies observed.

International Marriage Women by Agency: Do They Really Succeed in Economic Status After Marriage?

Sunghun Lim
Sponsor: Giovanni Peri, Ph.D.
Economics

International migration has been one of the core topics that economists have researched because of its prevalence and economic impact on the human resource and host countries. Adding to the large number of studies on immigration, this paper attempts to shed a light on a type of immigration that has been understudied in the economics literature: female immigration through cross-border marriages. This paper analyzes the impact of the international marriage agencies on the economic success of Mail-ordered brides in marriage. To accomplish this, I use the data of marriage migrant females in Republic of Korea in 2009, grouped by the channels to meet Korean males: agencies and the others. Using micro-level datasets, I find that the immigrant females by the brokers are less successful than those who married by other routes in their various economic sections such as husbands' income, type of jobs or level of education. This result contradicts females' positive expectation for the private agencies. Finally, I find the evidence that international marriage agencies provide distorted information to Mail-ordered brides for their benefits, which causes Agency Dilemma.

Finding Solutions Through Integrating Science and Art

Kristi M. Lin
Sponsor: Gina Werfel, M.F.A.
Art History

What connection exists between science and art? As a biology major with a love for art, I believe that scientists and artists encounter many similar problems such as uncertainty, logistics, and presentation of results. Though dealing with similar issues however, scientists and artists take different approaches to problem solving. While working on a painting for my Integrated Studies Introduction to Visual Thinking class, I became curious about how scientific and artistic approaches could be woven together. Our assignment was to paint a self-portrait using the color scheme of a masterpiece we had seen at the deYoung Museum. After choosing a still life by Paul CÇzanne and studying how he used color, I was overwhelmed and did not know where to start my painting. However when I looked at my painting with a more scientific approach, the direction became clear. Similar to balancing a chemical equation, I distributed colors evenly to create unity. Furthermore, similar to doing algebra, I matched different tones in my self-portrait to colors in the still life. I believe that taking a scientific approach to art and an artistic approach to science can help artists and scientists solve problems in new and creative ways.

The Effect of Globalization on Chinese and Taiwanese Cultural Identity in Films Directed by Zhang Yimou and Hou Hsiao-Hsien

Sharon G. Lin
Sponsor: Michelle Yeh, Ph.D.
East Asian Languages and Cultures

Globalization, a phenomenon that began roughly two decades ago, negatively impacted the culture of the film industry in both the People's Republic of China and Taiwan. While globalization allowed for international expansion, it also allowed Eastern culture to be swallowed up by Western standards. By examining the works of Chinese director Zhang Yimou and Taiwanese director Hou Hsiao-Hsien, two of the most prominent directors of the period, this study will attempt to trace the rise of Western influence and market appeal in the formation of recent films. The research will assess how the political histories of the two nations affect the degree to which Western culture has shaped the film industry in the last twenty years. The criteria for rising Western influence in this project include the use of the English language, the exotification of Asia, and focus on Western religion in the films. Gaining depth in understanding globalization's affect on the Chinese and Taiwanese film industries will help to create the best approach to maintaining cultural identity and integrity in their respective films when facing alluring incentives to exoticize, Westernize, and make the films friendly for foreign box offices and economic success.

Sea Otter Dental Pathology

Shannon M. Liong
Sponsor: Frank J. Verstraete, DrMedVet
Surgical and Radiological Sciences

Knowledge of the oral pathology of a particular species may augment our understanding of behavioral and feeding habits of animals in their natural habitat. The aim of this study was to determine the nature and prevalence of dental pathology in southern sea otters. Skulls (n = 1205) were examined macroscopically according to defined criteria. The results from all young adult and adult specimens were pooled according to tooth type. Ninety-two percent of teeth were available for examination, with 6.5% artifactually absent, 0.6% deemed absent due to acquired tooth loss, and 0.03% deemed congenitally absent. All teeth were normal in morphology, except 3 pairs of fused teeth. Supernumerary teeth were associated with 97 teeth. The majority (94.6%) of alveoli, were not associated with bony changes consistent with periodontitis; however, the majority (74.4%) of specimens did have at least one tooth associated with periodontitis. The mesial root of the mandibular third premolar teeth was the most common location of bony lesions (56.6%). The majority of teeth (52.0%) were abraded; almost all adult specimens (98.1%), while fewer young adults were affected (76.4%). Tooth fractures were uncommon (4.5%). Periapical lesions were associated with 409 teeth (1.3%), which would have caused considerable morbidity while alive.

The U.S. Abduction and Imprisonment of Peruvian Japanese During World War II: War Necessity or Business Negotiation?

Gregory W. Loh
Sponsor: Cecilia Tsu, Ph.D.
History

The systematic abduction of 2,200 Latin American Japanese during World War II and their placement in secret prisons in the United States is virtually unknown outside of those involved in the program. Described as necessary for national and hemispheric security, the program seized Latin Americans of Japanese descent and used them as hostages for trade with Japan. The justification for these actions claimed that the Japanese community engaged in espionage and represented a fifth column of subversives awaiting orders from Japan. Existing scholarship accepts the explanation of xenophobia and fears of a fifth column as the motivation behind the deportation and incarceration of these foreign nationals. However, my research at the National Archives in Washington D.C. revealed evidence that the United States recognized the Japanese in Peru presented no threat. Despite this knowledge, the U.S. followed through with the abductions giving lie to their justification. The presentation of primary source documentation will demonstrate the complicated nature of the U.S. involvement in Latin America. Scholars have called this program, "The best kept secret in World War II." With this research, I intend to present a more complete understanding of the dynamics leading to the origins of the abduction program.

Identification of Regulators of Zonal Olfactory Receptors

Sydney A. Lopez
Sponsor: Connie Champagne, Ph.D.
Molecular and Cellular Biology

Mammals depend on olfaction to interact with their surroundings. Mice express approximately 1500 olfactory receptors (ORs), each expressed within one of four zones in the olfactory epithelium (OE). Although poorly understood, these zones may provide a mechanism for the brain to compartmentalize and decode detected odorants. Zonal developmental signals likely are expressed throughout the life of the animal due to the high turnover rate of the OE. The ultimate goal of this work is to identify non-OR genes expressed in zonal patterns in the OE that drive the zonal expression of ORs. I tested the hypothesis that such genes could be putatively identified by a GENSAT *in silico* screen. I dissected mouse OE tissue sections by laser capture microscopy. Eight potential zone-specific genes were identified and were used to create *in situ* probes. To confirm that these genes are expressed in zonal patterns, Genes Crym and Enc1 were shown to be expressed in zonal patterns, and may influence the development of the OE, but further experimentation is necessary. Understanding the development of the anatomical organization of the OE may help us understand the development and function of the olfaction complex, but also the relationships between neural receptors and brain interpretation.

The Effects of Lactoferrin Transgenic Cow Milk and Lysozyme Transgenic Goat Milk on the Small Intestinal Inflammmatory Response in Young Pigs

Samantha N. Lotti
Sponsor: James Murray, Ph.D.
Animal Science

Lactoferrin and lysozyme are antimicrobial proteins that are produced in high quantities in human milk, which aid in gastrointestinal (GI) maturation in infants. Beneficial health effects have been observed when supplementing human and animal diets with both lactoferrin and lysozyme separately and in conjunction. A herd of genetically engineered cattle that secrete recombinant human lactoferrin in their milk (rhLF-milk) and a herd of genetically engineered goats that secrete human lysozyme in their milk (hLZ-milk) have been generated. The cows and goats provide an efficient production system and produce an ideal medium for rhLF and hLZ consumption. The effects of consumption of rhLF-milk, hLZ-milk, and a combination of rhLF and hLZ milk were tested on young pigs as an animal GI model for children. To determine the different milk treatments effects on inflammation and inflammatory pathways in the small intestine, expression of cytokines TGF-β, TNF-α and IL-6, as well as receptor TLR-4 was analyzed. RNA was isolated, and then quantitative real time polymerase chain reaction (qRT-PCR) was performed utilizing β-actin as an internal control. The qRT-PCR results were analyzed using the Pfaffl method with REST-MCS software. Data is currently being analyzed; therefore there are no conclusive results at this time.

Sustainable Agriculture and Social Capital: Alleviating Food Insecurity in Sub-Saharan Africa

Rebecca K. Lucas
Sponsor: Eddy U, Ph.D.
Sociology

Much remains to be understood regarding the mechanisms that can actively alleviate food insecurity in countries that have not industrialized. Large-scale industrial agricultural techniques are most often pursued with macro economic development and participation in the global food market. But the results do not directly demonstrate whether this type of modernization helps the local populations address their immediate biological needs. By contrast, research shows the methods of sustainable agriculture improve small-scale localized food yields for communities. This paper investigates the conditions under which a strategy of sustainable agricultural development can mitigate food insecurity in Sub-Saharan Africa. Through a survey of articles and reports I show that sustainable agriculture is successful at a community level when it produces stronger networks of social capital. Emphasizing the connection between increased social capital and sustainable agriculture addresses the problem of food impoverishment and insecurity by producing more food locally, utilizing indigenous knowledge and institutions, and creating systems of trust, reciprocity, and increased sharing. These practices have a significantly positive impact on the livelihoods of rural people, improving quality of life and reinforcing favorable asset bases in individual communities.

Characterization of Somatic microRNAs Detrimental to Development of SCNT-Derived Embryos

Eugene Lurie
Sponsor: Pablo Ross, Ph.D.
Animal Science

Somatic cell nuclear transfer (SCNT) utilized in reproductive cloning introduces microRNAs (miRNAs) not typically encountered in the oocyte environment during fertilization by sperm. Somatic miRNAs can alter key steps vital to proper embryonic development. In a previous experiment, six cell lines from different animals were used for SCNT to check their reproductive capability, resulting in three lines that performed significantly better. Expression of miRNAs was screened as a possible factor affecting the variability in reproductive success. Initial findings gathered from miRNA expression data of the cell lines showed differentially expressed miRNAs between the successful and inadequately performing lines. This data was cross-referenced with miRNA expression profiles of various developmental stages (germinal vesicle, MII, and blastocyst), and compared to that of a fibroblast. Several miRNAs upregulated in fibroblast were also upregulated in the unsuccessful cell lines, suggesting a role in the observed discrepancy of reproductive successes. Elucidating the specific mechanisms of these miRNAs could lead to applications for ameliorating the efficiency and success of future SCNT derived embryos.

Interactive Control Systems for a Tilting Ball Maze

Henry Ly
Sponsor: André Knoesen, Ph.D.
Electrical and Computer Engineering

With the current shortage of science and engineering graduates, this project is aimed to encourage and inspire incoming students to pursue a degree in the field of Computer and Electrical engineering. This interactive exhibit displays the practical applications of concepts learned in class. Our project takes the traditional titling table marble maze and infuses it with computer imaging and accelerometer technologies. The user will be able to control the angle of the maze by either moving a piece of paper with a pre programmed image under a camera or by using a balance board with an embedded accelerometer. From this information, a tilt angle and direction is calculated, and information is sent to the controller and motors to cause the board to tilt. Using careful software integration techniques, we run our system with two control devices as a single entity. An elegant and streamlined solution here is paramount to success in integrating the physical and digital worlds. Not only does this project excite and inspire, it demonstrates the boundless creativity that will be evident in tomorrow's computer and electrical systems.

Assaying HTM Phagocytosis on Biomimetic Substrates

Irene Ly
Sponsor: Chris J. Murphy, D.V.M.
Surgical and Radiological Sciences

Glaucoma is a group of eye diseases commonly characterized by elevated intraocular pressure (IOP), leading to the degeneration of the optic nerve and irreversible vision loss. One of the principal regulators of IOP is the human trabecular meshwork (HTM), the primary outflow pathway for aqueous humor from the eye. HTM dysfunction has been implicated in the development and progression of glaucoma. A primary function of HTM cells is to clear debris from the outflow pathway via phagocytosis, a cellular process in which cells engulf and degrade extracellular materials. HTM phagocytosis has primarily been studied in vitro on hard, flat tissue culture plastic surfaces, dissimilar from the nanofeatured and compliant in vivo environment. The purpose of this study was to investigate how the phagocytic behavior of HTM cells is influenced by biomimetic features such as nanoscale topography and substratum stiffness. Our experiments reveal that presentation of nanotopographic features alone does not induce a significant change in HTM phagocytosis. Together, these in vitro experiments will help us better understand the basis of HTM phagocytosis and its implications in glaucoma.

Effects of Aspirin and Meclofenamate Sodium on Tripeptidyl Peptidase II Activity

Sarah Macabales
Sponsor: Aldrin V. Gomes, Ph.D.
Neurobiology, Physiology, and Behavior

Hepatocellular Carcinoma (HCC), a type of liver cancer, is one of the leading causes of cancer deaths with over 500,000 people affected worldwide. Recent studies have shown that aspirin, a non-steroidal anti-inflammatory drug (NSAID), can reduce the risk of developing HCC and death due to chronic liver disease, whereas other NSAIDs have only been shown to do the latter. Because of its important role as a protease, tripeptidyl peptidase II (TPPII) from mice liver cells was chosen to test the effects of aspirin and another NSAID, meclofenamate sodium (MS). The main role of TPPII is to further trim peptides degraded by the proteasome, a multicatalyic complex that digests more than 60% of proteins in eukaryotic cells, for antigen preparation and processing. Although it is not understood in detail, TPPII has been shown to play a role in cell death control and cancer-related fields. TPPII in mice liver homogenate was used for TPPII assays. TPPII activity in liver homogenates was not affected by low (1 mM) or high concentrations of aspirin (2mM) but was significantly inhibited by high concentrations of MS (0.5mM). These results suggest that taking certain NSAIDs are likely to affect not just proteasome activity but also TPPII activity.

The Implications of American Hegemony in Global Higher Education: The Case of Brazilian Students at UC Davis

Lily MacIver
Sponsor: Luis Guarnizo, Ph.D.
Human and Community Development

The US system of higher education has become hegemonic worldwide. This project proposes to investigate the implications of US global hegemony in higher education for Brazilian students. Specifically, it seeks to determine, first, how US hegemony influences Brazilian students' subjective motivations and expectations for studying abroad. Second, it seeks to establish what these students expect to gain upon returning to Brazil. Third, with the global Americanization of education expanding and with developing countries increasing investment in education as essential for their future, this study will explore whether transnational educational exchanges reproduce asymmetrical international power relations between developed and developing countries or not. Using qualitative research methods, the project will focus on students who come to UC Davis through Brazil's federally funded 'Science Without Borders' program, which sponsors students to study abroad in the fields of science, technology, engineering, and math. The project interrogates existing literature on higher education, globalization, and the mobility of the highly educated. As such, the analysis will be contextualized in relation to Brazil's higher education system, current economic climate, along with the historical context of knowledge flow and international relations between the US and Brazil-particularly as they relate to knowledge exchange and development.

Comparison of Plasmodium falciparum Infection Rates Between *Anopheles gambiae s.s.* and *Anopheles arabiensis*

Saman Mahmood
Sponsor: Gregory C. Lanzaro, Ph.D.
Pathology, Microbiology and Immunology

Anopheles gambiae s.s. is the main vector of malaria transmission in Africa, but its sibling species, *A. arabiensis*, has also contributed to a large proportion of the infectious mosquito bites that drive the intense malaria transmission throughout sub-Saharan Africa. Although the two species significantly overlap in their geographic distribution, they differ with respect to host preference, which is important for malaria transmission. *A. gambiae* strongly prefers taking blood meals from human hosts, while *A. arabiensis* are known to feed on both animals and humans. In some localities, *A. arabiensis* feeds exclusively on animal hosts, and thus have received less attention in research areas of host-parasite interactions. Here, I investigated the relative importance of the two mosquito species for malaria transmission in Mali. PCR was used to determine the *P. falciparum* infection status for mosquitoes collected over two years from three villages in Mali, where *A. gambiae* and *A. arabiensis* coexist. The infection rates were similar between *A. gambiae* and *A. arabiensis*s in all three villages (P>0.05). *A. arabiensis*, thought to be preferentially feeding on animals, contributes equally to malaria transmission in this region.

French or Jewish: Moroccan-Jewish Movements for Citizenship in the Interwar Era

Maya Makker
Sponsor: Susan Miller, Ph.D.
History

The conclusion of World War One facilitated the growth of changing notions of statehood and nationalism in many European countries. While historians have written extensively about the conditions of European, Ashkenazi Jews during this period, less work has been done on the influence of World War One on Eastern, Sephardic communities. The case of French rule of Morocco highlights the influence westernization had on shaping how Eastern Jewish populations came to identify themselves at a time when conceptions of what it meant to be French, Moroccan, and Jewish were in flux. In the years following the creation of the French Protectorate of Morocco in 1912, Jewish populations assimilated to western life, and inclusion into French society as French citizens became a political objective for many Jews who saw themselves as Europeans. At a time when questions of majority-minority relations were gaining prominence in French discourse, this struggle for citizenship among Jewish populations in the East engaged Zionists, French authorities, and French Jews in a debate concerning the qualities and circumstances that distinguished an individual as "French"—a distinction that became central as anti-Semitic activity grew in Europe.

Histamine Appears to Enhance Syrian Hamster Hippocampal Neuronal Activity at Low Levels of Synaptic Stimulation

Kevin J. Malins
Sponsor: Barbara A. Horwitz, Ph.D.
Neurobiology, Physiology, and Behavior

In earlier studies, infusion of the neuromodulator histamine (HA) into the ground squirrel hippocampus was found to increase hibernation bout duration. This observation led to the suggestion that histaminergic excitation in hippocampal regions increased neuronal inhibitory signals to the Ascending Arousal System (AAS), thereby delaying arousal from hibernation. Several observations are consistent with this suggestion, including: (a) the hippocampus, unlike the neocortex, exhibits neuronal activity during deep hibernation; (b) production and turnover of HA increases during hibernation bouts of ground squirrels, as does the apparent density of hippocampal HA receptors; and (c) HA increases Syrian hamster hippocampal pyramidal cell population spike amplitudes (PSAs), a widely-used measure of assessing neuronal activity. I am testing the hypothesis that HA exerts its effect on PSA by decreasing the minimum response threshold for the pyramidal neurons. Specifically, I am measuring HA-induced PSAs over a range of voltages that includes the threshold response in hippocampal slices at 30°C and 20°C to evaluate responses that more closely mirror the weak signals in hibernating animals. In early results, the PSAs evoked at low stimulus intensities appear dependent on both voltage and HA, consistent with my hypothesis.

East vs. West: Cultural and Physical Directionality of the American Westward Movement in *East of Eden*

Samantha R. Mandell
Sponsor: Jack Hicks, Ph.D.
English

The premise of John Steinbeck's *East of Eden* is to tell side-by-side the story of a family and the history of humanity through a retelling of Genesis set in California's Eden, the Salinas Valley. Both physical and biblical place play a significant role in the novel, particularly through the novel's structural dichotomy of "east" and "west." This directional opposition connects the issues of Adam Trask's role in the American westward movement and the implications of the biblical land of Nod referenced in the novel's title. In a philosophical way as well, the novel presents a comparison of the"psychic geography" of eastern and western culture through the characterization and presence of Lee Chong, a Chinese-American man whose knowledge and personal perseverance reflect the triumphs and limitations of the Trask family's classic American journey. Lee's biblical scholarship brings a hidden conflict to the foreground in *East of Eden* as it produces an"eastern" reading and revision of a distinctly western tradition, and dramatizes a failed attempt to moralize the American west.

Ammonium and Nitrate Interactions with Elevated CO_2: Their Effects on the Peach Canopy (*Prunus persica*)

Phillip Mann
Sponsor: Theodore DeJong, Ph.D.
Plant Sciences

Increasing levels of carbon dioxide (CO_2) are an important contributor to global warming. Currently, our atmospheric concentration of CO_2 is at 400 parts per million (ppm) and is continuing to rise. There have been some hypotheses that plant biomass, photosynthesis, and growth rates are increased when grown in higher levels of CO_2. Alternatively, some hypotheses suggest that some C3 plants (most crop-plants) eventually acclimate to increased CO_2 due to the inhibition of nitrate assimilation which leads to limited enzyme production for photosynthesis. In this study, peach trees (*Prunus persica*) that assimilate nitrate in their roots, were grown in growth chambers at ambient CO_2 (400 ppm) and elevated CO_2 (800 ppm) for one month. Half of the trees in both chambers received nitrate (NO_3^-) as their nitrogen source while the other half received ammonium (NH_4^+). Weekly photosynthesis measurements were collected, the phyllochron was observed (rate of addition of leaves), final biomass calculated, and nitrate was extracted from leaves. Our *preliminary* results show that leaves were added at a faster rate in high CO_2 and with NH_4^+ treatment. Additionally, biomass was higher in high CO_2 trees and more nitrate was found in the leaves of ambient CO_2 trees.

Novel Small Molecule Regulators of CTP Synthetase

Gregory M. Maring
Sponsor: Enoch Baldwin, Ph.D.
Molecular and Cellular Biology

Cytidine Triphosphate Synthetase (CTPS), is essential to life. CTPS is an enzyme that catalyzes the last step in pyrimidine nucleotide biosynthesis, converting UTP to CTP. CTP is an essential building block for DNA, RNA, phospholipids and sugars. My goal is to investigate novel small molecule regulators of *E. coli* CTPS. I will identify potential regulators from a collection of small molecules that are components of pathways that utilize CTP or are known to regulate other cellular processes. The effects of candidate molecules on CTPS activity will be determined using a spectrophotometric kinetic assays performed by varying amounts of substrates and candidates. The structural bases for these effects will be investigated through X-ray crystallography of CTPS/regulator complexes. The results of this research will reveal the metabolic inputs that control CTPS activity and may provide potential therapeutic compounds in the future. Since human and *E. coli* CTPS are roughly 50% identical, identification of novel CTPS regulators may provide new ways to fight antibiotic-resistant bacteria, parasitic diseases, or cancer.

The Effect of Estrogen on the Anterior Cruciate Ligament

Louise A. Marquino
Sponsor: Keith Baar, Ph.D.
Neurobiology, Physiology, and Behavior

Rupture of the anterior cruciate ligament (ACL), the main stabilizer in the knee joint, is a common orthopedic injury that requires surgical repair. Female athletes suffer this debilitating injury at a 3-4-fold higher rate than male athletes. The reason for this disproportionate injury rate is currently unknown. In this study we determined whether intrinsic differences in the cells or the hormone estrogen change the biomechanical properties of ligaments. Ligaments made from primary human ACL fibroblasts were engineered *in vitro* in the presence or absence of estrogen. The tensile strength and collagen content of the ligaments were analyzed at fourteen days. Cells from female donors produced ligaments with similar tensile strength and collagen as those produced using male donor cells. Fourteen days in low (representing follicular phase estrogen levels), medium, or high (representing luteinizing hormone surge) estrogen levels did not alter ligament mechanics. However, mimicking the cycle with twelve days of low estrogen followed by a 48 hour period of high estrogen resulted in ligaments with decreased stiffness despite having similar collagen content as the control group. These findings suggest that varying estrogen levels during the female menstrual cycle may contribute to ACL injuries in women.

Having Your Cake and Eating it Too: Vote Switching in the California State Assembly

Stephanie A. Martin
Sponsor: Daniel Kono, Ph.D.
Political Science

Vote switching is a political maneuver that allows a California State Assemblymember to change her recorded vote after the initial vote has occurred. Switched votes cannot change the outcome of legislation, so why do legislators switch their votes? I argue that vote switching serves as a mechanism for releasing a "vote option": a tactic used in the US House of Representatives to gain support for bills, support that can be "released" if it is ultimately not needed. Because California voting procedures do not allow for a release to occur during voting, vote switches may serve as a replacement release procedure. I reviewed 752 Assembly bills considered in 2012. Of these, 82 vote switches occurred over 64 bills. I classified each vote switch as a plausible vote option or not based on "vote closeness," a proxy for uncertainty of a bill's passage. Securing vote options provides a plausible explanation for approximately one third of all vote switches. Considering other factors, such as voting errors, explained approximately half of all vote switches. Vote switching has recently garnered media attention and calls for reform. This process lacks transparency and allows legislators to avoid the tough decisions they were elected to make.

Mexican-Origin Adolescent Alcohol, Tobacco, and Other Drug Use and Symptoms of Anxiety, Depression, and Substance Use at Age 15

Ixchel P. Martinez
Sponsor: Amanda E. Guyer, Ph.D.
Human and Community Development

Mexican-origin adolescents are one of the fastest growing groups in the U.S. population. This particular group has an increased vulnerability to experimentation with alcohol, tobacco, and other drugs (ATOD). ATOD use in adolescence correlates with a range of negative outcomes, such as substance use disorders, poor coping skills, and unemployment. Thus it is important to identify factors that differentiate between Mexican-origin adolescents who do and do not initiate ATOD use. One key vulnerability factor that warrants attention in this group is mental health. To address this, Mexican-origin youth who at age 14 reported that they used ATOD in a three-month period (High ATOD risk, n=25) and those who reported abstinence from ATOD use (Low ATOD risk, n=25) will be compared on symptoms of anxiety, depression, and substance use at age 15. Understanding mental health similarities and differences between these groups is critical to developing targeted interventions effective at combatting the negative risks associated with Mexican-origin adolescent ATOD use.

Measuring Male Greater Sage Grouse Responses to Female Signals During Courtship: An Experiment with a Robotic Female

Marty J. Martinez
Sponsor: Gail L. Patricelli, Ph.D.
Evolution and Ecology

Female preference favors the evolution of elaborate male display traits in many species. However, little is known about whether this process of sexual selection also favors males with better courtship skills, such as the ability to respond to female signals. Here we used a robotic female to determine experimentally whether male Sage Grouse, *Centrocercus urophasianus*, adjust their display behavior in response to female signals and whether more responsive males are more successful in courtship. Our experiment involved two treatments in which the robot imitated natural female signals of interest or disinterest in courting males. In the interested treatment, the robot remained upright and looked side to side. In the disinterested treatment, the robot pecked at the ground as if foraging. We then compared the male display behavior before and during the experimental treatments. Key male display behaviors such as strut behavior, position of the fembot, and display rate were measured. We predict that if male courtship skills are favored by sexual selection, then males who adjust their behaviors more strongly in response to robotic female signals will be more successful in mating with real females.

Profiling Bottled Kombucha Drinks Using Terminal Restriction Fragment Length Polymorphism Analysis

Chad F. Masarweh
Sponsor: David A. Mills, Ph.D.
Viticulture & Enology

Recently, the fermented tea beverage known as kombucha has received much public attention as a new health drink sold at major supermarkets. Proponents claim the drink improves the immune system, assists the liver in detoxification, and could even help beat cancer, all benefits that they link to unsubstantiated probiotic properties. Kombucha fermentation is carried out by a combination of yeast and bacteria, using only added sucrose and tea as substrates. However, no studies have been done on the residual microbial communities present in bottled, commercially available kombucha, in spite of its growing popularity in the United States. To better understand the microbial species present in bottled, commercial product, we performed terminal restriction fragment length polymorphism analysis to identify both the yeast and bacterial communities. Preliminary analysis indicates a microbial profile that mirrors that previously determined by culture-dependent profiling. Complete profiling of the microbes inherent to kombucha products will help define the natural diversity of this fermented beverage and aid in production and quality control determinations.

Does Overexpression of miR-30 Weaken Force Production in Engineered Skeletal Muscle?

Susana Mateos
Sponsor: Keith Baar, Ph.D.
Neurobiology, Physiology, and Behavior

More than 50,000 Americans are affected by the nine major muscular dystrophies, conditions categorized by weakened muscle and loss of muscle tissue. The objective of this study is to determine whether miR-30 overexpression is responsible for weakened muscle tissue. Specifically, I am testing the hypothesis that increasing miR-30 expression in differentiated skeletal muscle will result in decreased force production. The C2C12 cell line will be used to engineer 3D muscle constructs *in vitro*, a method that we have previously shown to be suitable for studying muscle physiology and development. Seven days after differentiation, engineered muscle tissues will be transfected with adenoviral vectors expressing miR-30 or LacZ (as a control). My next step is to measure levels of miR-30 three days after adenoviral transduction via qPCR. Once the level of virus is determined, the effect of miR-30 on muscle function (i.e. force production) will be measured. If my hypothesis is correct, the cells transduced with miR-30 should produce less force than cells transduced with the control LacZ. If successful, this experiment could provide the medical community with a new target for treatment of muscular dystrophies as well as profound insight into the physiological role of the miR-30 family of mRNA.

Prediction and Validation of the Influence of Length on Residual Stress in a Long, Quenched Bar

Yuka Matsuyama
Sponsor: Michael R. Hill, Ph.D.
Mechanical and Aerospace Engineering

This study is conducted to confirm that residual stresses measured in a body will decrease, in a manner consistent with the theory of elasticity, as the length of the body shortens. Residual stresses exist within a body without external loading. They can be as large as the material strength, influence material performance, and are important in engineering. One of the challenges with understanding residual stresses is that they depend on part size; however, the relationship between size and stress can be predicted through the theory of elasticity. To demonstrate that the size effect on residual stresses can be predicted through elasticity, we used a quenched aluminum bar having a 76.2 by 50.8 mm rectangular cross section and an initial length of L = 610 mm. Residual stress measurements were made in the bar at full length L, and at subsequently smaller lengths L/2, L/4, L/8, and L/16. Comparison of the measurement results with predictions based on elasticity theory shows that the differences in stress among the different length bars are consistent with the prevailing theory.

Gene Therapy in Angelman Mice and the Impact on Coordination

Michelle McAlister
Sponsor: David J. Segal, Ph.D.
Biochemistry and Molecular Medicine

Angelman Syndrome is a single-gene disorder that affects one in twelve-thousand births. The symptoms include severe intellectual disabilities, seizures, uncoordinated behavior, and happy, child-like demeanors. In humans, Angleman Syndrome is caused by a deletion in the maternally active UBE3A gene. Mice have been produced with a similar deletion in the UBE3A gene and symptoms include uncoordinated behavior, such as clenching of hind legs, and freezing in place under stimulation. A gene therapy trial in mice is currently taking place that activates the paternally healthy UBE3A gene, potentially ameliorating the symptoms. The coordination of mice undergoing this gene therapy trial will be measured before, during, and after the trial using four groups of mice. The groups of mice will include Angleman mice undergoing treatment, a sham group, a no treatment group, and a wild-type group. Coordination will be measured by comparing stride lengths, ability to remove adhesive from noses, and how long the hind legs remained clenched when stimulated. This study could result in a reduction in symptoms for mice as they undergo the trial. Positive results for the gene therapy experiment for Anglemans Syndrome could have a major impact on the health of humans with the disorder.

System Design and Integration of a Tilting Ball Maze

Collin McCarthy
Sponsor: André Knoesen, Ph.D.
Electrical and Computer Engineering

With the current shortage of science and engineering graduates, this project is aimed to encourage and inspire incoming students to pursue a degree in the field of Computer and Electrical engineering. This interactive exhibit displays the practical applications of concepts learned in class. Our project takes the traditional titling table marble maze and infuses it with computer imaging and accelerometer technologies. The user will be able to control the angle of the maze by either moving a piece of paper with a pre programmed image under a camera, or by using a balance board with an embedded accelerometer. From this information, a tilt angle and direction is calculated, and information is sent to the controller and motors to cause the board to tilt. Using careful software integration techniques, we run our system with two control devices as a single entity. An elegant and streamlined solution here is paramount to success in integrating the physical and digital worlds. Not only does this project excite and inspire, it demonstrates the boundless creativity that will be evident in tomorrow's computer and electrical systems.

Characterization of *Entamoeba histolytica* APS Kinase

Brian K. McGarry
Sponsor: Andrew J. Fisher, Ph.D.
Chemistry

Entamoeba histolytica is a parasitic protozoon commonly found in tropical environments that can cause amoebic dysentery and liver abscesses. Killing nearly 100,000 people every year, it is a serious global health problem. In the Sulfur Activation Pathway, which normally occurs in the cytoplasm, inorganic sulfur from the environment is converted to metabolically serviceable sulfide. Peculiarly, in *E. histolytica* this pathway is compartmentalized in the mitosome, a subcellular organelle related to the mitochondrion where sulfate-activating enzymes are overexpressed. Little is known about the biochemical properties of these enzymes. One such enzyme, Adenosine 5'-phosphosulfate (APS) Kinase, contains an APS Kinase domain and a putative ATP Sulfurylase-like domain. I aim to characterize this protein's structure and function through a combination of experiments using techniques in biochemistry, enzyme kinetics, and X-ray crystallography. I have cloned the gene for the enzyme into a bacterial expression system for expression and purification of the protein. Initial findings demonstrate that the enzyme exhibits substrate inhibition, a characteristic of known APS Kinases, and that the ATP Sulfurylase-like domain is inactive. The results of these experiments will provide mechanistic and structural insights into *Entamoeba histolytica* APS Kinase that will spur further research towards drug development and eradication of disease.

Live Cell Imaging of Chromosome Movement During Meiosis in *Saccharomyces cerevisiae*

James M. McGehee
Sponsor: Sean M. Burgess, Ph.D.
Molecular and Cellular Biology

Meiosis is a specialized form of cell division, in which homologous chromosomes pair and form crossovers to ensure proper segregation. Improper segregation can lead to nondisjunction and diseases such as Down syndrome. It is not known if chromosome pairing is directed or stochastic and it is unclear if it involves strong interactions that hold the chromosomes tightly together or weak interactions that allow dissociation. We have addressed this question by assaying chromosome pairing in 3D space over time using *Saccharomyces cerevisiae*, budding yeast. We studied mutant strains and drug treated strains to remove two processes closely associated with chromosome pairing, homology search and actin dependent motion. Using homologous chromosomes tagged with Green Fluorescent Protein (GFP) we acquired images of yeast cells over time, from which we could measure the distance between foci. We identified three classes of homolog interactions: always paired, never paired, and "kissing" where they pair and unpair. We calculated Mean Square Displacement (MSD) and the volume occupied by the foci to quantify chromosome motion. A shorter chromosome was tagged near the centromere and a longer chromosome was tagged in the arm. We found that the shorter chromosome exhibited active motion whereas the longer one did not.

Comparing Body Condition of Western Pond Turtles Before and After Removal of the Invasive Red-eared Slider

Jennifer M. McKenzie
Sponsor: Bradley Shaffer, Ph.D.
Evolution and Ecology

The purpose of this project is to examine the possible effects an introduced competitor, the red-eared slider, can have on the western pond turtle. Western pond turtles, California's only native freshwater turtle are declining throughout the state. Understanding causes for decline of this turtle is important because it assists in the future conservation of this species. In the summer of 2011 a substantial portion of red-eared sliders were removed from the University of California, Davis Arboretum waterway. With many of their possible competitors removed, I wanted to see if the body condition, mass of the turtle divided by its length, of the western pond turtle would change. To analyze body condition in western pond turtles, the Arboretum waterway was sampled for seven days with 39 submersible turtle traps approximately a year after the removal of red-eared sliders. When turtles were captured they were weighed and measured. Preliminary results suggest that more time is needed between sampling efforts to accurately judge changes in body condition because turtles are so long lived.

Plant Cell Walls: An Attempt to Further Our Understanding of Their Biology and Why They May be Important to Human Energy Consumption

Lucas J. McKinnon
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Plant Sciences

As we become more cognizant of the ecological and financial implications of sustaining our current use of fossil fuels, the need for renewable energy sources becomes more apparent. Biofuel research is becoming increasingly popular because the potential raw materials are diverse and seldom utilized. Plant cell walls represent an attractive source of feedstock because they are ubiquitous and are composed of chains of sugar molecules whose simple sugar "links" can be fermented by microorganisms into useful biofuel molecules. The primary challenge facing researchers concerns the difficulty of degrading cell walls into simple sugar units which necessitates expensive key steps to remove polymers called xylans coating the major cellulose components. This study employs several genetic and biochemical approaches to learn about the following: (1) activity of enzymes known to catalyze the breakdown of xylans (i.e. xylanases), (2) effects on cell wall composition of expressing a bacterial xylanase gene in rice plants, and (3) if these effects can improve the breakdown of cell walls. Currently, numerous transgenic rice plants have been identified that express the xylanase gene. Future studies involve testing the efficiency of the same enzyme on xylans from other plant species and taking a closer look at the breakdown products.

Measuring Gene Expression of Brain Natriuretic Peptide as a Sign of Heart Failure

Harrison M. McUmber
Sponsor: Samantha P. Harris, Ph.D.
Neurobiology, Physiology, and Behavior

Hypertrophic Cardiomyopathy (HCM) is a disease that causes thickening of cardiac muscle that can eventually lead to heart failure. HCM is found in one out of every five hundred people and is the leading cause of sudden death in young adults. HCM also occurs naturally in cats, providing us with further insight to the disease. In cats and humans, the diagnosis of HCM is primarily made using echocardiograms to measure myocardial wall thickness. In cats, the current definition of HCM is a myocardial wall thickness of at least 6mm. The goal of the current study was to determine whether gene expression differs in cats with and without HCM. It is known that Brain Natriuretic Preptide (BNP) is elevated in hearts with HCM, and expression levels are thought to be proportional to severity. By using mRNA from cats with and without HCM to run Quantitative PCR, we can measure the expression of BNP within the heart. We expect to see higher levels of BNP mRNA in cats with HCM. Results from these studies should provide us with an alternative method to more accurately diagnose presence or absence, as well as severity of hypertrophy.

Tobacco Smoking Cessation: Will It Repair the Airways?

Pooja Mehta
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Pediatrics

Benefits of smoke cessation (SC) for airway disease prevention, including chronic obstructive pulmonary disease (COPD) is known, but epithelial cell repair mechanisms following smoking are not understood. This study's aim was to investigate SC and re-exposure to tobacco smoke (TS) effects on airway epithelium in former smoker rats (TS). Spontaneously hypertensive rats exposed to filtered air (FA) or TS for 6hrs/day, 3days/wk for 12wks were examined at 0, 1, 3, 4 and 6wks post-smoke exposure. 4 week smoke recovery rats were re-exposed to TS for 2 days. Intrapulmonary airways were examined for epithelial thickness and cellular mucin volume. All control-animal time points demonstrated simple cuboidal epithelium lining airways, in contrast to thickened stratified squamous epithelium in TS rats. Following weeks of smoke recovery, TS rat epithelial volume remained significantly increased changing to pseudostratified epithelium, also containing increased mucin. Epithelium of FA control rats lacked mucin. Following re-exposure in former smoker rats at 4 weeks of recovery, mucin volume increased, while control rats demonstrated epithelial thickening, but an absence of mucin. These results suggest SC leading to recovered epithelium, but never returning to control animal epithelium. TS re-exposure significantly aggravates airway epithelial cells and mucin production in former smoker rats.

Evaluation of ^{14}C-Glufosinate Translocation in Young Almond (*Prunus dulcis*) Trees

Rolando S. Mejorado
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Plant Sciences

California almond growers spend a tremendous amount of money and resources protecting their fields from weeds. Rely herbicide, containing the active ingredient glufosinate, has become an important herbicide in almond fields since registration in California. Although glufosinate is used as a contact-only herbicide, almond growers expressed concern about injury to young almond trees suspected to be from translocation of the herbicide. The objective of this study was to measure absorption and monitor translocation of the herbicide within young almond trees using ^{14}C-radiolabeled glufosinate. Glufosinate was applied to leaf, green bark, and brown bark of greenhouse-grown trees and the plants were destructively harvested 1, 3, and 7 days after treatment. Most of the absorbed ^{14}C-glufosinate recovered remained on the surface or in the treated tissue. However, depending on the tissue treated, a minimal amount of ^{14}C-glufosinate was observed in roots and other parts of the tree. These observations suggest that there is some translocation of glufosinate in almond trees although more research is needed to determine whether the radioactivity recovered was in the form of glufosinate or a metabolite. This work addresses almond grower concerns and increases our understanding of the mobility of glufosinate in woody specialty crops in California.

In a Rodent Model of Traumatic Brain Injury, Deep Brain Stimulation of Hippocampal Theta Improves Cognitive Function

Mikhail M. Melnik
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Neurological Surgery

Over 5.3 million individuals suffer chronic cognitive deficits as a result of prior traumatic brain injury (TBI). Deep brain oscillatory rhythms, such as theta (5-12 Hz in a rodent), play a critical role in coordinating distal neural networks. Interruption of theta oscillations between the medial septum (MSN) and the hippocampus impairs learning and memory. Lateral fluid percussion, a rodent model of concussion, decreases hippocampal theta in rats. We hypothesize that stimulating the MSN at 7.7 Hz to replace hippocampal theta will improve cognitive function in TBI rats. Following TBI, rats received no stimulation, stimulation immediately prior to or continuously throughout behavioral assessment in the Barnes maze spatial learning task. Both stimulation paradigms improved the outcome in the Barnes maze, as treated animals used an improved search strategy to more rapidly locate a hidden escape box. Reduced latency to find the escape box was not related to increased search speed or distance traveled. Furthermore, in a sham injury group, stimulation did not enhance function. These data demonstrate that deep brain stimulation of the MSN restores cognitive function in injured rats and therefore represents a novel paradigm for treating patients with chronic cognitive deficits following TBI.

Identification of the Chemoreceptor for p-coumarate Chemotaxis in *Pseudomonas putida* F1

Herlinda Menchaca
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Microbiology and Molecular Genetics

Aromatic compounds include both non-toxic plant metabolites as well as toxic man-made environmental pollutants. *Pseudomonas putida* F1 is a catabolically versatile bacterial strain that is capable of degrading many toxic and non-toxic aromatic compounds. This organism is also capable of sensing aromatic compounds using chemotaxis, a process that allows the bacteria to move towards or away from specific chemicals. Recent studies demonstrated that *P. putida* can grow on and is attracted to p-coumarate, a major component of lignin in wood. The purpose of this study is to identify the receptor for p-coumarate. Chemotactic responses are mediated by cell surface receptors, and previous research identified 27 chemoreceptor genes in the genome of *P. putida* F1. A series of mutant strains each lacking one receptor gene was tested for the ability to sense p-coumarate using swim plate chemotaxis assays. A mutant lacking the aer2 gene was defective in responding to p-coumarate, and complementation with the wild type *aer2* gene restored the response. *Aer2* is an energy taxis receptor that detects changes in intracellular energy levels resulting from cellular metabolism. Future research will examine whether chemotaxis to toxic aromatic pollutants is also mediated by *aer2*.

Detritus of the Working Class Experience as Material

Daniel A. Mendoza
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Art Studio

My art is an investigation of labor as subject, and memories of certain events, actions, materials, or objects from my working class lineage. This lineage has inherently informed my art resulting in an interest of the detritus, or debris, of the working class as sulpture material, and how this practice relates to the conditions of contemporary sculpture and portraiture. I am interested in relating my investigations into a larger cultural context by fusing personal references, narratives, and portraiture with the viewer's response and associations of these images. By utilizing common place items and more traditional sculpture and painting materials (plaster, wood, casting materials, acrylic mediums), I aim to create work that emphasizes a sense of labor and intention. The results are minimal, yet intricate, sculptures that exploit un-idealistic imagery of everyday life with an integration of the detritus of the working class experience. The use of such detritus (human hair, saw dust, imagery of electrical work) becomes a further understanding of my relationship to these objects and materials within my own personal history. It, as well, becomes a social and visual conversation of the human response and the cultural perception of these materials.

Naphthalene Induces Focal Cytotoxicity in Nasal Septum Epithelia

Ryan Mendoza
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Anatomy, Physiology and Cell Biology

Naphthalene (NA) is a volatile air pollutant currently classified as possibly carcinogenic to humans. Previous studies have shown that cytochrome P450 (CYP) enzymes, abundantly present in nasal septum olfactory mucosa and much less in respiratory mucosa, are essential to naphthalene's mechanism of toxicity. We hypothesized that an acute nasal exposure to NA would cause two responses: 1) cytotoxicity in nasal epithelium adjacent to bioactive mucosa and 2) more damage to the metabolically favored olfactory epithelium compared to respiratory epithelium. Sprague-Dawley rats were exposed for six hours to either a control (filtered air or filtered air plus Triton X-100) or NA vapor (15 or 30 ppm), followed by necropsy. Localized epithelial damage was identified using an ethidium-based fluorescent viability assay and then quantified using unbiased stereology. Compared to the control group, rats showed increases in olfactory epithelial cytotoxicity when exposed to NA at 15 or 30 ppm by 355% (statistically significant, p=.044) and 327%, respectively. There were decreased levels of cytotoxicity in respiratory epithelium with increases of 265% and 351% (statistically significant, p=.011) for the same exposures. We conclude that NA does induce significant focal damage in rodent nasal epithelium and that CYP possibly influences relative location and amount of damage.

Effects of Ocean Acidification on Intertidal Predator-Prey Relationships Proxied by Upwelling and Abundance

Gregory B. Merrill
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Geology

Ocean acidification is a process by which the oceans are becoming more acidic due to anthropogenic input of carbon dioxide into the atmosphere through the burning of fossil fuels. Acidification affects various taxa differently; a clear and definitive understanding of how ecosystem structures and function change as a result has yet to surface. In examining the intertidal species *Mytilus californianus* and *Nucella* spp., effects on *Nucella* abundance with respect to *M. californianus* percent cover as a function of upwelling, a proxy for ocean acidification, were considered by sampling plots containing both species at various tidal heights at distinct geographic formations exposed to various wave action in Bodega Bay, CA in association with the Bodega Marine Laboratory. Furthermore, using abundance as a proxy for predation, examinations into the indirect effects on the predator-prey relationship between these two species as a function of upwelling were conducted. Subsequently, abundance of *Nucella* with respect to *M. californianus* migrates to higher tidal heights during upwelling . If all low-pH events affect *Nucella* in this manner, it may be forced to occupy a narrower niche, potentially increasing predation in higher tidal zones, altering ecosystem structure and function in the future should ocean acidification continue.

Differentiation and Engraftment of Muscle Progenitors Derived from Induced Pluripotent Stem Cells

Carlos L. Mikell
Sponsor: David Wilson, Ph.D.
Molecular and Cellular Biology

Induced pluripotent stem (iPS) cells are somatic cells that have been reprogrammed to an embryonic stem cell-like state by overexpressing four specific transcription factors. iPS cells are pluripotent, can undergo self-renewal, and can be patient specific. Directed differentiation of iPS cells into various lineages is promising for use in cell therapy to treat genetic disorders. Here we show that we are able to induce iPS cells to differentiate into muscle cells *in vitro.* Using immunocytochemistry, we show that differentiated iPS cells express several markers of muscle cell development. We then sought to demonstrate the engraftment capability of muscle stem cells. We injected luciferase-labeled muscle stem cells or differentiated iPS cells sorted with cell surface marker SM/C 2.6 into the tibialis anterior muscles of recipient mice. At multiple time points following engraftment, we inject the mice with luciferin, the substrate for luciferase, and tracked the level of bioluminescence using live imaging. We show levels of bioluminescence in muscle stem cell recipient's increase with time, however recipients of iPS cells showed no signal. To improve iPS cell muscle engraftment, we will optimize cell number, recipient mouse pretreatment and purification of differentiated iPS cells in the effort to promote iPS cell engraftment.

Neuroprotection in Syrian Hamster Hippocampal Neurons Challenged with Transient Oxygen and Glucose Deprivation

Alexandra Mikhailova
Sponsor: Barbara A. Horwitz, Ph.D.
Neurobiology, Physiology, and Behavior

Stroke, a pathology involving reduced oxygen (hypoxia) and glucose availability, is a major cause of death worldwide. Understanding how it results in neuronal death/apoptosis and how this death can be attenuated may lead to improved treatment of stroke victims. CA1 hippocampal neurons are particularly sensitive to hypoxia, and I focused on these neurons from Syrian hamsters, a hibernating species, because they are more protected from cold temperatures occurring during hibernation and transient hypoxia than are neurons from non-hibernating species. Using hippocampal slices, I examined temperature effects (25°C, 30°C, 35°C) and hibernation state on recovery from hypoxia (OD) and hypoxia plus glucose deprivation (OGD) to test three hypotheses: (a) OGD is a greater stressor than OD; (b) CA1 neurons are more tolerant to OGD at lower temperatures; (c) CA1 neurons from hibernating hamsters are more neuroprotected than those from euthermic (unprepared for hibernation) hamsters. I found less neuronal recovery from OGD than OD at all three temperatures [supporting hypothesis (a)]; more complete recovery from hibernating and euthermic hamsters at 30°C vs. 35°C [supporting hypothesis (b)]; and a trend for more complete recovery from hibernating vs. euthermic hamsters at 25°C [consistent with hypothesis (c)].

Double Mutant Analysis of Hsp93 and Hsp70 in Tic/Toc Complex

Lillian Miller
Sponsor: Steven Theg, Ph.D.
Plant Biology

Plant cells contain chloroplasts, which convert sunlight into usable energy. Of all the chloroplasts' proteins, 90% are encoded in the nucleus, translated in the cytosol, and must be translocated across the chloroplast's double membrane by utilizing complexes called translocons that reside in both the chloroplast's outer and inner envelope membranes. Two Heat-Shock Proteins (Hsp93 and Hsp70) are associated with the translocons, providing the force for translocating proteins by hydrolyzing ATP. Historically, it was believed that the energy needed for protein translocation was delivered solely by Hsp93; however, Hsp70 has recently been shown to play a central role in this process. The current hypothesis is that Hsp93 and Hsp70 synergistically provide energy to translocate proteins. To test this, temperature-sensitive mutations were introduced into the Hsp93 and Hsp70 genes, which were then transformed into *P. patens*, both individually and together. The phenotypes and the protein translocation efficiencies of the resulting three mutant organisms will be compared. We anticipate that while the mutation of single genes will reduce translocation efficiency, the double mutation will cause a greater decrease in translocation than the two single mutants combined, indicating the two Hsps work synergistically.

The Impact of Osteogenic Stimulation Time on Stable Mesenchymal Stem Cell Commitment

Vaishali Mittal
Sponsor: Kent Leach, Ph.D.
Biomedical Engineering

Tissue engineering represents a promising alternative to using autograft bone to treat bone defects. It aims to generate functional replacement tissues through the combination of tissue-forming cells with an underlying material matrix and instructional signals. Considering their capacity to yield bone-forming osteoblasts, mesenchymal stem cells (MSCs) are an exciting candidate for use in cell-based strategies of bone formation. MSCs are transplanted into bone defects after osteogenic differentiation to varying degrees, yet the extent of MSC differentiation required to promote healing is unknown. We hypothesized that MSCs' capacity to maintain an osteogenic phenotype after removal of soluble cues is dependent upon the duration of culture in the osteogenic cocktail. To test this hypothesis, we cultured MSCs for 2 or 4 weeks in osteogenic media, then removed the soluble cues and measured the persistence of the osteogenic phenotype. After 14d and 28d of differentiation, we observed significant reduction in mineral deposition one day post-differentiation between the two groups. These results indicate that 28d of differentiation, commonly considered long-term differentiation, does not result in robust commitment. This is important for understanding the value of *ex vivo* differentiation times and whether differentiated MSCs retain their acquired phenotype when implanted in a bony defect.

Migratory Behavior of Gambel's White-crowned Sparrow at Departure from Breeding Grounds in Fairbanks, AK in the Autumn

Raagav Mohanakrishnan
Sponsor: Marilyn Ramenofsky, Ph.D.
Neurobiology, Physiology, and Behavior

White-crowned Sparrows (*Zonotricha leucophrys gambelii*) are nocturnal migrants that exhibit specific behaviors during spring when birds travel to high latitudes (Fairbanks, AK, 64° 50' 16" N) to breed and in the autumn return to wintering sites at lower latitudes to survive. Migrants held indoors under captive conditions display active flight behavior called migratory restlessness (MR) during the night that represents the migratory flight of free-living birds (Agatsuma and Ramenofsky, 2006). To date, MR has not been studied in birds held in outdoor enclosures on the breeding grounds during autumn departure and thus the timing of departure and specific behaviors are unknown in relation to the natural conditions. Therefore, I hypothesized that birds observed under more natural conditions would elucidate the timing and nature of Migratory Restlessness in relation to the natural conditions. Behavior including MR, jump, fly, and rest were recorded during the autumn departure. Studying these behaviors may provide insight into the differences in migratory behavior at comparable times throughout the annual cycle. Thus far, analyses suggest departure timing may diverge from previous captive studies.

Optimizing UAV Design to Achieve Maximum Payload Fraction

Carlos F. Montes
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Mechanical and Aerospace Engineering

Considering how the unmanned aerial vehicle (UAV) industry on the rise, there are many applications of designing one capable of highest payload fraction. Thus, the research is meant to produce an innovative aircraft while meeting certain restrictions such as materials used, overall dimensions, take-off and landing distance, and manufacturing methods. Majority of the preliminary design work including airfoil selection, conceptual model wind tunnel testing, and wing analysis was done using various computer software packages. Other testing includes a scaled wing spar model stress analysis in order to assure that the spar can withstand applied flight loads. The project is currently progressing in construction with several analytical tasks remaining such as a drag analysis, static and dynamic stability analysis, and the payload versus density altitude prediction. When all analytical tasks and construction is completed, flight testing can be conducted prior to departing for the international student design competition. With the data compiled and pending testing and competition performance, the design optimization process can begin.

The Secret Life of Bees: Religion and Gender in Classical Greece

Rebecca Moore
Sponsor: Stylianos Spyridakis, Ph.D.
History

Religious practice often entwines with the creation and enforcement of social boundaries. This was clearly manifested in classical Greece, where pagan cult practices provided vocabulary with which philosophers would subsequently discuss women's household duties. For example, Semonides, who wrote in the 7th century BCE, deviated from his scathing misogyny to praise the ideal woman, whom he compared to a honeybee; similarly, in the 4th century BCE, Xenophon praised another bee-like woman in *Oeconomicus*, a discussion of estate management. The present study will follow the narrative of honeybees, and corresponding concepts of orderliness and self-control, through the writings of several centuries, beginning with the foundational stories of hero cults and continuing until the Hellenistic period. Though this vocabulary is well studied, the paper investigates parallel social developments to suggest a close relationship between the terms used to represent honeybees in cult practice and those employed to describe, and even proscribe, the role of women in Greek society.

Comparing SynDIG Family Protein Expression Through Western Blot Analysis

Jackelyn J. Moya
Sponsor: Elva Díaz, Ph.D.
Pharmacology

SynDIG1 (*Synapse Differentiation Induced Gene 1*) is an activity regulated integral membrane protein found at the post-synaptic membrane of excitatory synapses. SynDIG1 interacts with AMPA-type glutamate receptors and recruits them towards the developing synapse. SynDIG1 is a part of the SynDIG family that includes SynDIG2, SynDIG3, and SynDIG4. Variable protein expression was observed when the cDNA sequence coding each protein was inserted into the identical expression vector in mammalian cells. Specifically, SynDIG3 and SynDIG4 appear to display reduced expression than both SynDIG1 and SynDIG2. To confirm this phenotype, we performed transfections with freshly prepared plasmids under identical conditions for each construct. To determine if this effect was a cell-type specific artifact, we transfected both COS-1 cells and DAOY human cells. Western Blot analysis of each transfection performed revealed that regardless of cell type SynDIG1 and SynDIG2 are preferentially expressed compared with SynDIG3 and SynDIG4. The drastic reduction in protein levels seen in SynDIG3 and SynDIG4 expressing cells are unexpected due to the homogeneity of the expression system used. Proper expression of each may be dependent on one another rather than being expressed independently in which further experiments are needed to test this possibility.

Viewing Regulated Genes in *Myxococcus xanthus* Through RNAseq

Andrew Y. Mu
Sponsor: Mitchell H. Singer, Ph.D.
Microbiology and Molecular Genetics

The ability for *Myxococcus xanthus* to form multicellular fruiting bodies when faced with starvation is unusual in microorganisms. This project will utilize high throughput sequencing technology to view the *M. xanthus* transcriptome under varying conditions to see exactly which genes are up and down regulated throughout the organism. Conditions that are being studied includes growth in solid, medium, liquid medium, and flow cells. These conditions are analyzed first to understand base line levels of genes in our normal experimental conditions. To sequence the transcriptome total RNA must first be extracted and rRNA levels must be reduced. With the remaining samples they will be converted to cDNA and tags will be added to distinguish different experiment sets, before sequencing. The experiment will then move on to sequencing mutants created from previous experiments that demonstrate a defect in development. Combined with data gleamed from previous research, the enigmatic relationships between genes in the developmental pathway of *M. xanthus* can be found.

Mapping the Genetic Bases of Highland Adaptation in Maize (*Zea mays*)

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

Grown worldwide across diverse conditions, maize is one of the most important crops in terms of usage, area under cultivation, and annual yield. Different maize inbred lines show adaptation to distinct environmental conditions characterized by marked differences in latitude, altitude, temperature, and light exposure. Here we aim to map genetic variants involved in phenotypic adaptation to highland and lowland environments in a maize panel. Two hundred two inbred lines were phenotyped in controlled environments mimicking tropical highland and lowland conditions. Phenotypic data was collected on germination, total leaf number, plant height, leaf length, leaf width, stomatal density, and above ground biomass. Our preliminary results indicate that overall vegetative growth was faster under lowland condition. A large variability was, however, observed for all traits in both conditions. In the second phase of this project, we will be using genotyping by sequencing SNPs to map genetic regions underlying the adaptation mechanisms. We anticipate that our work will help better understanding the differential adaptation of maize to analyzed environments.

Synthesis of Martinelline and Martinellic Acid: Potential Inhibitors of Colon Cancer Cell Proliferation

Manuel A. Munoz
Sponsor: Jared T. Shaw, Ph.D.
Chemistry

Colon cancer is the leading gastrointestinal cause of death in the United States. Detecting colon cancer in its early stages increases the effectiveness of current treatments. However, once the cancer becomes invasive, the efficiency of current therapies greatly diminishes. Therefore, there is a need to develop new therapeutic compounds that can halt the proliferation of colon cancer cells. In 1995, Varga et. al. published the isolation of martinellic acid and martinelline from an organic extract of *Martinella quitosensis* roots. Of these two compounds, the latter has shown an affinity for the muscarinic receptor M_3 ($CHRM_3$). It has been reported that inhibition of $CHRM_3$ reduces colon cancer cell migration and proliferation. Martinelline inhibits the $CHRM_3$ receptor with an IC_{50} of 90 nM, making it an attractive candidate for SAR studies to determine which pharmacophores are responsible for its anti-cancer effects. Using methodology developed in our lab, we have synthesized a library of small molecules that resemble the core structure of martinelline. These compounds can be further modified to yield analogs of marinelline, facilitating SAR studies.

Association Between Sleep Duration and BMI Among Mexican-American Children in California's Central Valley

Mayra A. Munoz Gomez
Sponsor: Sara Schaefer, Ph.D.
Food Science and Technology

Sleep duration is associated with levels of body mass index (BMI). Short sleep duration is found to be associated with an elevated BMI and an increased prevalence for obesity (Bjorvatn, B., 2007). Obesity is a significant problem among California's Central Valley Latino children (de la Torre, Adela, 2012). Niños Sanos, Familia Sana (Healthy Children, Healthy Family) is a five-year community-based intervention study which aims to decrease the rising rates of childhood obesity among Mexican-American children in California's Central Valley. Baseline physical activity data collection was conducted in children (n=150) between 5-7 years of age in both Firebaugh and San Joaquin communities. The objective of this research is to explore associations between sleep duration and BMI of children in these communities. Children's height and weight were measured to calculate BMI. An accelerometer, a watch-like activity-monitoring device, was used by children for one week, 24 hours/day to measure children's activity and sleep duration. Preliminary results were determined by correlation analysis and do not indicate a relationship between sleep and BMI (r=0.075) in this population.

Biological Dynamics of Tribolium castaneum

Felix S. Munoz-Teng
Sponsor: Alan Hastings, Ph.D.
Environmental Science and Policy

The red flour beetle, *Tribolium castaneum*, is an invasive species that provides an ideal model for understanding population dynamics. Due to its relatively short life cycle and rapid dispersion throughout a given area the species renders invaluable insight into the broad patterns of spread as well as growth and dispersal of other organisms. However, little attention has been given to studying the shape and distribution of the dispersal kernel of any species in a highly replicated fashion. In this experiment the flour beetles were dispersed from an end set point and allowed to spread throughout a human-made landscape for a given amount of time. Census data was collected and compiled into a graph to determine whether there were indications of a "Gaussian" or "kernel" distribution with a particular tail shape. In a Gaussian distribution, the graph resembles a bell-shaped spread in which the bulk of the organisms are found in the center of the spread. In a kernel spread with either a "thick-tailed" or "thin-tailed" distribution, the graphs show how the organisms either disperse very short or long distances within the given parameters.

Wood Versus Stone Mortar Technologies: An Experimental Approach to Food Grinding Efficiency

Christina M. Murray
Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

Ground stone technologies have been used for millennia to process various materials, the most important being plant foods. In prehistoric California, inhabitants relied heavily on the consumption of gathered acorns and grass seeds which comprised a large percentage of their diets. In order to render these foods edible, ground stone technologies like mortars and pestles were used extensively. In the Central Valley, however, large stones were not readily available for mortar production; instead, hardwood mortars were often used to process foods, as seen in the ethnographic record. The effectiveness of wood versus stone for grinding foods is not well known. This paper details an experiment that gauges the relative efficiencies of two mortar designs and two raw material types at grinding two foods, acorns (*Quercus lobata, Quercus douglasii*) and chia seeds (*Salvia hispanica*). Efficiency is assessed by comparing how much time it takes to manufacture each item against the time it takes to process a specific amount of food material to a definitive consistency. The data will be applied to the Point Estimate Model (Bettinger et al, 2006) to predict when one design is advantageous over another.

Underwater Wireless Ultrasonic Communication System

Zachary Myers
Sponsor: André Knoesen, Ph.D.
Electrical and Computer Engineering

The growing extraction of underwater resources requires significant use of submersible vehicles and underwater infrastructure. Current communication methods between different underwater platforms, vehicle or structure, utilize cables and wires, which hinder the mobility of the underwater vehicles. Our project implements an underwater wireless communication system using ultrasonic transducers. This system removes the need of cables to communicate between structures and vehicles. The wireless communication system uses two frequency channels to communicate, which allows for bidirectional, simultaneous communication. The system transmits data using Differential Phase Shift Keying (DPSK), a transmission scheme that provides strong noise immunity. With our communication system, engineers and operators will have the ability to send and receive information between their platforms and vehicles without affecting the mobility of the vehicle. Some challenges we faced in our design were how to distinguish our signal from interference in the water, and increasing the rate at which information can be sent between modules, all while maintaining low power and high reliability.

Influence of Extracellular Matrix Proteins and Substratum Topography on Corneal Epithelial Cell Alignment and Migration

Rachel Naik
Sponsor: Christopher Murphy, D.V.M.
Surgical and Radiological Sciences

Understanding the migration and alignment patterns of corneal epithelial cells allows for further research in tissue engineering strategies and the development of prosthetics. This experiment was done to note the patterns involved in migration and alignment of cell nuclei in response to topography and extracellular matrix proteins. The experiment utilized immortalized corneal epithilial cells (hTCEpi) that were run under two treatments, with and without the superfluous coating of extracellular matrix proteins (FNC). The hTCEpi cells were cultured in the laboratory and were only used till the 50th passage to ensure consistency and viability. Alignment and migration were tracked via the use of live cell imaging movies. It was observed that in the absence of FNC the cells aligned in a parallel fashion to the surface topography and had limited migration capacity. Other factors, such as, elongation and orientation of cytoskeletal elements were also influenced by the presence of FNC. These results indicate that surface associated proteins modulate the effect of topographic cues.

Pathogen Detection in Coastal Waters and Marine Mussels

Anna M. Naranjo
Sponsor: Patricia Conrad, D.V.M.
Pathology, Microbiology and Immunology

An increase in marine mammal deaths due to terrestrial parasites led to a series of studies to investigate the sources of contamination. This two-year study began to detect pathogens in coastal waters and marine mussels in order to identify coastal areas of high parasitic contaminants. Marine mussels are sampled twice during a dry season and twice during a wet season each year, from four locations along the coast. Using polymerase chain reaction (PCR), gel electrophoresis and other techniques, the marine mussels are tested for the presence of pathogens known to cause intestinal parasitic diseases in animals and in humans. All mussels are tested for *Toxoplasma gondii, Giardia, Cryptosporidium, Salmonella* and fecal coliforms. The infected mussels indicate the presence of pathogens in the coastal waters they were sampled from. By identifying contaminated waters, further precautions can be taken to avoid animal and human infections. This study will continue for another year before there can be any definitive results.

Investigating Bacterial Communities in Air-conditioning Filters and on Inanimate Surfaces in Unitrans Buses

Wan Nurul Naszeerah
Sponsor: Jonathan Eisen, Ph.D.
Evolution and Ecology

Our air is not a sterile space; it is laden with microbes transitioning from surface to surface and is an important route of exposure to pathogens. While it is well-understood that man-made environments (and their air) are important in the transmission of disease, there is surprisingly little known about the "normal" microbial communities found in these environments. My research project aims to improve our knowledge of the microbial ecology within public transportation, specifically getting a comprehensive measure of the bacterial communities in air conditioning (AC) filters and selected inanimate surfaces of Unitrans buses. Collected samples are being subjected to culture-independent methods to characterize the bacterial communities that are present. Aside from testing for significant differences between bacterial communities from different sites, the samples will undergo Basic Local Alignment Search Tool (BLAST) analysis to compare each bacterial species with a database of reference sequences and determine if any pathogens were trapped in the AC filters. Thus, this investigation will provide useful information not only to health practitioners and environmental scientists, but also to engineers of ventilation systems and air filters.

Characterizing the Role of Calprotectin as Part of the Immune Response

Frances A. Navea
Sponsor: Scott I. Simon, Ph.D.
Biomedical Engineering

Neutrophils are the most abundant white blood cell in the human circulation and are the "first responders" at the site of infection, migrating into tissue and producing substances that are toxic to the invading organisms. Neutrophil cytoplasm consists of ~60% calprotectin protein. When induced and secreted by cells during inflammation, calprotectin binds tightly to divalent metal cations, thus "starving" bacteria of cations necessary for respiration. Furthermore, calprotectin can create a cascade of immune events by activating other cell types. Little is known about how neutrophils interact with calprotectin when released extracellular in tissue at the infection site. This motivated our study of calprotectin's ability to activate neutrophils and thereby initiate an immune response. In these experiments neutrophils were isolated from human donor blood and perfused through microfludic chambers that mimic shear forces at the wall of blood vessels, over different substrate conditions: either a natural calprotectin (two binding sites active) or a mutant calprotectin (no binding sites). The number of neutrophils firmly adhered to the substrate under shear stress indicates level of activation. Thus far we have observed that substrates with natural calprotectin, which present Mn^{2+}, tend to have higher levels of neutrophil arrest as compared to substrates without calprotectin.

In Silico Modeling of Mutations in RyR1 Receptor

Alexander R. Neckelmann
Sponsor: Cecilia Giulivi, Ph.D.
Molecular Biosciences

Ryanodine receptors are composed of homotetrameric proteins involved in the Ca^{2+}-induced release of Ca^{2+} from the sarcoplasmic reticulum, playing a role in excitation-contraction coupling. One of the isoforms, RyR1, is found in skeletal muscle and heart mitochondria of mammals. Mutations in RyR1 are often associated with producing a leaky Ca^{2+} channel or increasing the sensitivity of the receptor to activators, or both (Tung 2010), which manifests themselves through malignant hyperthermia and/or central core disease. To gain understanding on the pathogenicity of point mutations in RyR1, partial sequences of RyR1 of overlapping 1,500 amino acid fragments were analyzed through the protein-folding algorithm, I-TASSER (Zhang 2008). Data from X-ray crystallography on the first 531 amino acids of rabbit RyR1 was used as a template in I-TASSER. PyMol was used to model the effects of mutations at R163C, Y522S, and T4826I on protein conformations of RyR1. The mutation Y522S appears to increase the size of the Ca^{2+} vestibule by disrupting H-bonding between adjacent alpha helices, thus resulting in greater ion permeability. Further analysis is required to establish links between the severity of the phenotypes and the alteration of the protein conformations elicited by R163C and T4826I.

Individualizing the Lophophora Williamsii Using DNA Analysis

Adrienne E. Ng
Sponsor: Terence M. Murphy, Ph.D.
Plant Biology

DNA analysis is one of the most important tools used in forensic investigation. Because of the prevalence of drug-related crimes, it is crucial to differentiate between illegal plants. Specifically, our project focuses on developing a methodology to distinguish individuals of *Lophophora williamsii* (Peyote cactus) using DNA analysis. Techniques used include DNA extraction, gel electrophoresis, polymerase chain reaction, and DNA sequencing. First, we sequenced the *rbcL* gene in the chloroplasts of various specimens. We found no significant DNA differences amongst the species in the *Lophophora* genus, which suggests that the sequence of the *rbcL* gene is highly conserved within the genus. However, we were able to differentiate between the *Lophophora* genus and other genera using the sequence of the *rbcL* gene. Next, we sequenced the *trnl* chloroplast gene of the same samples, and we found that species of the *Lophophora* genus could be distinguished by a repeated AT/TA DNA sequence of different lengths. This outcome may help differentiate the *L. williamsii* from the other *Lophophora* species. Though the results from the *trnl* analysis are promising, more replications and comparisons are necessary. Overall, our data appears to have forensic implications and preliminarily supports previous phylogenic analysis of cacti evolution.

Surveying Seed Adoption Processes Among the Barabaig in Tanzania, Africa

Angela W. Ngai
Sponsor: Paul Gepts, Ph.D.
Plant Sciences

Increases in agricultural production rely heavily on improved, higher-yielding seed varieties. Farmers in impoverished countries achieve greater food security when they are able to access and cultivate these stronger varieties. Yet, in the case of small-scale African farmers, it is well documented in seed systems literature that obtaining and retaining seed is difficult. The purpose of this study is to survey how farmers collect, store, and exchange or sell seed. To obtain this information, formalized surveys will be written out and administered to villagers of Basodami in the Hanang District, of Northern Tanzania. The Barabaig are traditionally a semi-nomadic "cattle-complex" society. However, following the 1987 decree of the Extinction of Customary Land Right Order, the Barabaig have faced increased alienation of their pastoral land. Apart of a "Villigization" program set out by the Ujamma Policy, these, and other pastoralists throughout Tanzania, must learn to adopt a agricultural-subsistence lifestyle. The survey will ask participants details about how they acquire, sell, and manage the seeds on their farm. The research on these seed adoption practices amongst small hold farmers in northern Tanzania might reveal a better way to introduce new, improved varieties to increase food security in remote and poor communities.

Electrochemical Behavior of Iron Carbonyl Clusters Containing Nitride and Carbide Interstitial Atoms in Aqueous Solution

An D. Nguyen
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Chemistry

The number of stable molecular electrocatalysts which can carry out the conversion of water or protons into hydrogen, ie. the hydrogen evolution reaction (HER) in aqueous media is limited. Each of the metal carbonyl anions $[Fe_4N(CO)_{12}]^-$, $[Fe_4C(CO)_{12}]^{2-}$, $[Fe_5C(CO)_{14}]^{2-}$, and $[Fe_6C(CO)_{16}]^-$ have been isolated as the sodium salt, and these are soluble and stable in aqueous solution. Cyclic voltammetry measurements were done to investigate their reduction potentials over the range of pH 2-12. Controlled potential electrolysis (CPE) experiments were done to investigate if certain reduction events are associated with HER. At pH 7 in 0.1 M $NaClO_4$/4mM phosphate buffer hydrogen was evolved with 97% Faradaic efficiency using the $[Fe_4N(CO)_{12}]^-$ catalyst and 82% Faradaic efficiency using the $[Fe_4C(CO)_{12}]^{2-}$ catalyst with an overpotential of 450 mV. The purpose of this study is to investigate the affect of changing the interstitial atom and cluster size in electrocatalytic HER. Similar experiments were done with $[Fe_5C(CO)_{14}]^{2-}$, and $[Fe_6C(CO)_{16}]^-$.

The Role of RAD21L1 in Homologous Chromosome Pairing in Spermatocytes and Oocytes in Zebrafish (*Danio rerio*)

An Nguyen
Sponsor: Sean M. Burgess, Ph.D.
Molecular and Cellular Biology

Meiosis is a process of cell division that produces haploid gametes from diploid cells. During this process, homologous chromosomes pair and segregate from their partners. Failure of this process results in gametes with abnormal numbers of chromosomes, which causes birth defects in humans. However, it is not well understood why the vast majority of these errors occur in oocytes rather than in spermatocytes (Hunt and Hassold, 2001). We hypothesize that inter-sex differences in pairing dynamics of meiotic chromosome may account for this. If our hypothesis is true, we expect that proteins that assist pairing will exhibit different characteristics in oocytes versus spermatocytes. Specifically, the protein RAD21L is conserved in many vertebrates and promotes synapsis initiation between homologous chromosomes in mouse (Lee and Hirano, 2011). Here we use the zebrafish to investigate a possible sex-specific role for its ortholog, RAD21L1. First we generate null mutants of RAD21L1 by targeting a site-specific endonucleases to its gene sequence. Next we will visually assay homolog pairing status in chromosome spreads by detection of the synaptonemal complex by immunostaining. This study will shed light on the mechanisms of meiotic homolog pairing in an attempt to prevent birth defects.

Investigating Telomere Epigenetic Landscape In Cancerous Cells

Dieu H. Nguyen
Sponsor: Lifeng Xu, Ph.D.
Microbiology and Molecular Genetics

Human telomeres function to cap chromosome ends. Every time normal somatic cells divide, the telomeres get shortened until they reach a critical length and cells enter senescence. Cancer cells, however, escape senescence by infinitely lengthening the telomeres. Most cancer cells, 85%, do this by activating telomerase - a normally suppressed protein in somatic cells. The remaining 15% keeps their telomeres lengthened through a recombination mechanism, termed Alternative Lengthening of Telomeres (ALT). To gain insight into how ALT is activated, we must understand how the higher-order heterochromatin structure of human telomeres is maintained. The epigenetic landscape of the telomere is thought to be enriched in repressive histone marks, but the specific marks are not well established. My hypothesis is that the epigenetic marks in ALT cell lines are different from those in telomerase-positive cells. We are performing Chromatin Immunoprecipitation (ChIP) using antibodies against canonical histone marks in four cancerous cell lines to examine the levels of these marks at the telomere and other genomic regions. Understanding the telomere epigenetic landscape permits a powerful insight into the activation of ALT. A greater comprehension of ALT can complement telomerase cancer treatment, leading to an even more powerful cancer therapy at clinical setting.

Using Fluorescence in Situ Hybridization Studies to Detect Specific RNA Levels in Angelman Mice

Jennifer Trang T. Nguyen
Sponsor: David J. Segal, Ph.D.
Biochemistry and Molecular Medicine

Angelman Syndrome is a neurological and developmental disorder that affects children by inhibiting their ability to function normally in terms of both movement and intellectual development. The disorder is caused by an inactivation or deletion of the gene UBE3A on chromosome 15, which is maternally inherited and paternally silenced due to imprinting; unfortunately there is currently there is no cure for the disorder. The method of Fluorescence in Situ Hybridization (FISH) studies is being used to measure transcription levels of relevant RNA. The study will detect levels of RNA expression for UBE3A-ATS, a transcript that regulates UBE3A, as well as determine if the treatment we have designed is working in a mouse model of Angelman Syndrome. Further studies on the structure and function of the RNA transcript may lead to procedures that can activate the UBE3A. The findings may be useful for future research and treatment regarding Angelman Syndrome.

Assessment of Field Methods for Quantifying Native Pollinators in Restored Agricultural Hedgerows

Karin Nguyen
Sponsor: Claire Kremen, Ph.D.
Environmental Science and Policy

A variety of conservation initiatives have supported restoration of the margins of farmland in Yolo County, CA, through the planting of native shrubs, herbaceous flowering plants and grasses. One of the major goals of these restored hedgerows is to provide habitat for native pollinators, including bees and syrphid flies in intensely managed agricultural landscapes. This study compares the abundance and diversity of bees at five hedgerows soon after they were established (2008) and three years later (2011), with the abundance and diversity of insects found on three fully mature hedgerows. The goal of this project is to look at the success of the restoration so far to see if we are able to detect increases in the development in the insect community, and whether these increases may be correlated with particular features of the restoration site. We placed twenty-one open pan traps along the selected 50meters hedgerows and netted insects which landed on reproductive flower parts for six ten minute intervals. Analysis of preliminary data compared two indirect indices of bee population: abundance and diversity. Preliminary results indicate that current sampling techniques may not accurately represent the actual abundance and diversity of insects at these sites.

The Effect of Varying Nitrogen on the Productivity of AtDof1 Gene Expression in Transgenic Tomato Lines

Kristy Nguyen
Sponsor: Diane Beckles, Ph.D.
Plant Sciences

Tomato (*Solanum lycopersicum L.)* is one of the most popular vegetables globally with healthful attributes, but like many horticultural crops, it requires high-nitrogen fertilizer to maintain yields. In order to combat the environmental degradation contributed by fertilizer, this study aims to investigate the efficiency of a transgenic tomato line for growth on low nitrogen (N). The tomato line chosen for this study, 4080, ectopically expresses the gene *AtTF1* cloned from Arabidopsis. Previous studies showed that the *AtTF1* transcription factor enhances N assimilation. This transgenic line showed increased fruit yield of 30% compared to the control, and preliminary results indicate increased tissue N and an elaborate root system. In this study, biomass measurements and *AtTF1* gene expression of the tomato lines will be evaluated at varying N concentrations (2.5%, 5%, 10%, 100 %). The anticipated outcome is that when N is reduced, biomass will be maintained in 4080 because of its increased efficiency of N-uptake, assimilation, and metabolism and that *AtTF1* expression will be stimulated, while the control tomato line will do poorly. The findings may be useful in determining if future research should be invested in generating high N-use efficiency, non-transgenic to efficiently absorb N by modification of this gene.

Machine Learning of Mathematical Documents

Longphi Nguyen
Sponsor: Jesus De Loera, Ph.D.
Mathematics

Researchers often collaborate with individuals of similar interests, but the process of identifying these individuals may be time consuming and labor intensive. In order to ease this process, we applied machine learning techniques from statistics to summarize a researcher's published works. We programmatically choose a list of terms, called summarizers, that represents a coherent set of sentences or words from a researcher's abstracts. The summarizers provide a quick overview of a researcher's interests, thus making identifying their interests more readily available. To produce these results, we used the following methods: co-occurrence, correlation, L1-penalized linear regression (LASSO), and L1-penalized logistic regression (L1LR). In addition, we applied Sparse Principal Component Analysis (SPCA) to reduce the computational time of the four methods by approximately 65% with little consequence to the overall results. We verified the accuracy of our results by having selected researchers review the summarizers for their own works. People can then more efficiently network and collaborate with others of common interest.

Reversibly Stabilized Multifunctional Disulfide Crosslinked Polymer-based Nanoparticles for Doxorubicin Delivery

Ngoc-Bich Nguyen
Sponsor: Kit S. Lam, M.D., Ph.D.
Biochemistry and Molecular Medicine

There have been big advances in the development of nanomedicine in the past decade. Highly toxic drug can, in principle be encapsulated, so that higher dose of drug can be given to the patient with less side effects. Examples of such nanocarriers include micelles, polymers, dendrimers and inorganic nanoparticles. However, one major challenge is that the toxic chemotherapeutic drugs often release into the circulation prematurely, hampering the potential of nanomedicine in cancer treatment. Premature drug release is caused by dilution of the nanoparticle drug into a large blood volume (~5-7 liters) and the presence of blood components that destabilize the nanocarriers. To avoid premature drug release from our polymer-based nanoparticle, we introduced intramolecular disulfide bonds to crosslink the nanoparticles. We loaded the nanoparticle with a chemotherapeutic drug called doxorubicin. Doxorubicin can be released inside the tumor cells where glutathione is high. Alternatively, the drug can be triggered to release via administration of a reducing agent such as N-acetylcysteine, on demand. We have tested the cytotoxic effects of such crosslinked nanoparticles on cancer cells. MTT assay was used to determine the cytotoxic effects. We are testing such nanoformulation of doxorubicin in xenograft model.

In Vitro Characterization of Cells Isolated from Human Atherosclerotic Blood Vessels

Thong D. Nguyen
Sponsor: Aijun Wang, Ph.D.
Surgery

Atherosclerosis is one of the leading causes of death worldwide. It is generally accepted that the build-up of artery-blocking plaques results from arterial damage caused by low-density lipoproteins. This damage triggers an inflammatory response, and eventually leads to the formation of intimal hyperplasia and atherosclerotic plaque. Traditionally, it was thought that smooth muscle cells (SMCs) from the blood vessel wall de-differentiated into proliferative, synthetic SMCs. Our previous work, published in *Nature Communications* (June 2012) demonstrated that it is predominantly the differentiation of a novel stem cell type, multipotent vascular stem cells (MVSCs), as opposed to SMC de-differentiation, that leads to intimal hyperplasia and possibly plaque formation. This ongoing study aims to characterize cells isolated from atherosclerotic plaque and different layers of normal blood vessels by performing immunocytochemistry. The preliminary results show that cells from the tunica adventitia, tunica media and plaque all express MVSC multipotency markers such as Sox10, Slug, NFM and S100β. Our differentiation assays show that these cells can also undergo adipogenesis, osteogenesis, and neurogenesis. More experiments will be conducted to confirm these findings and compare the multipotency of these vascular cells from tissues of different ages.

Evaluation of the Necessity of Pre-discharge Functional Testing in Low Risk Patients Presenting to the Emergency Department: A Clinical Study

Phuong An Nguyen-Huu
Sponsor: Ezra Amsterdam, M.D.
Cardiovascular Medicine

Pre-discharge functional testing (PDT) is used in the evaluation of low risk chest pain patients presented to the emergency department (ED). PDT may be exercise treadmill testing or cardiac stress imaging. Patients with chest pain are considered at low risk for myocardial infarction if their electrocardiogram and blood tests for cardiac injury are normal in the ED. These patients then undergo PDT which, if also negative, allows safe, early discharge from the ED. Recent reports suggest that not all low risk patients require PDT to ensure safe discharge. This retrospective study will attempt to confirm the hypothesis that it is safe to eliminate PDT in selected low risk patients presenting to the ED with chest pain. Data will be collected from the University of California Davis Medical Center Chest Pain Unit Registry and patients discharged from the ED without PDT will be compared to those who received PDT according to clinical features, duration of followup, and outcomes. Confirmation that PDT is not necessary in all low risk chest pain patients could result in wider use of this approach and improved hospital resource utilization.

Determining Haplotype Diversity of Modern North Pacific Albatross Using Ancient and Historic DNA Cytochrome b and D-Loop Sequences

Danielle Nisan
Sponsor: Benjamin Sacks, Ph.D.
Population Health and Reproduction

Short-tailed albatross (STAL) were over-exploited and driven nearly to extinction in the mid-1900s. The population has begun to rebound since this extreme bottleneck. However, in the time of the population lapse it appeared that other North Pacific albatross species, Laysan (LAAL) and Black-footed (BFAL), began to fill the recently available niche of the STAL. As STAL populations continue to recover there are conservation concerns regarding range contraction, availability of resources, and genetic diversity. Using samples of ancient and historic individuals collected from different regions in the North Pacific we amplified and sequenced different mitochondrial DNA regions. We have amplified Cytochrome b and d-loop regions to determine how many extant haplotypes persist in STAL, BFAL, and LAAL. The d-loop regions, with a faster mutation rate than cyt b regions, are more indicative of recent mutations and diversity within the target species. Cyt b data indicated very low levels of diversity within all three species, and especially in the STAL. We found that d-loop regions showed much greater diversity within all of the species, and especially in the LAAL.

Investigating Justice: Assia Djebar's La Femme en Morceaux

Christina Novakov-Ritchey
Sponsor: Noha Radwan, Ph.D.
Comparative Literature

Algerian writer, Assia Djebar, focuses some of her most compelling work on the issue of gender and colonial liberation. Djebar's 1997 short story, *La Femme en Morceaux* (*The Woman in Pieces*), retells the ancient story, *The Three Apples*, from the *One Thousand and One Nights* employing a contemporary narrator who is fated to transform into the story's namesake. In this piece and Djebar's other work, she engages with the dominant power structure by challenging the parameters of justice, physical violence, and gender roles through innovative literary tropes and textual references. Drawing upon Frantz Fanon's, *A Dying Colonialism* and Edward Said's, *Orientalism* this paper seeks to illuminate the unique power role held by modern Arab woman authors who address the parameters of oppression and liberation. Using Djebar's work as a point of departure, I will pay particular attention to her use of literary intertextuality as a way of illuminating oppression within her social framework and the broader Francophone world of North Africa. The paper specifically questions the nature of justice and punishment through the lens of Djebar's juxtaposition of contemporary post-colonial Algeria with the world of the *One Thousand and One Nights*.

Sex and Birth Order Predict Infant Growth and Survival: Consequences of Differential Maternal Investment in Rhesus Macaques (*Macacca mulatta*)

Chase L. Nunez
Sponsor: Lynne A. Isbell, Ph.D.
Anthropology

Among mammals, females initiate their reproductive careers before achieving somatic maturity and therefore face tradeoffs between allocating energy to reproduction or their own continued growth. Among rhesus macaques, infants of primiparous mothers are at risk for higher mortality, morbidity, and slower growth but the consequences later in juvenility are less understood. We investigated the long-term consequences of differential maternal investment during infancy in both first-born and later-born infants by jointly modeling growth and survival in a large sample of *Macaca mulatta* assigned the California National Primate Research Center (N=2724). By jointly modeling the growth and survival for the first three years of life, we were able to quantify the degree to which growth rates influence the likelihood of death. Using later-born daughters as a reference group, results demonstrate that, in general, first-born offspring are lighter at birth when compared to later-born offspring of the same mother, and that parity has a substantial influence on the growth rate of sons. Additionally, males were found to have a significantly higher hazard of mortality when compared to other sex/parity classes, yet this hazard is significantly attenuated for first-born males. This provides evidence for the influence of maternal investment strategies on infant outcomes.

Understanding Practices of Teaching Multiculturalism Through Children's Literature in Elementary Grade Levels 1-3

Erica Oberg
Sponsor: Pamela Major, Ph.D.
University Writing Program

Multicultural children's literature is a powerful tool to aid students in recognizing both themselves and others as part of an ethnically and culturally diverse world. Reading authentic, multicultural books in the classroom benefits students by creating an environment that welcomes diversity, as well as one where student perspectives are continually engaged and challenged. Research supported suggestions are also available for incorporating multicultural literature into the curriculum and selection of materials. However, there is limited data to support how multicultural education, through a literature based approach, is currently being implemented in schools. This research project addresses the need for a more in depth study of pedagogical practices utilizing multicultural literature. Through teacher observations and interviews this research investigates how educators in the Davis School District are using children's books as an effective approach to teach multiculturalism in grades 1-3. By gaining an educator's perspective, I hope to provide a better understanding of these teaching methods to encourage a more widespread implementation of the practice, beyond the theory, of multicultural education.

What Are Some of the Most Efficient Ways to Burn Glycerol?

Obdulio Ochoa
Sponsor: Benjamin D. Shaw, Ph.D.
Mechanical and Aerospace Engineering

Because glycerol is an abundant by-product of biodiesel production there is a great interest in converting this waste product into a fuel for onsite heat or power generation. Pure glycerol does not burn easily due to its high viscosity and a high auto-ignition temperature. The purpose of the project is to identify possible processes that will burn glycerol efficiently to maximize the use of this by-product. This research will attempt to decrease glycerol's viscosity and increase its burnability by blending it with other fuels. Temperatures of blended droplets will be measured using ARDUINO microcontroller and thermocouple technology. So far, accurate and reliable data does not exist on the gasification of glycerol blend droplets in a peer reviewed paper. This research would offer insightful and reliable data about glycerol gasification and burning processes. The temperature readings attained through this research can be used in the development of engine environments that would enable the extraction of workable energy from glycerol. The conclusions attained will determine the most efficient and ideal environment for the burning of glycerol and serve as a tabulated reference for properties of glycerol not yet explored.

A New Generation of Leaders: The Ideological Influence of September 11 on Naval Academy Graduates and Their Perception of Leadership and Ethics

Cassandra J. Olson
Sponsor: Naomi Janowitz, Ph.D.
Religious Studies

The personal recounts of their initial years of service of the 2002 graduates of United States Naval Academy provide an intimate picture of "call to arms" within America in the aftermath of September 11, 2001. In this paper, I analyze the recollections from, *In the Shadow of Greatness*, of these individuals concerning their time at the academy and subsequent decade in war. In contrast to Bruce Lincoln's analysis of the political rhetoric of President Bush and Osama Bin Laden in the immediate aftermath of the terrorist attacks, I focus on individual processing through personal storytelling of this traumatic event. In particular, to what extent this event defines them as leaders in wartime. In this radical shift from peacetime to war mobilization, these leaders had to internalize this event for their personal leadership. The "othering" of the enemy becomes more acceptable and necessary for the rationalization of combat. However, within the majority of these personal recounts and reflections, the zealous language within the political rhetoric and Lincoln's "symmetric dualism" is markedly absent. This paper explores the limits of the influence of the "vengeful response" to 9/11 and the degree of individual commitment to this idea through their experiences as junior officers.

A Novel Progammable Voice Coil Allows for Acurate Modeling of Both Concussion and Blast Injury Using the Fluid Percussion Device

Rafael Ordaz
Sponsor: Gene G. Gurkoff, Ph.D.
Neurological Surgery

Currently over 5.3 million people in the United States live with a disability related to traumatic brain injury (TBI) (Langlois et al. 2006). Limited treatment options are available to alleviate these deficits. The lateral fluid percussion device (LFP) is the most commonly used injury device to simulate TBI in rats. It injects a fluid pulse which generates a concussion-like injury. This device does not model blast-like injury as the rate of the injected fluid pulse is slow compared that of a blast over-pressure. We hypothesize that the novel programmable Voice Coil Lateral Fluid Percussion (VC-LFP) injury device, which can inject the fluid pulse over ranges of different speeds, can be used to model both concussion and blast injury. We will compare the original LFP injury to both slow and fast VC-LFP injury to determine whether we can replicate the standard concussion-like LFP injury as well as model a blast injury. Cognitive behavior and cell death, will be compared. As TBI patients suffer from ranges of injuries, from concussion to blast, it is critical to develop flexible models that allow us to test a range of injuries to identify either common or disparate mechanisms that may be targeted for therapeutic intervention.

Vitamins A, C, and E and Autism Spectrum Disorder

Crystal Orozco
Sponsor: Rebecca J. Schmidt, Ph.D.
Public Health Sciences

Previous studies suggest children with autism have high levels of oxidative stress. Antioxidant nutrients retinol, ascorbic acid, and tocopherol (vitamins A, C, and E) reduce levels of oxidative damage caused by free radicals, but have not yet been examined in association with autism risk. We investigated the role of vitamins A, C, and E in the CHARGE (Childhood Autism Risks from Genetics and Environment) case-control study. Information on the frequency and brands of cereals, prenatal vitamins, multivitamins, and nutrient-specific vitamins consumed 3 months before and throughout pregnancy and during breastfeeding was collected through parental interviews. We quantified a total daily average amount of supplemental intake of vitamins A, C, E for each subject and compared case and control maternal average intake of each vitamin for each month using Wilcoxon-Mann-Whitney and t-tests as appropriate. We compared the percent using nutrient-specific vitamins between groups using Chi-square tests. We found that mothers of children with ASD were less likely to report having taken a vitamin C supplement during pregnancy, but not vitamins A or E. Although this provides preliminary evidence for an association between ASD and decreased intake of supplemental vitamin C, additional evidence from prospective studies is needed to confirm the association.

The Integral Role of Religious Repetition in Culture

Francisco A. Ortega
Sponsor: Naomi Janowitz, Ph.D.
Religious Studies

Although repetition is known to be an integral part of religious ritual, this very fact has become central to the critique of religion in modern scholarship. Two distinct genealogical lines of thinking have emerged pertaining to the meaning of ritual. The genealogical line that informs theorists such as Margaret Thompson Drewal contends that the improvisational aspect of repetitive ritual is what gives ritual meaning. The opposing genealogical line that informs theorists such as Boris Groys asserts that repetition is symptomatic of the meaninglessness in ritual. Although a positive step forward, even Catherine Bell's theory of belief manifesting itself in physical movement does not entirely put this issue to rest for it fails to provide an inherent necessity to repetition. This paper places this scholarly debate in the larger context of the performative efficacy of ritual. It takes repetition from its former context in which it is symbolic of the inability to move forward and an aspect of obsession behavior, and recontextualizes it as a necessary function inseparable from the culture-creating capacity of human action.

Bartonella Infection in Domestic Animals from Mexico

Marissa S. Ota
Sponsor: Bruno B. Chomel, D.V.M.
Population Health and Reproduction

Bartonella are emerging vector-borne pathogens that mainly infect wildlife and domestic animals. They usually cause bacteremia in their animal hosts and can induce several clinical entities in both domestic animals and humans. We recently isolated *Bartonella* from vampire bats (*Desmodus rotundus*) from Hidalgo State, Mexico. However, no reports have yet been done for the presence of *Bartonella* bacteria in domestic animals in Mexico. We sought to investigate the presence of such organisms in sheep and goats from Hidalgo in flocks bitten by vampire bats and from impounded stray dogs in Tulancingo, Hidalgo. Presence of *Bartonella* in the blood was detected by PCR aiming at the citrate synthase gene (*gltA*). Overall, 75 sheep, 9 goats and 33 dogs are being tested. Preliminary results indicated that 13/35 (37%) sheep and 3/12 (25%) dogs were *Bartonella* PCR positive. Preliminary sequencing of a few sheep isolates indicated that they are infected with *Candidatus B. melophagi*, a *Bartonella* species identified in sheep keds and sheep, and possibly *B. bovis*, a *Bartonella* species identified in cattle. If confirmed, it will be the first report of *B. bovis* in sheep. Our results support that *Bartonella* infection is very common in domestic animals from Mexico.

The Three-dimensional Structural Analysis of HEP230-bound Hepatitis E Virus-like-particles

Tingwei Ou
Sponsor: R. Holland Cheng, Ph.D.
Molecular and Cellular Biology

The Hepatitis E virus (HEV) is an icosahedral, single-stranded RNA virus that infects humans primarily via contaminated water. HEV infection causes acute liver inflammation in otherwise healthy individuals, but fatal failure in pregnant women. Thus far, no vaccine is commercially available while the understanding of HEV antigenicity plays an important role in the development of anti-HEV strategies and in the prevention of potential HEV outbreak. Here, we report a three-dimensional structure of the HEV virus-like particle complexed with the antibody, HEP230, which was determined by cryo-electron microscopy and image analysis. The binding of HEP230 Fab relied crucially on the presence of Arg 573 residue on the surface of protruding spikes. The molecular detail of the binding interface will be further analyzed by docking the HEV crystal structure into cryo-electron density map. The obtained results can help us to not only decipher neutralization mechanisms of HEV, but also design and propose robust protocols for the clinical diagnoses of HEV.

Analysis of Hippocampal Abnormalities in TBI Patients

Sowmya Padakanti
Sponsor: Arne Ekstrom, Ph.D.
Psychology

Traumatic Brain Injury (TBI), a major cause of death worldwide, occurs when external force damages brain tissue. Over two million people sustain a TBI in United States annually; most TBI survivors have cognitive deficits. One brain structure thought to contribute to these cognitive deficits, particularly memory problems, is the hippocampus. Yet the degree of hippocampal damage during TBI and its relation to accompanying memory and cognitive deficits remains unexplored. The purpose of this research is to identify whether abnormalities in hippocampal structure, measured using T1-weighed magnetic resonance images, correlate with memory deficits assessed using neuropsychological measures of cognitive function. Volumetric analysis of hippocampus using fMRIb software library (fsl) will allow us to compute hippocampal volume and compare between TBI patients and controls. We predict an overall reduction in hippocampal volume in TBI patients compared to controls, which will in turn correlate with delayed memory functions and other cognitive problems. Determining hippocampal volume reductions in TBI patients will help us better characterize how it impacts cognition and opens the road to therapies targeting the hippocampus.

Borders in the Construction of Gender in Díaz's *The Brief Wondrous Life of Oscar Wao* and Cisneros' *Caramelo*

Julia-Rose V. Padilla
Sponsor: Desiree A. Martin, Ph.D.
English

Literal and figurative borders separate cultures, generations, and identities for people who migrate from one country to another. As a consequence, 21st century Latina/o novels such as *Caramelo* (2002) by Sandra Cisneros and *The Brief Wondrous Life of Oscar Wao* (2007) by Junot Díaz focus on such borders as they explore how characters negotiate identities that cross or straddle them. For my senior thesis project (through the English department's Critical Theory Honors Program), I examine these two novels to study the representation of the relationships between transnationalism and gender identity among Latino/a adolescents and adults who travel from Latin American countries (Mexico and the Dominican Republic) to the United States (and back again). Through literary analysis, I will investigate what factors contribute to a sense of belonging - or not belonging - in different cultures in order to shed light on the impact that transnationalism has on identity, as represented in contemporary Latina/o fiction. My preliminary conclusions are that despite a person's ability to cross over geographic borders, metaphorical and psychological borders remain in place.

Development of Cost and Energy Efficient Synthesis of Fe-based Superconducting Materials.

Chongin Pak
Sponsor: Kirill Kovnir, Ph.D.
Chemistry

Synthesis of iron-based superconducting materials with cost and energy efficient way is the key for real life application of superconductor. The phenomenon of superconductivity is the key point of the energy efficiency because it can avoid loss of energy while energy transfers from power plant to end-users. In iron-based superconducting material field, there are already several methods to produce superconducting materials using high temperature. Theses methods not only require high temperature but also they produce mixture of superconducting and non- superconducting materials. My current research project is devoted to development new way of synthesis of iron-based superconducting material using solvothermal methods at low temperatures of 190-220°C. Synthesized compounds are characterized with powder and single crystal X-ray diffraction methods, and Mossbauer spectroscopy and also their magnetic properties are measured with SQUID magnetic property measurement system. In course of study, I've produced new iron chalcogenides, $Fe_3Se_4(en)_2$, and its crystal structure has been determined. Details of synthesis, crystal structure, and the relationship to magnetic properties will be discussed.

Observations of Phototactic Behavior of the Cnidarian, *Hydractinia*

Mira Parekh
Sponsor: Rick Grosberg, Ph.D.
Evolution and Ecology

The phylum Cnidaria is notable for the variable array of multicellular light detecting organs that can be found throughout various Cnidarian taxa. Photodetector types found within the phylum range from simple photoreceptor spots or pigment cups to complex eyes that are most likely independently evolved from the complex eyes of bilaterian animals. Specifically, the family Hydractiniidae possesses various photodetector types that could provide insight into the evolution and development of light detection in animals. However, the extent to which photodetection capabilities are present in Hydractiniidae is unknown, as is the ability of hydractiniids to detect different wavelengths of light. To determine the presence of differential light detecting behavior, I conducted experiments on larvae of the model hydractniid *Hydractinia symbiolongicarpus*. I measured the larval response to differing wavelengths of visible light over the course of development. I also investigated the course of nervous system development in planulae larvae with the goal of identifying neurobiological correlates of photo-behavior. Our findings shed needed light on the evolution and development of photosensitivity and behavior in Cnidaria.

Development of a Data Analysis Framework for High Energy Physics

Jacob M. Pasner
Sponsor: Mani S. Tripathi, Ph.D.
Physics

High Energy Physics (HEP) is well known for its huge collaborations that work on giant accelerators and detectors. However, at the core of these electronic marvels lies the real challenge: fast, efficient, precise data analysis software. Without a well thought out and modular software structure even the best experiment can be crippled by time constraints due to hold ups in the analysis stage. Furthermore, without good analysis techniques, even the most precise detector can appear to produce noise filled "junk" data when it comes time to publish a paper. Collaborations spend a lot of time constructing a good analysis structure based on the requirements of the chosen detector. This can include choosing and building specialized data storage formats, producing code for the first rough data cuts to reduce data storage costs, and finally, developing actual techniques for precision data cuts to extract the physical quantities in question. My work in this project will be centered on developing an understanding of machine learning data analysis techniques and on the application of these methods in an analysis framework. This will include learning about and implementing the Toolkit for Multivariate Analysis (TMVA) and learning about the intricacies of data analysis structure in HEP.

Cultural Competence and Practices of Translation

Mar-y-sol N. Pasquiers
Sponsor: Cristiana Giordano, Ph.D.
Anthropology

As medical practitioners and theorists have become aware of the ways in which health is culturally constructed and enacted the necessity for 'cultural competence' within clinical settings has become increasingly important. My research has shown commonalities amongst the many writings on cultural competence in that all emphasize the importance of contextualizing medical interactions within the political, social, and cultural contexts that characterize interactions between practitioners and patients. It is also necessary for medical practitioners to be aware of their own cultural bias and worldviews when treating patients. Despite translation assistance in medical encounters, biomedicine often assumes mutual understanding of certain concepts regarding medical care and treatment adherence leading to issues of misunderstanding. In this paper, I analyze the various definitions of cultural competence in the fields of medical anthropology, transcultural psychiatry, and biomedicine. I ask whether cultural competence can be standardized and universally applied, or whether it needs to be tailored to individual patients and doctors, and their biographies. My question will guide my ethnographic research in a culturally specific clinic in Sacramento.

Characterization of MJ0066 PUA Domain by X-ray Crystallography

Raina H. Patel
Sponsor: Andrew Fisher, Ph.D.
Chemistry

The complete genome sequence of *Methanocaldococus jannaschii* was an important breakthrough for defining and understanding the evolution of the third domain of life, archaea. *M. jannaschii* is an archaea found in deep-sea hyperthermal vents 2,600 meters below sea level. This thermophile grows optimally at 85°C with pressures exceeding 200 atm. Organisms usually activate sulfur through enzymatic reduction, adding electrons to sulfate to form sulfite or sulfide. In archaea, sulfur metabolism is not well understood; many of the known enzymes are missing from methanogen archaea genomes. *M. jannaschii* contains a 480 amino acid sequence, MJ0066, which shares a significant similarity to PAPS reductase, an enzyme involved in the sulfur pathway. Current work in the Fisher lab has confirmed that MJ0066 is not a PAPS reductase. The gene also contains an N-terminal domain called the PUA domain, hypothesized to bind nucleic acids. The PUA domain is typically found on tRNA modifying enzymes, changing our hypothesis that MJ0066 modifies tRNA with sulfur. Through X-ray crystallography, I hope to determine the crystal structure of the PUA domain, confirming the structural annotation, as well as aid in future research toward determining the function of MJ0066.

Slow Growth After the Great Recession and How Government Policies Are Related

Vedang J. Patel
Sponsor: Bagher Modjtahedi, Ph.D.
Economics

The Great Recession that began in 2007 is the worst economic decline in the United States since the Great Depression. To this day there is still debate on why the financial crisis that caused it was so devastating. There is also contention over what has motivated such slow growth after the subsequent Recession. Analysis of several studies reveal that policies adopted by the government during the crisis were swift compared to other recessions and seems to have had an effect on mitigating it; however some economists believe they may also have contributed to the slow pace of the recovery. Others believe that the slow growth is mainly the result of some structural weaknesses in the economy caused by the financial crisis. In this research we analyze the relative importance of different factors for this slow growth. Some key factors to consider are reduced aggregate demand, residential investment, erosion of skills, increased business uncertainty, and generous unemployment benefits.

Salamander: A Software Platform for Filtering and Segmenting Video in Real Time

Christopher J. Patton
Sponsor: Owen Carmichael, Ph.D.
Neurology

I report on the development and testing of Salamander, an image processing software application designed to automatically detect and track targets of interest in a video stream. Behavioral studies is an integral part of numerous areas of biological and environmental research. A challenge of this work is to distance the researcher from the ecosystem as to mitigate the impact of human presence on behavior. When the experimental design requires direct observation, a solution is to install solar-powered field cameras. However, the task of searching through hours of video for appearances of interesting targets is impractical. The use of motion sensing hardware has proven inadequate in our experience, as such systems are extremely vulnerable to noise and false positives. Salamander comprises an image processing pipeline that detects and tracks targets in real-time and filters the video stream for these instances. Performing this processing at the software level enables us to reason about the video feed and targets intelligently, thus increasing accuracy. Although Salamander has proven affective in many scenarios, it requires further refinement to account for certain conditions. I present the results of some experiments and speculate how machine learning techniques may be used to improve reliability.

An Optimum Acceleration Strategy for Wind Turbines in Winds of Varying Velocities

Aaron Pereira
Sponsor: Jean-Jacques Chattot, Ph.D.
Mechanical and Aerospace Engineering

Wind energy is a growing contributor to electricity generation, providing 3.4% of US electricity and accounting for 45% of new generation capacity in 2012 (US Energy Information Administration). Gust patterns, however, are uncertain and hard to predict, which can mean the high inertia system of a large wind turbine is not harvesting optimum energy. A computational model based on a Helicoidal Vortex Model has been developed (Chattot, 2003); a pitch strategy is developed to optimize the aerodynamic power at every advance ratio. From the behavior of the wind, it is possible to develop an acceleration strategy, so that while the advance ratio is not at that of the optimum efficiency, η, it can be determined how much of the aerodynamic power is to be allocated to acceleration and how much to power generation, to optimize overall energy production. In the model, a scenario is considered where gusts of constant speed follow a known length distribution. An acceleration strategy which optimizes energy generated for that wind behavior, while taking into account the practical considerations of the generator and other components of the rotor, is sought for a range of realistic wind behaviors. Specifically, this is relevant in optimizing the start-up phase.

Mosquito GST Activity and Pyrethroid Resistance

Luis A. Perez
Sponsor: Bruce D. Hammock, Ph.D.
Entomology

Pyrethroid insecticides are commonly used to control pest insects such as mosquitoes. Resistance to pyrethroid insecticides, however, is always a concern. Insecticide resistance is thought to occur through several modes of action. One proposed mechanism of resistance is an increase in the activity of glutathione S-transferase enzymes (GSTs). GSTs add reduced glutathione to reactive targets found on a large variety of compounds that the insect naturally encounters in its diet or environment. In pyrethroid resistant mosquitoes enhanced GST activity or the development of GSTs with a higher activity for pyrethroids could lead to pyrethroid resistance. Specifically, following GST metabolism, the pyrethroids become more water soluble and are more easily excreted so that they have less chance to take effect. My hypothesis is that pyrethroid resistant mosquitoes will show elevated GST activity compared to the wild type mosquitoes. In addition, I hypothesize that this additional GST activity will be specific for pyrethroid insecticides. In order to test this hypothesis, two assays will be developed and used to measure GST activities. One will be based on the common GST substrate CDNB and the other on a unique fluorescent pyretheroid-like compound. I will compare GST activities between pyrethroid resistant and nonresistant mosquitoes.

Studying Bi-Hamiltonian Structures in Partial Differential Equations

Mick Petchprom
Sponsor: John Hunter, Ph.D.
Mathematics

We studied completely integrable systems by looking at bi-Hamiltonian structures of partial differential equations such as the KdV equation. Given a Hamiltonian operator, $J(u)$, we verified that this is a Poisson bracket by checking the following properties: skew symmetry and Jacobi identity. An application to this is looking at the KdV equation where we found lower order terms other than u_{xxx}. So, our equation looks like $u_t = (u\partial_x + \partial_x u + L)[u]$ which only satisfies the Jacobi identity if $L(u) = \alpha(\partial_x)^3 + \beta(\partial_x)$, where α and β are constants. Also, we studied the Hunter-Saxton equation, $(u_t + uu_x)_x = \frac{1}{2}u_x^2$ with the Hamiltonian operator $J(u) = u_x\partial_x^{-2} - \partial_x^{-2}u_x$. Ultimately, we found lower order terms, L, that are compatible with $J(u)$: $L = a\partial x^{-1} + b\partial x^{-3}$ where a,b are constants. In the future, we use the same operations in hopes to find a simpler bi-Hamiltonian structure to the Ostrovsky-Hunter equation, which is known to be integrable.

Genetically Encoded Small Illuminants (GESI)

Tuong V. Pham
Sponsor: Kit S. Lam, M.D., Ph.D.
Biochemistry and Molecular Medicine

Green fluorescent protein (GFP) and its derivatives have been extensively employed as biosensors for fluorescent microscopy in many biological disciplines. However, GFP is so large that it might interfere with evolved functions of host proteins. Moreover, GFP is difficult to be used as sensors for probing complex biochemical processes with desired signal-to-noise ratio, such as protein phosphorylation and histone modifications. Therefore, we hypothesize that sequential screening of immobilized One Bead One Compound combinatorial bead arrays with a series of probes under different conditions will enable identification of short peptide tags that can be used as functional illuminants to probe specific biochemical and cellular functions. Peptide hits will be genetically encoded into cells to confirm fluorescent activity and dynamics of fluorescent-positive peptides *in vitro*. The success of GESI gives rise to the possibility of tracking proteins without interfering with biological activities. Modified GESI with broad color spectrum are also more accessible to allow multiplex and whole animal imaging. The genetic peptides can also be designed as sensors to simultaneously report a variety of cellular signaling pathways with unprecedented spatiotemporal resolution.

Identification of a Regulatory Gene Involved in Vanillate Degradation and Chemotaxis in *Pseudomonas putida* F1

Ngoc B. Pham Lam
Sponsor: Rebecca Parales, Ph.D.
Microbiology and Molecular Genetics

Bacteria are important in the turnover of organic compounds in the environment. *Pseudomonas putida* F1 is a Gram negative motile bacterium with diverse metabolic pathways enabling it to use many non-toxic aromatic plant metabolites as well as toxic man-made aromatic compounds as growth substrates. These bacteria are also able to detect and respond to aromatic compounds through a process called chemotaxis. Vanillate is an aromatic plant metabolite that *P. putida* F1 can utilize as a growth substrate. It also has been found that strain F1 is chemotactic to vanillate. In addition to the genes encoding vanillate degradation, we have identified a putative regulatory gene, *Pput*_2025, which we hypothesize plays a role in both vanillate degradation and chemotaxis in strain F1. To test this hypothesis, we are constructing a *Pput*_2025 deletion mutant of F1 and will determine if the mutation affects the degradation of vanillate and/or vanillate chemotaxis in *P. putida* F1. We will then clone the wild-type *Pput*_2025 gene in the broad-host-vector pRK415_Km. This clone will be used to complement the F1 *Pput*_2025 deletion mutant, which should restore wild-type vanillate degradation and chemotaxis to the mutant strain.

The Analgesic Efficacy of Vaporized Cannabis for Patients with Spinal Cord Injury

Amy Phan
Sponsor: Barth Wilsey, M.D.
Physical Medicine and Rehabilitation

This study is designed to evaluate the analgesic properties of vaporized cannabis in patients with neuropathic pain due to spinal cord injury. Neuropathic pain occurs when peripheral nerves, the spinal cord, or the brain are diseased or injured. Qualified subjects are given three different doses (7%, 3.5% or placebo delta 9-THC) on three different visits. In order to test the pain relieving effects, spontaneous and evoked pain will be determined and pain intensity and pain unpleasantness will be assessed. Heat evoked pain will be studied by applying a moderately painful heat stimuli to a sensitive area on the subject's body. Psychoactive side effects and neuropsychological performance (attention, memory, and psychomotor performance) will also be evaluated. Tests that will evaluate neuropsychological functioning include the Digit Symbol Modalities Test, the Hopkins Verbal Learning Test, the Grooved Pegboard Trail Making Test and the Paced Auditory Serial Addition Test before and after administration of vaporized cannabis. Emotional responses will be assessed using locally developed mood scales. The hypothesis will be that vaporized cannabis will reduce sensitivity to spontaneous and evoked pain. The low dose will not interfere with neuropsychological testing as much as the high dose and will produce less psychoactive side effects.

Exploring Microbial Preservation in Iron Oxides with X-ray and Neutron Ray Computed Tomography

Athena Phan
Sponsor: Dawn Sumner, Ph.D.
Geology

The physical traces of life that microbes leave behind in rocks help scientists study the environment they once lived in. Certain environments coat microbial life with iron minerals to leave behind micrometer-scaled filaments in rocks. Iron mineral precipitation is controlled by the acidity and chemistry of the water that flowed through the pores of the rock. In order to investigate how minerals preserve the microbes, the porosity and permeability of iron oxides found in Iron Mountain, CA were examined. 2D approaches to studying porosity damage samples. In contrast, X-ray and neutron ray computed tomography (CT) scans record the porosity in 3D without destroying the sample. This is the first time CT scans have been used for iron oxide porosity quantification. Scanned image stacks were used to visualize the interior of the rocks in the KeckCAVE 3D visualization program. The porosity of the entire rock was calculated by using the NIH software ImageJ. Sample 1 (JS4) porosity was 1.12% and sample 2 (PS3) porosity was 6.04%. Future work will utilize nano CT scans and scanning electron microscopy to correlate the pore interconnectivity to microbe preservation.

A New Eternal Flame: The Preservation of Identity Through Social Media

James T. Pierce
Sponsor: Scott C. Shershow, M.A.
English

Facebook is a popular social networking website that allows people to create fairly complete representations of themselves through online profiles. Profiles capture a person's image, their interests and the way that he or she relates to the people around them. But how does a Facebook profile function when the person it represents is deceased? This question can be answered using N. Katherine Hayles' work *How We Became Posthuman* as well as David Mitchell's novel *Cloud Atlas*. Hayles' work demonstrates how the relationship between humans and technology affects a person's identity and the ways that technology, such as Facebook, can make the physical presence of a person secondary to the pattern of their existence. A person's pattern can be recorded by technology and preserved for as long as the technology lasts. *Cloud Atlas* is a fiction that shows the ways that the preservation of this pattern is enough to preserve a person's identity, even after s/he dies. Remembrance becomes the act of observing someone existing in the medium of technology rather than an act of imagining him or her present.

Investigating the Effect of Cobalt Chloride on the Secretion of Pro-Angiogenic Factors by MSCs in Fibrin Gels

Ken Pirondini
Sponsor: Kent Leach, Ph.D.
Biomedical Engineering

Bone defects often suffer from low oxygen microenvironments due to insufficient vascularization. Cell-seeded constructs designed to promote bone healing commonly exhibit a necrotic core of poorly vascularized cells. Mesenchymal stromal cells (MSCs) present a promising cell population for stimulating bone repair not only because of their capacity to differentiate down the osteogenic lineage, but also because of their ability to secrete trophic fact ors that promote angiogenesis, specifically vascular endothelial growth factor (VEGF). Hypoxia-mimicking agent cobalt chloride ($CoCl_2$) induces the upregulation of pro-angiogenic factors in MSCs, and is therefore of interest in creating tissue engineered constructs that quickly and effectively promote vascularization in hypoxic defect sites. Preliminary data suggests that monolayer cultures of MSCs incubated for 7 days in 1% O_2 and in the presence of $CoCl_2$ exhibit increased VEGF secretion over MSCs cultured in either $CoCl_2$ or hypoxia alone. This additive effect of $CoCl_2$ and hypoxia suggests that $CoCl_2$ could potentially stimulate the upregulation of VEGF by MSCs *in vivo*. We aim to show that $CoCl_2$ or MSCs preconditioned with $CoCl_2$ can be incorporated into fibrin gels to promote MSC secretion of pro-angiogenic trophic factors and stimulate endothelial cell sprouting *in vitro*.

Who Killed Everitt Hudson?: Communist Indoctrination During Second Red Scare

Scott A. Pittman
Sponsor: Kathryn Olmsted, Ph.D.
History

In 1948, Everitt Hudson was a seemingly normal college student until one day his body was discovered in the empty furnace pit in the basement of his co-operative dormitory near the University of California, Los Angeles campus. The inexplicable death of a healthy young man sparked an investigation into the causes and reasons for his untimely death, which culminated with the case being investigated by the California State Senate Fact-Finding Committee on Un-American Activities in 1951. At this time, the committee was investigating the extent and effects of communist infiltration of California schools. The committee's interest in the Hudson case arises from the strange circumstances surrounding his death and his involvement with communist activities throughout the last few years of his life. The committee, and those who testified about the Hudson case, came to the conclusion that Hudson died from inhibition-he was literally scared to death by communism. The Hudson case illustrates the paranoid, hyperbolic rhetoric of anti-communists in California during the second Red Scare.

Vector-borne Disease Survey of California Voles (Microtus californicus) and Their Common Ecto-parasites

Amanda Poulsen
Sponsor: Janet Foley, D.V.M.
Medicine and Epidemiology

The various subspecies and subpopulations of California voles (*Microtus californicus*) are present throughout California and have been known to carry ecto-parasites like ticks and fleas which can transmit pathogens. This study investigates the prevalence of tick and flea-borne diseases in vole populations throughout California by taking a comprehensive look at past and present data. Data was compiled from previous published studies on voles, historic data from the UC Berkeley Essig Entomology Museum, and tick and flea samples collected by current studies at UC Berkeley and UC Davis. Samples were processed and disease prevalence was found by DNA extraction and PCR methods. I analyzed the compiled data to determine parasite load on voles and disease prevalence of various tick- and flea-borne pathogens. I also used the data to perform spatial geographic analyses of disease prevalence and ecto-parasite species variation throughout the state of California. Considering the vole as both a host and a vector for disease, the findings from this study may support future monitoring of California vole populations for conservation and public health reasons.

Weak Lensing of Deep Lens Survey Galaxy Clusters on 10Mpc Scales

Meredith C. Powell
Sponsor: Tony Tyson, Ph.D.
Physics

Dark Matter is a key in understanding the formation and evolution of the large-scale structure of the universe. It is known that halos of dark matter are present around individual galaxies, and that galaxy clusters themselves lie within a larger scale overdensities of dark matter. However the correlated mass density of dark matter in very large scale structures (which is the result of the quantum fluctuations in the early universe and is dynamically separate from the gravitationally collapsed galaxy clusters) has been studied less extensively. Weak gravitational lensing is the tool to investigate these mass distributions, measuring the statistical alignment of background galaxies around the mass. For this project I examine the weak lens signal of a set of galaxy clusters in the Deep Lens Survey. Selecting about 600 rich clusters optically I use the photometric redshifts and stacked shear of a million background galaxies out to radii of 1° degree to obtain mass-density radial profiles. Beyond several Mpc the mass overdensity of large-scale structure dominates, rather than individual dark matter halos associated with each cluster. I finally bin the selected clusters into several ranges of redshift to examine the possible evolution of this mass correlation, if systematics allow.

Exposure of Embryonic Stem Cells to Diabetic Levels of Glucose Leads to an Increase in Glucose Utilization and ATP and ROS Production

Kimberly Y. Prado
Sponsor: Nicole Z. Nieden, Ph.D.
Molecular and Cellular Biology

Diabetes is a growing epidemic with 12.6 million women aged 20 years or older affected in the United States. Diabetic women are statistically shown to be 40% less fertile than healthy women. Infants born to diabetic mothers are often born with malformations. However, the mechanism by which diabetes affects fertility and early development is not known. The exposure to diabetic levels of glucose (Glu) is the underlying cause of problems observed in early diabetic pregnancy. Embryonic stem cells (ESCs) can be used as a model to study early developmental processes. ESCs are a comparable model system in that they are derived from the early embryo and share a number of characteristics with the embryo. This study investigates if ESCs absorb the excess Glu and release larger amount of ROS. Consistent with our hypothesis, exposure of ESCs to hyperglycemia exhibited an increase in ATP and ROS production, as well as a decrease in extracellular Glu, which implies that ESC utilize Glu. In addition, observed low proliferation of Glu-challenged ESCs also suggested maldevelopment as a result of effects downstream of ROS.

Understanding Health and Well-Being Among Farmworker and Rural Populations

Gladys E. Preciado
Sponsor: Bruce D. Haynes, Ph.D.
Sociology

Although California agricultural laborers are essential to the US economy, the communities they reside in are often characterized by poor access to quality medical care, low-performing schools, high unemployment rates, and as a result, concentrated poverty. Contributing to this inequality is the fact that throughout California's Central Valley, agricultural laborers are unable to obtain safe and affordable housing. Of concern is that these social factors are linked to risk for disease. Along with these socio-economic and environmental risk factors, the farmworker population is overwhelmingly a racial minority group and often lacks immigration documentation. Using historical information and fieldwork in Knights Landing, California, a predominantly Hispanic/Latino rural community, I analyze the well-being of Knights Landing residents and seek to identify barriers to health care access that affect the quality of life for rural and immigrant populations. Conclusions from this investigation will provide insight into the limited previous research on farmworker health services utilization patterns and health problems faced by rural populations.

The Chronological Distribution of European Grapevine Moth's Life Stages

Cindy Preto
Sponsor: Frank G. Zalom, Ph.D.
Entomology

Lobesia botrana, also known as the European grapevine moth (EGVM), is an invasive moth species that was first reported in Napa vineyards in 2009. EGVM larvae cause substantial damage to all the phenological stages of grapes resulting in economic loss. The possibility of introducing EGVM to unaffected areas of the US and other countries via grape exports is of concern. A study to document the chronological distribution of EGVM life stages from egg to eclosion is currently being conducted in the Contained Research Facility at UC Davis. The results of this study can be used to determine the distribution of life stages at a precise time in the EGVM life cycle at which fumigation to post-harvested fruit is applied. The goal of fumigation is to target the most vulnerable stage in the EGVM life cycle so that the application is most effective. Knowing the distribution and pinpointing EGVM's most vulnerable stage when applying fumigation to grapes for export can help ensure the containment of EGVM and continued trade.

Empathy and the Relation Between Child Victim Emotional Display and Jury Decision Making

Kimberly Procida
Sponsor: Gail Goodman, Ph.D.
Psychology

Over 61,000 cases of child sexual abuse (CSA) were reported in the United States in 2011 alone (Administration for Children and Families, 2012). A subset of these cases will go to trial in criminal court. These cases often hinge on jurors' interpretations of child victims' testimony. Research in psychology and law has shown that juror and victim characteristics including children's emotional display while testifying affect juror decisions in CSA cases (Bottoms, Golding, Stevenson, Wiley & Yozwiak, 2007). Jurors' expectations of child victims' emotional displays often contradict the children's actual displays and this could affect the jurors' decisions. The present study aimed to determine if the amount of empathy jurors have towards child victims mediates the relation between child emotional display and jury decisions. In total, 163 undergraduates were each presented with a scenario depicting a CSA case that featured a neutral, sad, or teary child and asked to answer jury-related questions and a child-victim empathy survey. A test of mediation will be conducted to determine if empathy accounts for the relation between participant decisions and the intensity of emotion displayed by the child. Implications for the legal system will be discussed.

Reward and Salience: The Competition For Attentional Selection

Kyle Puhger
Sponsor: Joy Geng, Ph.D.
Psychology

Objects associated with reward capture attention even when it is irrelevant to our current goals. Similarly, rapid, reflexive orienting of attention occurs in response to salient sensory inputs (e.g., bright flashing lights). However, little is known about how these two sources of information compete for attention when in conflict. Our goal was to determine whether rewards or perceptual salience was more powerful in inducing an automatic reorientation of attention. We hypothesized that the ability of reward-associated stimuli to capture attention decreases as the strength of sensory salience was increased. We tested this using a visual search task in which a target must be discriminated and a distractor ignored. The color of the two objects were randomly assigned a color previously associated with high-value (i.e., $0.04) or a low-value (i.e., $0.00). One stimulus was also preceded by a salient flash of varying luminance values (a manipulation producing stimulus-driven attentional capture). Contrary to our expectations, attentional selection was significantly faster to targets with the high reward color, even though color was irrelevant to task performance. Interestingly, salience did not modulate this effect. These results demonstrate that rewards can modulate attentional selection early, drowning out automatic responses like those to salient stimuli.

Localization of Cfh Transcript in Retinal Tissue

Chenghao Qian
Sponsor: Qizhi Gong, Ph.D.
Cell Biology and Human Anatomy

Age-related macular degeneration, or AMD, is the leading cause of vision loss in Americans who are 60 years of age or older. The current literatures have associated the cause the disease with the polymorphisms of a protein called complement factor H (Cfh). Cfh protein takes part in the body's immune system and is responsible for triggering inflammatory responses and removing debris as well as foreign particles. Studies have shown that mice that do not express Cfh have severely reduced visual acuity due to restricted perfusion of the retina that is caused by debris built up. It is unknown whether Cfh protein was produced in the retinal tissue, or was it produced elsewhere and reached retina through circulation. Our lab has established that Cfh protein is present within the rod and cone cells of the retina. Using in situ hybridization that allows us to visualize the localization of mRNA for Cfh gene, we are able to visualize the expression of Cfh gene in the retina, particularly in the outer nuclear cell layer as well as in the bipolar cell layer. The visualization of Cfh transcript supports the hypothesis that Cfh protein is produced inside the retinal tissue.

Effects of Motivation Type on Perceived PSA Credibility

Christina M. Quach
Sponsor: Narine S. Yegiyan, Ph.D.
Communication

The purpose of this study is to examine how individual differences in motivational activation affect cognitive processing of public service announcements (PSAs). Motivational activation is a relatively new measure that determines tendencies of individuals to approach positive stimuli (positivity offset) and avoid negative stimuli (negativity bias). Previous research has shown that those scoring high on positivity offset use different information processing strategies compared to those scoring high in negativity bias. The goal here is to examine these differences in the context of PSAs. Participants will watch 14 PSAs promoting various healthy behaviors and will be asked how the PSAs made them feel. Memory for each PSA will also be assessed. It is expected that those high in positivity offset would feel more positive about the PSAs and would remember more details about the PSA content. However, those high in negativity bias would feel more negative about the PSAs and would remember fewer details about the PSA content. The findings contribute to understanding of emotion and cognition interaction and the role of individual differences in emotional experiences in this process. Practically, the research informs practitioners on how to best tailor health messages to the needs of specific niche audiences.

The Unseen

Mariah Quintanilla
Sponsor: Bryce Vinokurov, M.F.A.
Art Studio

Most people are surrounded by a multitude of faces everyday. Young and old, we pass by them with an acknowledging glance or smile. We observe many of them, but there are countless that go unnoticed. These are the faces that interest and inspire me most. They are the dirty and downtrodden. It is the man with a filthy blanket and cardboard sign begging in front of the grocery store. It is the boy eating his lunch alone in the courtyard. They are the children in the gutters fishing for scraps of food. It is the skinny brunette with the baggy pants and bare feet staring into the distance as she starves herself. My goal in presenting you with the faces of the "unseen" is to allow you to feel what they have felt. I want to display the weary gazes that are so often missed or intentionally pushed aside. I search for those who reveal their story in their eyes, and put them on paper, so that they may not be forgotten. The creases defining each face form maps leading to their past. Follow them.

Glauber Monte Carlo: Geometry of a Heavy Ion Collision

Chadwick Rainbolt
Sponsor: Manuel Calderón de la Barca Sánchez, Ph.D.
Physics

When heavy ions collide at high energy, temperatures are reached similar to the ones that permeated the universe a microsecond after the big bang. Physicists recreate these conditions via collisions at massive colliders like the Relativistic Heavy Ion Collider (RHIC). In order to understand these complex collisions computer simulations are needed. The Glauber Monte Carlo (GMC) is a simulation to help physicists understand the collisions and the particles they produce. Specifically the GMC describes two heavy ions colliding, e.g. at RHIC gold ions are collided. The simulation breaks up the gold ions into smaller components and keeps track of these individual parts during the collision. These smaller components are protons and neutrons, which make up the nucleus, and collectively are called "nucleons". When a collision is head-on it is called a "central" collision, meaning almost all of the nucleons collide. The other type of collision, a peripheral collision, is one where most of the nucleons do not collide. My research uses GMC to estimate the geometry of collisions between gold ions at RHIC and, thus, the centrality of the collision.

Investigation into the Effects of Heat Treatment Conditions on Mechanical Properties and Microstructure of an Al-Fe Alloy

Krishnan A. Rajagopalan
Sponsor: Julie M. Schoenung, Ph.D.
Chemical Engineering and Materials Science

It has been shown that the presence of iron in an aluminum matrix can increase the strength and hardness of the aluminum alloy. Additionally, research in nanostructured materials has grown substantially in recent years due to the potential for increased hardness and strength, due to grain refinement. In this study, differential scanning calorimetry (DSC) was performed at different heating rates to understand the effects of heating rate on an Al-Fe alloy (5 atomic percent iron), and how these heating rates affect the enthalpy and activation energy associated with phase transformations. The largest exothermic peak was possibly due to the effects of precipitation or recrystallization, as evidenced by the low activation energy before the peak temperature, indicative of unstable grain boundaries. Heat treatments were carried out at temperatures slightly above and below each peak to identify the reaction taking place at each peak and its effects on the microhardness. Hardness values are expected to increase as a result of precipitation of the iron-containing intermetallic phases. Subsequent studies will utilize X-ray diffraction (XRD) and scanning electron microscopy (SEM) to determine phase composition and observe the microstructure, respectively, after each heat treatment.

Stereotypes of South Asians on Television

Akshaya Ramanujam
Sponsor: Kriss Ravetto, Ph.D.
Cinema and Technocultural Studies

One of the largest proponents of stereotypes, especially about South Asians, comes from television. Whether it's a single advertisement or an entire TV show, deliberate choices are made regarding what is portrayed, and this can often showcase South Asians in a negative light. However, through these deliberate decisions, creators of television can change these perceptions the public holds about South Asians. How do shows such as "Outsourced" and "The Mindy Project" address stereotypes concerning South Asians? Do they reaffirm or change these stereotypes? And how do you qualify that transformation? In order to address these questions, I used a combination of research on media theory in its historical context as well as close reading the two television shows. By examining Nielsen ratings to understanding demographic and viewership details of the show, as well as watching episodes or clips of shows with peers to document their response, I hope to understand the consequences of the shows and whether or not they adequately weaken these stereotypes.

Ball Bearing Arpeggiator

Ashwin Ramesh
Sponsor: André Knoesen, Ph.D.
Electrical and Computer Engineering

Music is innate to humans and there are an infinite ways to combine sounds into music. We wanted to create an interactive way to make music that would utilize fundamental concepts of electrical engineering while being engaging to all audiences. Our project was to make an arpeggiator, or note sequencer, using ball bearings. To operate, the user places metal ball bearings in receptacles which are sequentially scanned and illuminated. The arpeggiator will then produce a note sound or chord of notes based on the location of the ball bearings. This allows for the creation of complex rhythms and musical sequences as multiple sounds can be simultaneously played depending on where the bearings are placed. In addition to the receptacles, there are also buttons which can be used to change the instrument being replicated and knobs that allow the user to change the speed the notes are played and volume of the notes being produced.

Interspecific Variation in Leaf Complexity Between the Cultivated Tomato and its Wild Relative, *Solanum Pennellii*

Swetha Ramireddy
Sponsor: Neelima R. Sinha, Ph.D.
Plant Biology

Leaves are highly adapted structures that serve as important elements to the morphological evolution of plants. The most evident characteristic of leaf shape is its complexity: the degree to which the leaf is subdivided into smaller segments. Here, I am using the introgression lines (ILs) between the cultivated tomato and its wild relative *Solanum pennellii*, to identify the gene(s) responsible for the interspecific variation in leaf complexity. One of the ILs shows ~40% less leaf complexity compared to the cultivated tomato. My phenotypic analyses have revealed that the genes related to leaf complexity in the IL can only function at lower temperatures. Furthermore, I found that the leaf polarity is correlated with leaf complexity. By PCR genotyping based on nucleotide polymorphism and transcriptome analysis using RNA-sequencing, we found that there are only seven cis-regulated genes involved with leaf complexity. Of those only the *LEUNIG* gene is a transcription factor, allowing us to propose that *LEUNIG* is a major determinate factor of interspecific variation in leaf complexity seen in the wild tomato. To test this, we have performed a transformation analysis using RNA interference to knock down the expression level of *LEUNIG* and are currently analyzing the transgenic plants.

Genetic Diversity and Population Structure of Root Aphid Daktulosphaira vitifoliae in California

Bryan A. Ramirez-Corona
Sponsor: Andy Walker, Ph.D.
Viticulture & Enology

Phylloxera (*Daktulosphaira vitifoliae*), is an agricultural pest native to North America. This insect feeds on roots of *Vitis vinifera* grape varieties, damaging the roots and providing entry for soil-borne pathogens. Phylloxera is difficult to exterminate from an area, so understanding its biology is crucial in controlling existing populations and preventing the collapse of resistant materials. This study focuses on phylloxera population dynamics in the UC Davis department vineyards, which harbor diverse plant materials. The existing insect population coupled with the amount of host diversity raised concerns that vineyards may be a source of artificial selection driving phylloxera populations to adapt to resistant plant materials. Twenty-one blocks were sampled for phylloxera on the roots of vines. A total of 76 sites were examined, 369 samples were collected and DNA was extracted from 156 insects. Insects were genotyped at thirty-two microsatellite loci. One hundred forty-six samples yielded good amplifications. Allelic data was analyzed using software STRUCTURE, DARwin5 and MS Toolkit. Twenty-seven unique genotypes were discovered that grouped into 3 distinct clusters with no admixture indicating sexual recombination is not occurring at a noticeable rate. Results will be discussed in context of genotype diversity and its relation to different genetic backgrounds.

Indirect Antibody Staining to Determine ICM and TE Ratios in Bovine Blastocysts

Nasario E. Ramos
Sponsor: Pablo Ross, Ph.D.
Animal Science

We have established a method of indirect antibody staining to determine the ratio of trophectoderm (TE) and inner cell mass (ICM) cell numbers in IVF developed blastocysts. Performing IVF to develop blastocysts is not 100% effective. This method of counting ICM and TE cell ratios allow interpretation for the blastocysts health and maturity. In contrast to propidium iodide staining, indirect antibody staining allows for cell counting at a more accurate level increasing the visibility and differences of various cell types, such as blastocyst-specific cells, mitotic cells, and sperm from fertilization. In this study 3 different groups of blastocysts were placed in incubation media containing different combinations of CDX2, Sox2, Oct4 and Hoechst. The primary antibody incubations were performed overnight at 4°C and then washed prior to a second incubation of one hour with corresponding secondary antibodies. The blastocysts are placed on slides and are evaluated under a fluorescence microscope. Different emission wavelengths unique to each secondary antibody used allow counting of cells expressing specific markers. This accurate procedure for cell counting can be advantageous in assessing the health and quality of bovine blastocysts and can be implemented in studies of embryo development.

Religion's Impact on the Correlation Between Education and Political Participation: Evidence Across Countries

Amani B. Rashid
Sponsor: Giovanni Peri, Ph.D.
Economics

Religious affiliation is a fundamental force shaping individual and societal behavior and identity. The importance of religion in the public and social life of some countries, such as Middle Eastern region countries, has garnered notable attention. Religion can be a powerful force mobilizing social participation but it may also radicalize positions reducing democratic debate. One crucial question is what do religion and religious organizations mean for educated and informed democracy? This paper will study how religiosity effects the positive correlation between education and political engagement. In particular, does religious affiliation disproportionately increase the political participation of less educated individuals? I will investigate this question using a multivariate linear regression model and data attained from a diverse group of twelve countries. I will first study the effect of religiosity across all religious denominations, then I will focus on Islam and Christianity. Initial findings show across all religious denominations and countries stronger religious participation does not reverse the positive correlation between education and political participation, but it does attenuate the correlation. However, for highly religious people it is still true that the more educated tend to participate more. This implies religious political parties do not draw support disproportionately from less educated individuals.

Global Citizens: Pakistanis in England and America

Ahmad Raza
Sponsor: Gautam Premnath, Ph.D.
Asian American Studies

Globalization has led to an increase of migration across borders. This has brought with it many advantages, as well as new problems and issues faced in both the migrating communities and the communities which accept these migrants. This research will focus on the Pakistani communities that reside England and in the United States. It will focus on the structures of communities, their spaces for displays of culture, as well as trends and changes that have occurred within these communities. It will also look at various factors which affect these communities, including race, religion, class and relations outside their diaspora. Relations with the society at large, and efforts by these communities to either fully integrate or to retain certain cultural aspects will also be examined. The parallels and differences between the two communities will also be investigated, as each attempts to come to terms with their identity as both 'Pakistani' and 'American' or 'English.'

Interactive Two Dimensional Surface

Elodie Resseguie
Sponsor: André Knoesen, Ph.D.
Electrical and Computer Engineering

The purpose of this project is to create an interactive exhibit that attracts an audience of all ages to electronics and engineering as a whole. What is a better way to appeal to such an audience than to utilize not just the visuals but also sound and touch? Rather than build a grid board consisting of only tri-colored light emitting diodes that only presents visual appeal with no interaction, we combine the lights with proximity sensors to produce a stimulating response for the user. Set with a square matrix grid, the interactive two dimensional surface uses proximity sensors to respond to the user. As the user interacts with the surface, the proximity sensors react to the reflections in infrared light, sending signals to the microcontroller which then turns on the respective light emitting diode and sound device in the grid. We will make the interactive two dimensional surface of the table holding the printed circuit boards of individual components detachable, allowing users to learn and see how the parts are put together to make the system work. The table will also be programmed with simple games such as paint, puzzle blocks, and a music mode to encourage user interaction.

Polarity Proteins Asymmetrically Localize LET-99, a Regulator of Mitotic Spindle Positioning, in the *C. elegans* One-cell Embryo

Ella Richardson
Sponsor: Lesilee S. Rose, Ph.D.
Molecular and Cellular Biology

Asymmetric division produces daughter cells with different developmental fates, which is important for normal development and for stem cell maintenance. During asymmetric division, the mitotic spindle aligns with the axis of cell polarity, which in many systems is established by the PAR proteins. Previous work demonstrated that LET-99 is essential for normal spindle positioning in the *C. elegans* one-cell embryo. LET-99 is inhibited from accumulating at the posterior cell cortex by PAR-1, a kinase, and PAR-5, a 14-3-3 protein. In other systems, phosphorylation of targets by PAR-1 generates binding sites for PAR-5. We found that LET-99 binds to PAR-5 from wild type embryo extracts, but binding is diminished in extracts depleted for PAR-1. In addition, computer predictions identified several LET-99 serine residues that are potential phosphorylation sites. Using several methods, we are testing whether these sites are essential for PAR-5 binding, and whether changes to these sites that mimic phosphorylation are sufficient for PAR-5 binding. In the future, we will test whether PAR-1 directly phosphorylates LET-99 using *in vitro* kinase assays. The results thus far support the hypothesis that PAR-5 binds to phosphorylated LET-99 to prevent association with the posterior cortex.

The Use of PNGase F and Trypsin for Protein Digestion

Irene Rios
Sponsor: Carlito Lebrilla, Ph.D.
Chemistry

Lactoferrin is a glycoprotein found in cow and human milk. Lactoferrin from colostrum was used in this study where its protein make-up was analyzed. Two different procedures were used in order to see which method is preferred for finding the chemical make-up of lactoferrin-PNGase F Digestion and Trypsin Digestion. The glycans and glycopeptide abundances and quantification were compared between the two experiments. The PNGase F digestion procedure uses the enzyme PNGase F to cleave the N-linked Oligosaccharides from glycoproteins, which are isolated and identified through MALDI-FTICR-MS and CHIP/Q-TOF. The Trypsin digestion (in-solution) protocol uses the enzyme Trypsin to cleave the glycopeptides, which are purified and analyzed using CHIP/Q-TOF-MS for protein identification. The pH is critical in each procedure and both end with an overnight water bath of 37°C. It is more practical to use the PNGase F enzyme when looking at the protein identification of lactoferrin because it results in a higher abundance of glycans due to its specificity. Trypsin digestion is not as helpful in this instance because it isolates the glycopeptides which are more complex species to work with.

Machine Learning of Mathematical Documents

Laila S. Rizvi
Sponsor: Jesus De Loera, Ph.D.
Mathematics

Researchers often collaborate with individuals of similar interests, but the process of identifying these individuals may be time consuming and labor intensive. In order to ease this process, we applied machine-learning techniques from statistics to summarize a researcher's published works. We programmatically choose a list of terms, called summarizers, that represents a coherent set of sentences or words from a researcher's abstracts. The summarizers provide a quick overview of a researcher's interests, thus making identifying their interests more readily available. To produce these results, we used the following methods: co-occurrence, correlation, L1-penalized linear regression (LASSO), and L1-penalized logistic regression (L1LR). In addition, we applied Sparse Principal Component Analysis (SPCA) to reduce the computational time of the four methods by approximately 65% with little consequence to the overall results. We verified the accuracy of our results by having selected researchers review the summarizers for their own works. People can then more efficiently network and collaborate with others of common interest.

The Machiavellian Lens for Understanding Protestant Militia Groups in Northern California

Brandon Roberts
Sponsor: Naomi Janowitz, Ph.D.
Religious Studies

This project challenges the assumption that "fundamentalism," as understood by George Marsden and others, is a term capable of adequately describing religious phenomenon. Drawing from primary sources in special collections at the UC Davis Peter J. Shields Library, I analyze the doctrines of Anglo-Zionist Protestant militias specific to Northern California. The article begins with a critique of "fundamentalism" and argues the term is a pejorative used to label those standing in opposition to the norm. I argue the Protestant theological basis motivating the selected contemporary Anglo-Zionist militias cannot be explained by "fundamentalism" and is best understood through the lens of Machiavellian realism. Applying the Machiavellian understanding of "states" and "principalities" to incorporate the studied militias, I examine each militia as a group of whites that view themselves as being threatened in a domestic power struggle, despite belonging to a majority. As a response to the perceived threat, each militia has chosen to strictly adhere to their doctrinally founded heritage of bearing arms in preparation for conflict.

A Paleomagnetic Reconnaissance Study of the Powder River Volcanic Field, Union, Oregon

Rebecca L. Rodd
Sponsor: Kenneth L. Verosub, Ph.D.
Geology

The Powder River Volcanic Field (PRVF) is a series of middle Miocene extension-related lava flows in northeastern Oregon. Oriented samples for a paleomagnetic reconnaissance study were collected from three sites. Samples were subjected to progressive alternating field demagnetization to determine primary paleomagnetic directions and to study the magnetic behavior of the PRVF. Five of the units are lava flows; one is a volcaniclastic deposit: and three represent different horizons below a baked contact. Three of the lava flows and one of the units beneath the baked contact demagnetized smoothly and showed uni-vectorial decay. Two of these units have normal inclinations (~65°), but southern declinations (~-130°). The other two units have reversed inclinations (~-70°) and southern declinations (~150°). The other units did not demagnetize fully. Magnetic directions from the unit immediately below the baked contact indicate that the unit had been heated above the Curie temperature by the overlying flow. The results appear to be reliable but the normal inclinations/southern declinations are anomalous. One possibility is that these units were deposited during a geomagnetic reversal or excursion. Another possibility is that we sampled a significantly rotated small tectonic block. These results indicate the PRVF is suitable for further paleomagnetic study.

Monoploid Maize Generation

Andrea R. Rodgers
Sponsor: Anne B. Britt, Ph.D.
Plant Biology

Corn (*Zea Maize*) pollen can withstand relatively high levels radiation (upwards of five kilorads) and still compete with healthy pollen for fertilization of ears' ova. By using varying levels of radiation, a method may be found in which kernels are produced but the chromosomes contributed from the paternal side are shattered and do not provide a significant genetic contribution. Chromosomes would not necessarily have to been entirely destroyed, but instead any functional parts of the chromosomes would have to have been broken by the radiation. This means that any contribution would come solely from the maternal DNA. These offspring may be effectively haploid. If selfing the haploids is a viable option, then each offspring may have two identical copies of each chromosome, meaning there would be no heterozygotes. This lack of hybrid genotypes would make breeding much more predictable, as there would be no potential for recessive genes to be masked by dominant ones.

Measuring Chromosome Entanglements During Meiotic Segregation in Nup2 Mutants

Tomás C. Rodríguez
Sponsor: Sean M. Burgess, Ph.D.
Molecular and Cellular Biology

During meiosis, faithful segregation of homologous chromosomes is integral in the formation of viable haploid gametes. Errors in chromosome segregation can lead to aneuploidy or arrested cell division. Nup2, a nucleoporin with a role in chromatin organization, has been identified as a possible component in the organization of meiotic chromosomes. Deletion of NUP2 in *Saccharomyces cerevisiae* results in a delayed meiosis I division. We hypothesize that this delay results from chromosome entanglement manifested in meiotic anaphase I. To test this, we developed an assay to measure interchromosomal strain caused by the pulling forces of spindle microtubules. This assay employs fluorescent markers localized to centromeric and telomeric regions on two homologs. The distance between centromeric loci at anaphase I will report the separation of homologous chromosomes. Using telomere reference points, unresolved interchromosomal arm entanglements would be indicated by the presence of one spot instead of two, as would be expected in wild type. Finally, an increased distance between centromere and telomere loci on the same chromosome in the nup2 mutant compared to wild type would indicate intrachromosomal tension between entanglement sites and the spindle. These measurements will support or reject the presence of mechanical strain on meiotic chromosomes in Nup2 mutants.

Higher Baseline TNF Receptor and TNF-α Expression in Macrophages of Aged Mice

Axana Rodriguez-Torres
Sponsor: William Murphy, Ph.D.
Dermatology

Recent studies by our lab have shown that aged mice are much more susceptible to toxicity affecting multiple organs caused by cancer immune stimulatory therapies. We have recently found that this toxicity is dependent upon TNF-α secreted by macrophages. This toxicity after immunotherapy is exacerbated in animals with higher fat content. We hypothesized that this may be due to up-regulation in baseline levels of TNF receptors. To test our hypothesis, we compared bone marrow derived macrophages from young (4 months), middle aged (10 months), and aged (20 months) mice and examined baseline expression of TNFR1α, TNFR1β, and TNF-α by qPCR. At baseline, there were no differences between young and middle aged (4 and 10 months respectively) mice. However, aged (20 months) mice had significantly increased expression of TNFR1α ($p<0.01$), TNFR1β ($p<0.01$), and TNFα ($p<0.05$) compared with both young and middle aged mice. These results suggest that higher receptor expression may explain the heightened TNFα associated toxicity seen in aged mice. Further analysis of different tissues including adipose tissue as well as other parenchymal tissues may shed insights on this heightened pro-inflammatory response during aging.

Genetic Response to Heat Stress in *Tigriopus californicus*: an Analysis of Standing Genetic Variation

Eric J. Ronne
Sponsor: Richard K. Grosberg, Ph.D.
Evolution and Ecology

A fundamental question in climate change studies is the degree to which natural populations can adapt to changing environmental conditions through selection on standing genetic variation. Changes in gene expression patterns between populations under different stress regimes are a proxy for evolutionary change in these distinct populations. Here we report RNA-seq analyses of gene expression differences in experimentally thermo-adapted populations of the copepod *Tigriopus californicus*, a model intertidal taxon for environmental physiology. We map short read illumina data onto contigs of predicted transcripts that were assembled *de novo* and use statistical approaches designed to estimate the probabilities that a given locus is differentially expressed between samples. Our results clearly indicate that gene expression signatures of thermo-adapted populations of *Tigriopus* show marked differences when compared to control, non thermo-adapted populations. Our results will enable future research into the role that genetic variation in specific stress response pathways plays in adaptation to environmental change.

Stable Isotope Analysis of Dental Calculus: A New Potential Approach in Paleodietary Reconstruction

Samuel C. Rose
Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

Archaeological studies of dietary change reveal valuable information about the ways past humans interacted with each other and with their environments. One approach to reconstructing ancient diets relies on identifying animal bones and carbonized plant remains. However, this approach averages diet over groups and cannot capture the behavior of individual people. Stable isotope analysis of human bone and teeth focuses analysis on individuals. Unfortunately, this process requires the destruction of irreplaceable skeletal samples. This study examines the reliability of isotopic analyses of dental calculus (mineralized plaque) as a source of past dietary practices. The approach has merit as it conserves the individual scale but avoids destruction of skeletal samples. This study analyzes ratios of ^{13}C and ^{15}N isotopes in dental calculus and compares them to already-existing bone collagen and apatite data from those same individuals. If the data from these two methods are consistent, stable isotope analysis of dental calculus could serve as a new method of paleodietary reconstruction.

Maternal Immune Activation Alters Autism-like Behaviors in BTBR and C57BL/6J Mice

Joshua A. Rushakoff
Sponsor: Robert F. Berman, Ph.D.
Neurological Surgery

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social interaction, communication, and repetitive behaviors. The etiology of ASD remains unknown. However, mounting evidence suggests that ASD may be due to a combination of genetic and environmental factors. For example, activation of the maternal immune system during pregnancy is associated with an increased risk of having a child with ASD. We hypothesized that the expression of autism-like behaviors in mice following an environmental insult is dependent on genetic predisposition. To test this, we investigated the effects of maternal immune activation on ASD-like behaviors on the asocial BTBR and the highly social C57BL/6J mouse. Dams were exposed to the viral mimic polyinosinic-polycytidiylic acid (polyIC) and their offspring were tested for autism-associated behaviors: ultrasonic vocalization, repetitive behavior, and social approach. As expected BTBR offspring exhibited increased repetitive behaviors, decreased sociability, and altered vocalizations as compared to control C57 mice. These effects were exacerbated by maternal polyIC exposure. Results show that maternal immune activation can increase the magnitude of ASD-like behaviors in mice, and that the effects are strain-dependent providing support for a gene by maternal environment interaction in the etiology of ASD disorders.

Crotonase - Butanol Biosynthesis Enzyme: Purification, Characterization and Engineering

Nebay A. Russom
Sponsor: David K. Wilson, Ph.D.
Molecular and Cellular Biology

Biomass is a renewable energy source that grabbed increasing consideration because of energy and environment alarms. Often biomass is converted into ethanol. However, ethanol is not the best substitute for gasoline because of its high water content and low energy density relative to gasoline. A large quantity of distillation energy is required because ethanol is highly soluble in water. It takes large amount of energy to separate it from water. Butanol, on the other hand, has much less solubility in water and higher energy density. Therefore, it is expected that alcohol with more carbons in its chain to be drier. Crotonase (caCRT) is an important enzyme in the biosynthesis of butanol, a potential biofuel. It is an enzyme that converts β-hydroxybutyryl-CoA into Crotonyl-CoA, which are two intermediates in the biosynthesis pathway. So far, this enzyme is purified using affinity column. The structure and kinetics will be characterized to understand its specificity by crystallizing it. Hence, engineer its catalytic properties to yield drier alcohol with higher energy density than ethanol or butanol.

Methods Aimed at Reducing Sexual Stigma: How Do Heterosexuals Change Their Own Prejudice?

Jonathan T. Ryser-Oatman
Sponsor: Gregory M. Herek, Ph.D.
Psychology

This study examined how heterosexuals reduce their own prejudice against sexual minorities. Borrowing from research on racial prejudice, five specific prejudice-reduction techniques were examined: *perspective taking* (taking a minority person's viewpoint), *contact* (interacting with out-groups either directly or indirectly through media interaction), *individuating* (seeing personal rather than stereotypic aspects of a minority group member), *stereotype replacement* (recognizing stereotypes and replacing them with non-stereotypic responses), and *counter-stereotypic imaging* (imagining out-group members who are non-stereotypic). UC Davis undergraduates completed an online questionnaire that contained measures related to prejudice, attitudes, and experiences about sexual minorities, as well as their use of the five techniques. It was predicted that students who reported using fewer of these techniques or using them less often would display higher levels of sexual prejudice. Furthermore, based on previous research about prejudice and stereotypes it was hypothesized that lower-prejudice students would utilize contact experiences, individuating, and perspective-taking more than stereotype replacement and counter-stereotypic imaging to reduce prejudice. Knowing heterosexual's frequency and usage of these techniques can help develop programs to reduce stigmatization of sexual minorities and provide insights into undergraduate interactions with them. Furthermore, we can gain greater understanding of how often students encounter stereotypes about sexual minorities.

Fatty Acid Dinding Protein 7 & Plasmolipin mRNA Expressions are Downregulated in the CNS of Postpartum vs. Virgin Mice

Marissa Saenz
Sponsor: Connie Champagne, Ph.D.
Molecular and Cellular Biology

Behavioral and physiological changes occur during the transition from a virgin (v) to a postpartum (m) state. However, the molecular changes occurring during this transition are not well defined. I used real-time quantitative PCR (RT-qPCR) to confirm the mRNA expression changes of two genes that in previous microarrays exhibited expression differences between virgin and postpartum mice in brain regions related to maternal behavior: fatty acid binding protein 7 (Fabp7) and plasmolipin (Pllp). I hypothesized that the expression of both would be significantly downregulated in brain regions necessary for maternal behavior in postpartum mice. cDNA was synthesized from RNA extracted in the central/basolateral amygdala (CeA/BLA, n=12 v mice, n=12 m mice), the lateral hypothalamus (LH, n=12 v mice, n=12 m mice), and the ventral tegmental area (VTA, n=7 v mice, n=8 m mice) from age-matched virgin and postpartum mice. Using RT-qPCR, I found that Fabp7 was significantly downregulated in the CeA/BLA, LH and VTA ($p<0.05$) regions while Pllp was significantly downregulated in the CeA/BLA and LH ($p<0.05$) of postpartum mice compared to virgin mice. These data support my hypothesis that Fabp7 and Pllp may be important genes in the onset of maternal characteristics and social bond formation.

The Effect of Serum Deprivation on Human Mesenchymal Stromal Cell Osteogenic Differentiation

John Sagun
Sponsor: Kent Leach, Ph.D.
Biomedical Engineering

Over 1.6 million bone graft procedures are performed annually in the United States, at a cost of more than $2.5 billion. Tissue engineered approaches utilizing cells, signaling molecules, and scaffolds are attractive for repairing critical-sized bone defects because they eliminate many of the disadvantages of autografts. Human mesenchymal stromal cells (hMSC) are promising for such applications because of their ability to differentiate into osteoblasts, ready availability, and high proliferative capacity. However, unlike conventional culture conditions, large fractures are ischemic environments with low nutrient and oxygen content. While the effects of hypoxia on hMSC are known, hMSC behavior under serum deprivation is poorly characterized. The purpose of this project is to assess the contribution of both serum and oxygen concentrations on hMSC osteogenic differentiation *in vitro*. hMSC will be subjected to both growth and osteogenic media containing 1% or 10% serum under hypoxic (1%) or atmospheric (21%) oxygen tension in 2D culture for 3 weeks. Preliminary data show that low serum environments stimulate alkaline phosphatase activity and calcium deposition, markers of osteogenic differentiation, over 2 weeks.

GFP Activation Time in the Hippocampus in Mice During Fear Conditioning

Elizabeth Sahagun Parez
Sponsor: Brian Wiltgen, Ph.D.
Psychology

The hippocampus is important for learning and memory in humans and animals. This experiment will measure reactivation neurons in this area of the brain during the retrieval of context fear memory. H2B-GFP will be used to tag active neurons in the hippocampus during the encoding phase of fear conditioning then c-fos will be used to tag neurons during retrieval. The expression of H2B-GFP will be controlled using doxycycline in the mice's food. It is unclear how long GFP takes to be expressed and exactly when the signal starts to degrade so our lab typically waits 24 hours before the retrieval task. We will be testing H2B-GFP activation at different times to get a better idea of when the tag is strongest and when it begins to degrade. In these experiments we will be measuring re-activation as the overlap between c-fos and H2B-GFP tagged neurons. These experiments will provide further insight on the neural circuits that are used to encode and retrieve memory.

Micromechanics of Fiber Pullout in High-performance Cement Composites

Christopher Salazar
Sponsor: John Bolander, Ph.D.
Civil and Environmental Engineering

One of the greatest benefits of adding fibers to cement-based composites is in their ability to limit cracking and thus improve the durability of the composite material. The fibers' ability to restrain crack widths reduces the passageways of harmful substances, such as carbon dioxide and chlorides, into the material. Currently, the understanding of fiber behavior within such fiber-reinforced cement composites (FRCC) is based from either single-sided or double-sided fiber pullout tests, both of which provide little insight into the micromechanics of fibers within the damage zone. These experimental tests do not take in consideration the complex factors present in FRCC. This study investigates the internal behavior of the fibers, with the goal of providing a more accurate basis for modeling the micromechanics of FRCC fracture. Initial experiments exhibited much scatter in the fiber pullout data. As part of refining this initial experiment, pullout methods that both reduce external influences and produce consistent results are being sought.

The Making of a Pest: Novel Ovipositor Morphology Opens a New Ecological Niche in *Drosophila*

Raul Salazar
Sponsor: Artyom Kopp, Ph.D.
Evolution and Ecology

Most *Drosophila* species are harmless to agriculture because they lay eggs in decaying fruit and other dead vegetation. However, a recent evolutionary change in the morphology of the egg-laying organ, the ovipositor, has allowed *Drosophila suzukii* to deposit eggs in ripening fruit, making it a formidable pest. To better understand this morphological innovation, we compared ovipositor morphology in *D. suzukii* and three other closely related fruit fly species. We conducted elliptical Fourier analysis to quantify variation in ovipositor shape and analyzed ovipositor bristle number, structure and patterning. The results suggest that enlarged, pigmented bristles evolved in the ancestor of *D. suzukii* and its sister-species, *Drosophila subpulchrella*. This evolutionary novelty may be responsible for their capacity to penetrate soft-skinned fruits such as raspberries. Differences in the relative abilities of these two species to puncture different types of fruit, on the other hand, are more likely to be a consequence of variation in ovipositor shape than in the number of modified bristles. Greater understanding of these morphological differences may yield better methods of preventing further expansion of this fruit pest.

A Modified Gale-Shapley Algorithm For the TA-Classes Assignment Problem

Sachin A. Salgaonkar
Sponsor: Jesus De Loera, Ph.D.
Mathematics

In the past, administrators in the Mathematics Department spent upwards of eight hours constructing a feasible matching between graduate student teaching students and discussion sections by heuristics, which often led to a less than optimal pairing between the two. This led to a subsequent need for a more efficient and effective method of matching. We discuss an implementation of a program that generates an optimal matching between these two parties based on the theory of the Stable Marriage Problem, or more generally the Assignment Problem. This new method generates a solution on the order of one hour, which includes generating the input by hand. Although our problem could be formulated as an integer-programming problem, we instead present our matching problem using graph theory and utilizing the Gale-Shapley algorithm to generate a solution in polynomial time. Several constraints are considered, including a graduate student's availability, seniority, and the need to assign a single graduate student to multiple classes.

Psychological and Experiential Aspects of Emotional and Physical Abuse Among Latina Teens

Susan Samborsky
Sponsor: Angie Chabram, Ph.D.
Chicano Studies

This thesis examines psychological and experiential aspects of emotional and physical abuse among Latina teens. The review of the literature sets the stage for understanding short-term and long-term consequences on victim's mental health. Unfortunately, much of this research reflects a dearth of cultural and linguistic competencies that make exiting abusive situations more challenging for people of color, people with disabilities, and low-income people. My thesis stands as a corrective to this state of affairs. The heart of my thesis is a unique Latina teen love story that unravels the depths of harmony, strong rich young love, and the trap of abuse. It is my hope that my personal healing narrative and the interviews I conducted with five Latinas in Woodland, California, can educate the public on the dynamics and experience of abuse in a Mexican American setting. To effectively support Latina victims of abuse and help them to exit abusive situations, services for victims must be culturally competent, recognizing the importance of traditional families and religion. Because culture is a key factor that may debilitate women or encourage them to break the cycle, special attention is focused here. My research indicates that abused women can heal through narrative.

Radial Distribution Behavior of *Tribolium castaneum*

André Sanchez
Sponsor: Alan Hastings, Ph.D.
Environmental Science and Policy

The red flour beetle (*Tribolium castaneum*), is an agricultural nuisance for the grain industry. Despite its negative effects in industry, *T. castaneum* is an ideal and long-used experimental subject for use in population dynamic study. Having rapid dispersal capabilities and relatively brief life cycles, this organism allows us to have considerable insight on distribution patterns and population growth with regard to their environment. While often used experimentally, limited amounts of research on replicated movement patterns have been analyzed for this or for any other species. In this experiment, *T. castaneum* were dispersed from a central point and then allowed to disperse through multiple replicate human-made landscapes for a single 6 hour period. Data on the dispersal were collected and consolidated into a graph to determine the presence or absence of a normal (or Gaussian) distribution. The results of the distribution patterns will be evaluated with regard to environmental distribution of organisms.

Temperature Dependent Urchin Grazing

Monique Sanchez
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Evolution and Ecology

Temperature may affect urchin grazing activity due to their differential metabolic rate as ectotherms and has variable ecological significance based on seasonal variation of net primary productivity. Additionally, increasing temperature has the potential to alter urchin preference from a specialist to generalist grazer (as food becomes limited due to increases in grazing activity). We observed the grazing of two urchin species under different temperatures and compared this for two algae species to understand the preference of urchins under multiple temperatures. Our results showed a trend with increasing temperature there is an increase in grazing rate. Our data also demonstrates that *Salmacis belli* grazed at a higher rate than *Temnopleurus alexandri* regardless of species consumed or temperature with a significance of $p=0.036$. Both these factors, grazing activity and preference, can act as an ecological disturbance keeping a single species from dominating the landscape, most notably, urchin grazing has the potential to keep algae from competitively excluding seagrasses.

Forensic Ecology: Uncovering the Scent Mark of a Seabirds' Burrow Using Leach's Storm-Petrels (*Oceanodroma leucorhoa*) as a Model System

Sukhjot S. Sandher
Sponsor: Gabrielle Nevitt, Ph.D.
Neurobiology, Physiology, and Behavior

Leach's Storm Petrels (*Oceanodroma leucorhoa*) have among the largest olfactory bulbs of any bird. They can relocate their home burrows by smell but the volatile organic compounds that individually mark each burrow have not been identified. I hypothesize that Leach's storm petrels perfume their burrows with plant material that differs from the surrounding vegetation. This hypothesis predicts that the odor signature of the burrow entrances should differ from the odor signature of the surrounding vegetation. A transect tape was extended through the colony and divided into 10 meter segments. Burrows (n=22) were selected using a randomized design along each segment. A one-meter quadrat was placed over each burrow and a picture was taken from a vertical distance of 1.75 meters. Plants were identified to species on site. Soil samples were collected from burrow entrances (n= 3 per burrow). Control samples (n=3) were collected within the quadrat, but outside the burrow. Samples were kept in the freezer and shipped back to the laboratory for odor analysis using Solid Phase Microextraction-Gas Chromatography/ Mass Spectrometry (SPME-GC/MS). Samples contained a variety of compounds including heptadecane, toluene, decanal, and camphene, Analysis comparing burrow odor profiles to vegetation patterns (using ImageJ software) is currently underway.

Focal Modulation of Interferon Regulatory Factor 1 by Hemodynamics in High Cholesterol Fed Swine

Angad Sandhu
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Biomedical Engineering

Despite an understanding of the importance of dyslipidemia as a risk factor for cardiovascular disease, the specific mechanisms that determine the localization of atherosclerotic plaques in arteries, particularly in the context of local hemodynamic factors, are not well-defined. Vascular endothelial cells respond to hemodynamic cues to focally modulate inflammation. Interferon regulatory factor 1 (IRF-1) is a shear stress (SS)-sensitive transcription factor that acts cooperatively with NF-κB to regulate the inflammatory response to dietary lipoproteins after a high-fat meal. To support a role for arterial hemodynamics in the focal modulation of diet-induced inflammation via IRF-1, we examined IRF-1 and downstream vascular cellular adhesion molecule 1 (VCAM-1) expression in the arteries of pigs fed a high-cholesterol (HC) or normal diet by immunohistochemistry, comparing a representative site of atherosusceptibility to one of relative atheroresistance. Our initial results demonstrated that IRF-1 but not VCAM-1 was more highly expressed in the endothelium at the susceptible site in the normal diet. Both IRF-1 and VCAM-1 were more highly expressed at this site under the HC diet. These findings support a mechanism for the convergence of signaling via hemodynamic cues and dyslipidemia to influence focal susceptibility to atherosclerosis in arteries.

Light Emitting Diode Generated Red Light Modulates Keloid-Derived Fibroblast Migration Speed

Surinder S. Sandhu
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Dermatology

Keloids are a disorder characterized by increased fibroblast proliferation and extracellular matrix deposition. Cultured keloid-derived fibroblasts also demonstrate increased migration speed compared to fibroblasts derived from normal human skin. Here we hypothesized that LED-RL can modulate keloid-derived fibroblast migration speed. To test this hypothesis, two different keloid-derived fibroblast lines were irradiated with LED-RL, each matched with a temperature regulated "bench control plate" (BCP), to ensure that the measured effect was a result of LED-RL treatment and not due to other environmental factors. Keloid-derived fibroblasts demonstrated decreased migratory speeds compared to BCPs as measured by time-lapse video microscopy imaging over a period of 4 hours at 30-minute intervals. A fluence of 320 J/cm2 decreased their speed by 15-20% of that of the BCP ($p<0.02$). Similar LED-RL-induced decreases in cell migration were observed in a second keloid-derived fibroblast culture and two normal fibroblast cultures. We conclude that LED generated red light modulates keloid-derived human skin fibroblast functions that are associated with fibrosis. There are few effective treatment options for keloids and other cutaneous fibrotic diseases. We envision that our findings will serve as the foundation for future translational studies that contribute to the management of fibrotic skin disease.

Low Body Weight Gain During Pregnancy and Mitochondrial DNA Deletions in Mothers at Risk of Having a Child with Autism Spectrum Disorder

Erica C. Santos
Sponsor: Cecilia Giulivi, Ph.D.
Molecular Biosciences

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by impaired social interactions and cognitive deficits. Previous studies have shown a link between oxidative stress and mitochondrial dysfunction in ASD individuals. Given that mitochondrial DNA is more prone at exhibiting oxidative stress damage than nuclear DNA, we investigated the occurrence of mitochondrial DNA (mtDNA) deletions in blood from mothers who had a biological child with ASD. Deletions were quantified by using dual-labeled probes with polymerase Chain Reaction (PCR). Mothers who gained normal (13-40 lbs) or more body weight (>41 lbs) during pregnancy had a similar amount of mtDNA deletions; however, those that gained <13 lbs presented 12% more deletions. This may indicate that mothers who gain less weight during pregnancy could be experiencing more oxidative stress than mothers who experience normal or higher weight gain. This data is relevant because mothers who gain less weight may be fostering a maternal environment that puts the developing fetus at risk for mitochondrial dysfunction and other disorders.

Derivation of Zantrin Z3 Towards Antibacterial Efficacy

Francisco J. Sarabia
Sponsor: Jared T. Shaw, Ph.D.
Chemistry

The use and misuse of antibiotics since around WWII has led to an increase in drug resistance in multiple strains of bacteria. This has been exacerbated by the decrease in the development of new antibiotics by pharmaceutical companies, leading to the potential risk for human health. Thus, we have looked at novel drug targets specifically having to do with bacterial cell division in hopes to meet this unmet medical need. Filamenting temperature sensitive mutant Z or FtsZ has been considered a promising novel drug target because of its characteristics as a highly conserved and primary component of the bacterial divisome or "z-ring", which is essential in bacterial cell division. A small molecule discovered from high throughput screening, Zantrin Z3, has been identified as an inhibitor of FtsZ GTPase activity with an IC_{50} value of 20 μM. Derivatives of Z3 have been synthesized in hopes of obtaining more potent analogs that could lead to the elucidation of FtsZ's biochemical behavior and potentially lead to the development of a new class of antimicrobials.

The Eyes Don't Lie -- Predicting Your Decisions Before You've Made Them

Farhan Sareshwala
Sponsor: Eve A. Isham, Ph.D.
Psychology

Is it possible to predict your decisions from looking at your eyes? Past studies have shown that eye parameters such as looking time could be used as a predictor for subjective decisions (e.g., Isham & Geng, under review). In the current study, we monitored eye movements while the participants performed a visual decision task. The observers were asked to choose between two novel black and white patterns based on two criteria: preference (i.e., which pattern was more aesthetically pleasing) and symmetry (i.e., which pattern was more symmetrical). Consistent with Isham & Geng, the chosen object was fixated upon for a longer time. Moreover, this was true for both the subjective preference task and the objective symmetry task, suggesting that looking time could be generalized for any types of visual decisions. In addition, we identified the point at which these fixation durations became significantly longer for the chosen object and found that this was approximately 1000-2000 ms before the participants explicitly reported their choice. This further implied that looking times were temporally sensitive and could serve as a pre-decisional indicator of post-decisional choice.

The Kinetic and Structural Analysis of CysQ, a Sulfate Activation Pathway Regulator

Reta D. Sarsam
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Chemistry

Sulfur-containing metabolites, such as amino acids and lipids, are significant for all organisms. In the environment, most sulfur is found in the form of sulfate (SO_4), which is not chemically reactive. The sulfur activation pathway produces useful metabolites from sulfate. CysQ is considered an important regulator of this pathway in plants, yeast, and other bacteria. The Bertozzi lab initially determined CysQ's function using genetic knockouts (Hatzios, Stavroula K., et al. 2008). CysQ has the ability to dephosphorylate 3'-phosphoadenosine 5'-Phosphate (PAP) to make adenosine monophosphate (AMP). The goal of this study is to characterize the enzymatic function of CysQ and solve its structure using x-ray crystallography. The gene encoding CysQ from *Mycobacterium tuberculosis* was cloned into the *Escherichia coli* plasmid pET-28b(+). CysQ protein was over expressed in BL21 (DE3) cells, and its production confirmed by SDS-PAGE and Western Blot analyses. By understanding regulation of the sulfur activation pathway, we can gain insight into the virulence and survival of bacterium, which in turn can lead to novel ways to fight bacterial infections.

Bridging the Disconnect: Understanding the Factors of Patient Satisfaction

Yassaman Sarvian
Sponsor: Daniel Potter, Ph.D.
Plant Sciences

More than 450,000 people die from breast cancer every year worldwide; nearly 40,000 of those deaths are female patients in the United States alone. Many of the women who succumb to this disease are not able to diagnose and treat it early in the process, or receive proper health care during the harshest stages of the cancer. Breast cancer research is a multi-billion dollar industry, yet thousands of women continue to suffer every year due to certain variables that affect their relationships with their doctors. The purpose of this project is to conduct and use first person interviews to examine and address the disconnection between breast cancer patients and their physicians. We will research and evaluate the various cultural, legal, and economic factors that affect the quality of healthcare that women receive from their physicians. This presentation will focus on the legal factors and how they affected patient's satisfaction. We hope to publish our findings along with facts and guidelines for patients, medical students, and physicians to help resolve this disconnect.

Outer Rise Fault Behavior in Subduction Zones

Jessie K. Saunders
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Geology

In subduction zones, normal faults form on the outer rise due to extension that occurs on the subducting plate as it bends and sinks beneath the overriding plate. Analogue models of bending regimes have shown that size-frequency distributions for fault spacing fit an exponential model and that fault length does not follow either an exponential or power-law model. This is counter to stretching regimes where fault characteristics exhibit power-law models. However, initial analysis of the size-frequency distributions for fault characteristics in the subduction zones featured in this study - the Middle America, Tonga, and western Kuril trenches - indicate that escarpment height and length fit exponential models while fault spacing does not follow either an exponential or power-law model. The fault characteristics also appear to depend on the age of the subducting plate as well as the orientation of the inherited spreading fabric. Investigating outer rise fault formation can lead to better understanding of the hydration and serpentinization of the lithosphere and improve models for subduction zone dynamics.

Lateral Bias in Agonistic Interactions in Male Greater-Sage Grouse (*Centrocercus urophasianus*)

Tawny N. Scanlan
Sponsor: Gail Patricelli, Ph.D.
Evolution and Ecology

Lateral bias in agonistic interactions has been discovered in numerous vertebrate taxonomic groups. The generalized pattern shown in higher vertebrates is the predominance of a left eye-right hemisphere mechanism in agonistic behaviors. In this study we investigated the prevalence and consequences of lateral bias in a lekking bird, the greater sage-grouse (*Centrocercus urophasianus*). We examined whether or not male agonistic behaviors were predominantly mediated by the left eye-right hemisphere mechanisms shown in other species. Behaviors were recorded and documented from a wild population of greater sage-grouse and males showed lateral orientation biases in agonistic encounters. We found an overall population bias of left-eye use in aggressive behaviors. Also, males who successfully mated were found to be significantly more left-eye biased than non-mated males in aggressive behaviors. Our results suggest that agonistic behaviors in greater sage grouse follow the pattern of left eye-right hemisphere control and this pattern has fitness implications for males.

Exposure to Virtual Environments in Video Games and the Development of False Memories

Deborah Scearce-Miles
Sponsor: Andrew Yonelinas, Ph.D.
Psychology

Causal observation revealed that video game enthusiasts sometimes confuse places, objects, and situations from the virtual environment (VE) of games with those of the real world. Studies indicate no correlation between violent video games and aggression, other research indicates the use of video games and digital media increases creativity, yet little attention has been paid to the issue of how memories are influenced by exposure to the VE and more particularly first person (FP) video games. The purpose of this research is to identify factors that lead to the occurrence of false memories from VE's becoming confused with real world memories. Participants exposed to both a VE and real environments, are then asked to remember whether objects were from the real world, from the VE, or whether they were new to the experiment. Source memory will be tested using the signal detection theory and quantified using an ROC function that will relate the proportion of correct recognitions to incorrect recognitions. This project may identify a relationship between exposure to a VE and the development of false memories and possible avenues for future applied research of VE's as presented in FP video games using memory enhancement and "edutainment."

An Artist's Journey of Discovery: Seeing the World Through Two-dimensional Painting & Three-dimensional Sculpture

Andrew M. Schutt
Sponsor: Annabeth Rosen, M.F.A.
Art Studio

In making art there is a process of disovery that demands constant attention. In my ceramic sculpture and oil/acrylic painting there has been a necessity to maintain a cohesive vision--regardless of the medium. The journey has been about expressing the way in which I (as an artist) understand the social and cultural world around me, and then relaying that vantage point to the viewer in a myriad of ways. The goal has been to engage the individual properties of the materials used, and gain access to a discovery process that informs me of what piece needs to be made next. My work has evolved (since being in the art department at UCD) from dealing with two dimensional canvasses to investigating the ways that line and form exist in the three dimensional world of ceramic sculpture. This kind of cross-polinization has produced a variety of works outside the realm of glazed ceramic sculpture and figurative/from-life painting to a place where painting exists on the ceramics and the ceramics are rediscovered in the painting. The hope is that one way of making can inform the other, and eventually some sense of my next assignment will appear.

Bitch: An Anthropological Study of Femininity and Power

Nicole A. Sears
Sponsor: Janet S. Shibamoto-Smith, Ph.D.
Anthropology

Power, this worldly phenomenon, entices us, but how does one manifest power? Currently, research concerning power focuses on male agents. The study of femininity and power is limited, with the most elaborate text describing female gang members. Understanding the moment-to-moment workings of power offers individuals a better notion of how they fit into their environment. My study focuses on the femininity and power of young ordinary females; it uses chick flicks that fit the genera of romantic comedy for a case study to investigate how power struggles occur. An anthropological lens will be used to study *Mean Girls, House Bunny,* and *Legally Blonde*. Coding of language, analysis of the word "bitch", and network influence charting will offer an understanding of how power struggles play out between female characters in the films. Preliminary findings suggest that females fight for power and use interfeminam communication chains in power struggles. Analysis shows that females use "bitch" in two specific ways: for inclusion or exclusion. This research will offer women a better understanding of how they interact with each other, as well as offering us all a better understanding of females as a powerful sex.

Synthesis of Amphiphillic Peptidomimetics for Treatment of Alzheimer's Disease

Rahwa T. Sebhatu
Sponsor: Krishnan Nambiar, Ph.D.
Chemistry

Alzheimer's disease, commonly known as dementia, is one of the top ten leading causes of death in the United States. However, hitherto there hasn't been any form of prevention or cure. The main physiology of Alzheimer's disease in the brain is the formation of amyloid fibrils that are formed by the aggregation of beta amyloids. These aggregates block the nerve connections causing decline in memory. Initially, the Aβ peptide comes from proteolytic cleavage of the amyloid precursor protein (APP) whose function is not known yet. APP is proteolytically cleaved by the β and γ secretases. In some studies, these enzymes are targeted as a way to remedy the disease. Our research focuses on synthesizing amphiphillic peptidomimetics that are better able to override the protease effects in the body and survive longer than natural peptides. The peptidomimetics are expected to inhibit amyloid beta aggregation and disrupt the aggregate structure. The peptidomimetics are able to inhibit amyloid beta aggregation *in vitro* and protect neurons from amyloid toxicity. These are promising results in the prevention/treatment of Alzheimer's disease.

An Examination of How Fragile X Mental Retardation Protein Affects the Size of the Corpus Callosum in Children and Adolescents with FXSI

Marquel Seither
Sponsor: Susan M. Rivera, Ph.D.
Psychology

The genetic cause of fragile X syndrome (FXS) is a mutation on the fragile X mental retardation 1 (FMR1) gene. *Fragile X spectrum of Involvement* (*FXSI*) is defined as the range of neurodevelopmental problems experienced by individuals with expanded CGG-repeat forms (alleles) of the *FMR1* gene, which negatively affects production of the *Fragile X Mental Retardation Protein* (*FMRP*). Carriers of premutation alleles (and mosaics), who have clinical involvement, overlap with symptoms of FXS, which likely reflects a combination of pathogenic mechanisms (RNA toxicity, *FMRP* insufficiency). Previous research has found that diminished *FMRP* expression can selectively alter white-matter anatomy, such as the corpus callosum (CC), during early brain development (Haas 2009). Here, we collected structural MRI scans and molecular measurements of *FMR1* gene expression from children and adolescents with FXSI and age and gender-matched neurotypical controls. Following a protocol published by John and colleagues (2008), the area of the whole CC, and its radially divided sub-regions, were measured on all participants. It is hypothesized that there will be a positive relationship between FMRP expression and area of the CC, particularly in the posterior sub-regions.

Trait-Mediated Indirect Interactions Between a Predatory Crab and Different Populations of the Striped Dogwhelk, *Nucella ostrina*

Emily Seubert
Sponsor: Eric Sanford, Ph.D.
Evolution and Ecology

A well-known phenomenon in food webs is the cascading effect of a top predator's consumption of a lower prey species, and the direct and indirect interactions that result. Our experiment focused on trait-mediated indirect interactions (TMIIs), where the presence of predatory cues affects traits in the prey species, which subsequently affects that prey species' resource. We conducted a laboratory experiment to test the effect of the presence of a crab predator (*Cancer productus*) on feeding, growth rates, and shell morphology changes of the striped dogwhelk, *Nucella ostrina*. We also tested if these responses would differ between individuals from two source populations. For two months, we exposed laboratory-reared whelks originating from the open coast and Bodega Harbor to waterborne cues from a predator consuming conspecific snails, just predator cues, and no cues. Dogwhelks not exposed to predatory cues consumed more barnacles and grew more than those exposed to predatory cues, particularly those exposed to predators consuming conspecifics. We found a trend in the data that indicates the origin of the dogwhelks affects their feeding behavior and growth rates. These results indicate that predator presence, depending on prey population, may have varied non-lethal effects on marine food webs.

Cognitive Deficits Caused by Decreased Theta Due to the Loss of Hilar and CA2/3 Neurons

Haroon Shafique
Sponsor: Gene G. Gurkoff, Ph.D.
Neurological Surgery

An estimated 1.7 million people sustain a traumatic brain injury (TBI) every year in the USA with over 5.3 million TBI patients suffering from persistent deficits and reduced quality of life. The hippocampus is one region of the brain that has a specific role in learning and memory function. In rodent models of TBI, injury can lead to significant hippocampal cell death and reductions in EEG oscillatory rhythms in the theta frequency band (6-10 Hz) that correlate with changes in learning and memory behavior. We hypothesize that TBI-induced hippocampal cell death is directly related to the reduction in theta power and deficits in cognitive performance. TBI animals will be assessed for changes in theta power during cognitive performance. Then stereology will be used to estimate the number of hippocampal CA2/3 and hilar neurons. We will then determine whether there is a relationship between cell number, theta power and cognitive behavior of rodents following TBI. The goal of this project is to better understand the anatomy and function of the hippocampus as it relates to cognitive performance following TBI. Understanding relationships between structure and function is critical to the development of therapeutic interventions that will someday help the TBI patient population.

Place, Possibility, and Progress: Social Mobility in *A Tree Grows in Brooklyn* and *The Great Gatsby*

Claire Shalinsky
Sponsor: Mark Jerng, Ph.D.
English

The early 20th century was characterized by increased mobility: with an influx of immigration, a booming industrial economy, and new technologies like the automobile, Americans believed it was easier to move through physical space and social strata. I examine two novels that explore the possibilities and limitations of social mobility: Betty Smith's, *A Tree Grows in Brooklyn* 1943) and F. Scott Fitzgerald's, *The Great Gatsby* (1925). These works approach issues of poverty, class, and the vexed relationship to the past from vastly different perspectives: *A Tree Grows in Brooklyn* sketches the coming-of-age of Francie Nolan in the tenement slums of New York City, while *The Great Gatsby* confronts the tragic disintegration of a self-made millionaire. Yet both novels grapple with questions of mobility: to what extent can one move beyond one's physical, economic, and cultural place and, more importantly, what is the cost of such movement? In engaging these complex and often elusive discourses of place, possibility, and "progress," these authors invite readers into an ongoing discussion of social mobility that existed before-and continues to exist beyond-the historical period of these novels.

MCP-1 Directed Migration Following Exposure to K(Ca)3.1 and Kv1.3 Channel Modulators in Murine Microglia

Alexzander Sharp
Sponsor: Heike Wulff, Ph.D.
Pharmacology

Inflammatory processes are implicated in a number of neuropsychiatric disorders and neurodegenerative diseases. Microglia carry out various immune-related activities in the central nervous system, including phagocytosis, antigen presentation, and regulation of neuronal function. Derived from hematopoietic stem cells, microglia reside in relative passivity in the brain and spinal cord prior to immune challenge. Upon exposure to inflammatory signals, microglia activate to express dynamic processes, including the extension of thin probing filopodia and migration towards areas of distress. Microglia, like all other immune cells, utilize intracellular calcium signaling in the initiation and propagation of migratory as well as other immune-related activities. Modulation of activity of the calcium-activated potassium channel K(Ca)3.1 has been shown to alter the proliferation, cytokine secretion and migration of macrophages and glioma cells. Our laboratory therefore assayed the migration of neonatal microglia from wild-type and KCa3.1-/- mice following exposure to increasing concentrations of the K(Ca)3.1 channel blocker TRAM-34 and the K(Ca)3.1 activator SKA-31. Migratory activity was also measured in microglia exposed to increasing concentrations of the voltage-gated potassium channel Kv1.3 blocker PAP-1. Cells were allowed to migrate toward monocyte chemotactic protein-1 (MCP-1) in Boyden chambers and were optically quantified on the filter membranes.

Pro-Victim Protocols Predict Pro-Victim Perceptions

Alexandra E. Shelley
Sponsor: Gail S. Goodman, Ph.D.
Psychology

Most research on jurors' perceptions of the accuracy and credibility of child sexual abuse (CSA) victims' reports has concerned traditional investigative approaches to child abuse allegations. There are no published studies on how Child Advocacy Centers (CACs), a more modern and child-focused investigative approach, affect jurors' assessments of CSA victims' reports, despite the fact that CACs are being established worldwide. In the present study, mock jurors rated statements of CSA victims questioned by either a CAC interviewer or police interviewer. Analyses indicated that participants rated female victims interviewed using a CAC approach as more accurate than female victims interviewed using a police approach. Contrary to predictions, female jurors rated male compared to female victims as less responsible for the abuse; however, this was only true when victims were older. Differences in female victim accuracy ratings may provide evidence for stronger pro-victim perceptions associated with investigations that take place at CACs.

The Effects of Nutrient Levels on the Colonization of *Poa Secunda* by Arbuscular Mycorrhizal Fungi and Dark Septate Endophytes

Preya S. Sheth
Sponsor: Kevin Rice, Ph.D.
Plant Sciences

Mycorrhizae and endophytes are both root-inhabiting fungi that form symbiotic relationships with host plants, assisting in host nutrient acquisition, growth, and resistance to pathogens. Depending on environmental conditions such as soil nutrient levels, the symbiosis can range from mutualistic to parasitic. To determine nutrient levels conducive to growth of arbuscular mycorrhizae and dark septate endophytes, *Poa secunda*, a native grass species, was grown in potting media inoculated with soil from the root zone of *P. secunda* individuals, expected to contain both types of root fungi. Soil nutrient level was then manipulated to three concentrations, high, medium, or none. The roots of the host were then examined to assess percent colonization by mycorrhizal and endophytic fungi at each nutrient level. It is predicted that mycorrhizal colonization will be higher in low nutrient levels because prior research has shown that at low nutrient levels the relationship between mycorrhizae and the host plant is mutualistic since mycorrhizae enhance the root's ability to acquire nutrients. Conditions influencing endophytic symbiosis have not been studied extensively due to endophytes' intracellular growth, making it difficult to visually observe endophytes' effects on plant growth, however it is predicted that endophytic colonization to be higher in high nutrient levels.

Age-Based Disparities in the Use of Total Thyroidectomy for Papillary Thyroid Carcinoma

Ivan Shevchyk
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Surgery

Elderly patients may not receive indicated therapies offered to younger patients. We hypothesized that older patients with papillary thyroid carcinoma (PTC) would be less likely to receive a total thyroidectomy than their younger counterparts. The Surveillance, Epidemiology, and End Results database was queried for adult patients (age ≥18 years) diagnosed with PTC from 2000 through 2009. We used multivariate logistic regression models to predict the use of less than total thyroidectomy. Likelihood of undergoing less than total thyroidectomy was reported as odds ratios (OR) with 95% confidence intervals (CI). Of the 67,961 patients identified with PTC, 51,276 (75%) underwent total thyroidectomy, 14,750 (22%) obtained a less than total thyroidectomy and 1,935 (3%) received no surgery. On multivariate analysis, there was a clear association between increasing age and the likelihood of receiving less than a total thyroidectomy (age 45 to 54: 1.15 [1.09-1.20]; age 55 to 64: 1.20 [1.14-1.26]; age 65 to 74: 1.40 [1.32-1.49]; 75 to 84: 1.80 [1.65-1.95]; ≥85: 3.01 [2.51-3.62], all p<.001). Older patients with PTC are less likely to receive total thyroidectomy than their younger counterparts. Further research is needed to assess if older patients are negatively impacted by having less than a total thyroidectomy.

Exchange-Rate Models for CNY/USD – Assessment and Prediction

Jingyang Shu
Sponsor: Bagher Modjtahedi, Ph.D.
Economics

Four mainstream models are used by economists to explain the behavior of equilibrium exchange rates between currencies. These are: the Purchasing Power Parity model adjusted for Balassa-Samuelson and Penn effects, the behavioral equilibrium exchange model, the fundamental equilibrium exchange rate model, and macroeconomic balance model. Some of these models perform better than the others in explaining the exchange rate between RMB (or CNY), the currency in mainland China and the US dollar (USD). Nevertheless, even the "best" model is not expected to perform perfectly due to China's special economic and political environment. Some Chinese scholars suggest that a new exchange rate model should be developed specifically for RMB that takes these special conditions into consideration. This proposal implies that some parameters or indices in existing ones should be replaced or removed. Therefore, it is necessary to study how well these models explain the behavior of RMB. I will test these four models and compare their strengths and weaknesses. Thus far, some fundamental data is being collected and programs about the four models are being written and compiled. Once these four models are tested, suggestions and predictions about a more effective and accurate CNY/USD exchange-rate model can be provided.

Effect of NSAIDs on Tripeptidyl peptidase II Activity in Cardiac Cells

David Simionas
Sponsor: Aldrin Gomes, Ph.D.
Neurobiology, Physiology, and Behavior

Treatment of patients with nonsteroidal anti-inflammatory drugs (NSAIDs), such as Aspirin and Meclofenamate Sodium (MS), has shown increased risk of cardiovascular dysfunction. The molecular mechanism by which NSAIDs affect heart function is not fully understood. Tripepidyl peptidase II (TPPII) is a large enzyme that works downstream of the Ubiquitin Proteasome System (UPS), which is a major degradation pathway for 60-80% of proteins in eukaryotic cells. TPPII trims small peptide fragments that exit the UPS, playing a critical role in antigen processing and presentation. TPPII deficiency has been linked to decreased life spans in mice due to cell-type specific initiation of apoptosis in TPPII deficient cells. Due to TPPII's importance in regular cell function, effects of NSAIDs on TPPII activity were studied. H9c2 rat cardiac cells were treated with Aspirin or MS and then assayed for TPPII activity by using fluorogenic substrates. TPPII activity was not affected at low concentrations of NSAIDs tested.

Identifying the Function of Unknown Plant Proteins

Vikram Singh
Sponsor: Georgia Drakakaki, Ph.D.
Plant Sciences

Plant growth and development are dependent on vesicular trafficking in the endomembrane system, which helps to package and deliver molecules to specific target destinations within the cell in response to internal and external signals. The plant sessile lifestyle requires such specific features in order to build its cell wall and to adapt in various biotic and abiotic stress conditions. In a recent study, Drakakaki and colleagues (Drakakaki et al., 2012) isolated vesicles containing the SNARE protein, syntaxin of plants 61 (SYP61) from *Arabidopsis* in their native state using an immunoisolation approach. SNARE complexes between vesicle and target membranes are involved in vesicle fusion leading to the release of cargo. The SYP61 vesicle proteome contains proteins related to endomembrane trafficking, cell wall synthesis, stress response and thirteen proteins of unknown function. Based on these data we hypothesize that the SYP61 trafficking pathway is involved in cell wall deposition and stress response. To identify the biological role of proteins of unknown function, we have taken a reverse genetics approach using T-DNA insertion mutants. Genotypic characterization and preliminary characterization of the acquired mutants will be presented.

Interactive Control Systems for a Tilting Ball Maze

Anthony Siu
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Electrical and Computer Engineering

With the current shortage of science and engineering graduates, this project is aimed to encourage and inspire incoming students to pursue a degree in the field of Computer and Electrical engineering. This interactive exhibit displays the practical applications of concepts learned in class. Our project takes the traditional titling table marble maze and infuses it with computer imaging and accelerometer technologies. The user will be able to control the angle of the maze by either moving a piece of paper with a pre programmed image under a camera or by using a balance board with an embedded accelerometer. From this information, a tilt angle and direction is calculated, and information is sent to the controller and motors to cause the board to tilt. Using careful software integration techniques, we run our system with two control devices as a single entity. An elegant and streamlined solution here is paramount to success in integrating the physical and digital worlds. Not only does this project excite and inspire, it demonstrates the boundless creativity that will be evident in tomorrow's computer and electrical systems.

Cloning and Functional Analysis of Effector Candidate Proteins in *Bremia lactucae*

Rachel H. Siu
Sponsor: Richard W. Michelmore, Ph.D.
Plant Sciences

Every year, many crops are lost due to damage done by pathogenic organisms. *Bremia lactucae*, an oomycete, is an obligate pathogen that causes significant economic losses to lettuce in California and worldwide. Recently, genomic studies have shown that oomycete genomes harbor hundreds of effector proteins that mediate infection processes. We are currently cloning the effectors found in *B. lactucae* with the objective of transferring them into different expression systems. This will aid in the study of their function *in planta*. After mining of the genomic sequences through bioinformatic approaches, primers of the candidate effectors were designed. These effectors were then amplified and cloned using the Gateway system. The plasmid prep was then used for sequence verification and effector genes were transferred into two different vectors (EDV7, pBAV139). Proteins expressed from the vector EDV7 have the necessary motifs to translocate from *Pseudomonas sp.* in to the host plant. While genes cloned into pBAV139 and transformed in *Agrobacterium* will mediate transient transgenic expression in the plant. At the moment over 50 RxLR candidate effector genes from *Bremia* have been cloned; both in EDV7 and pBAV139. The assays *in planta* are ongoing.

Constructing Innate Immunity in Grapevine by Further Understanding of Pathogenesis Related Family of Proteins

Daniel R. Skipp
Sponsor: Abhaya Dandekar, Ph.D.
Plant Sciences

Xylella fastidiosa (X. fastidiosa), is a Gram-negative bacterium that causes Pierce's Disease in grapevine and many other economically important crops. Previously, we have shown that Human Neutrophil Elastase (HNE), an immunity-related protein in *H. sapiens,* was found to possess the ability to clear *X. fastidiosa* cells efficiently. Using CLASP (CataLytic Active Site Prediction), we were able to find a pathogenesis related protein 1 (PR-1), from a wild variety of grape resistant to Pierce's Disease that has the same active site as HNE. PR-1 is one of the first lines of defense against an invading pathogen in many plants. Using *in vitro* analysis, we will characterize the efficacy of PR-1 in recognizing and clearing *X. fastidiosa*. This will be accomplished by measuring potential elastase activity, the ability of PR-1 in targeting specific *X. fastidiosa* outer membrane proteins, and *X. fastidiosa* mortality effect. This will pave the way for engineering new innate immunity proteins in plants that have the ability to fight off and resist a broad spectrum of bacterial and fungal disease.

Investigation of Aging Kinetics in Ultra-Fine Grained Aluminum 7075 Alloy

Thale R. Smith
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Chemical Engineering and Materials Science

High strength, lightweight aluminum alloys have become a technologically crucial material in modern times; however, engineering demands periodically require stronger materials. For this reason ultra-fine grained (UFG) aluminum alloys, have received increasing attention due to the strengthening mechanism known as the Hall-Petch relationship. Compared with traditional coarse grained (CG) materials, recent research suggests that the reduction in grain size that defines UFG materials may alter the microstructural evolution in aged aluminum alloys, impacting the strength of the material. For example, it has been shown in aluminum (Al) 7XXX alloys that the morphology, size, and chemical composition of the precipitates differ between the CG and UFG materials. Considering these developments, it is probable that the precipitation kinetics in UFG Al 7075 would be different from those observed in the CG counterpart. As a result, it is likely that the traditional T6 heat treatment used to achieve peak aging in CG Al 7075 will not impart the same optimal strength increase to UFG Al 7075. The purpose of the current aging kinetics study is to elucidate the true peak aging conditions in UFG Al 7075 by measuring the Vicker's hardness of samples exposed to various heat treatments at select times and temperatures.

Effect of Type I Diabetes on the Proteasome in Mouse Skeletal Muscle

Mandeep Sohal
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Neurobiology, Physiology, and Behavior

Diabetes, one of the leading causes of death, results in skeletal muscle atrophy. In relation, the ubiquitin proteasome system (UPS) degrades cellular proteins. In this study, the role of the proteasome in the degradation of skeletal muscle was evaluated in the gastrocnemius of Akita Type 1 Diabetes Mellitus (T1DM) mice at 5 weeks and 12 weeks. This is in contract to 5 week and 12 week old heart tissue where dynamic changes in the activity of the proteasome occur. The ratio between the gastrocnemius weight and the tibia length indicated that Akita mice have sufficiently decreased skeletal muscle mass at 12 weeks. No difference was found in the caspase-like or chymotrypsin-like activities of the β1 and β5 subunits of 20S and 26S proteasomes. In addition, there was no difference in immunoblots probed for subunits of the 20S and 26S proteasomes. Furthermore, the activity of Cathepsin L was found to be unchanged. Protein synthesis quantified using puromycin terminated polypeptide chains in immunoblots of 12 week old mice also suggested no difference. Taken together, these results indicate that the activity and expression of the skeletal muscle UPS do not greatly contribute to diabetic skeletal muscle atrophy of Akita mice.

Identifying Pch2 Binding Protein Partners in *Saccharomyces cerevisiae*

Ryan D. Solis
Sponsor: Sean M. Burgess, Ph.D.
Molecular and Cellular Biology

In sexually reproducing organisms, meiosis serves as a specialized form of cellular division that creates four haploid gametes from a single diploid cell. In prophase I of meiosis, homologous chromosomes physically interact by pairing and exchanging genetic material through recombination. This is followed by the separation of chromosomes during the the first meiotic division. Inappropriate pairing and failed segregation of chromosomes can lead to improper chromosome rearrangements and aneuploidy. This can lead to birth defects, cancer and other diseases. In budding yeast, the Pch2 protein is involved in a meiotic recombination checkpoint that is responsible for the proper segregation of chromosomes by arresting cells that show abnormal crossover patterns. To further investigate Pch2 functions, a yeast two-hybrid assay was used that tests for physical binding between Pch2 and potential interactors. The sequences isolated from positive interactors were compared to the yeast genome to search for homology between known proteins. In addition, amino acid sequences were further analyzed for open reading frames and specific motifs that may function in other meiotic pathway. Currently, we have identified a total of five known protein interactors and four uncharacterized ORFs. With our results, we hope to further elucidate Pch2 and roles in meiosis.

Achieving Food Security Through Urban Agriculture: Environmental and Social Benefits

Grace Son
Sponsor: Kate Scow, Ph.D.
Land, Air, and Water Resources

Each day 800 million people go hungry and among them are 170 million children under five years of age. If we continue down this trajectory, 1.2 billion people are projected to go hungry by 2025. This misfortune is not driven by the lack of efficient technology to produce more food. To the contrary, there is enough food to provide every human being with 3,500 calories per day. Why the disproportionate discrepancy? Hunger today is caused by a number of factors with the largest being food commoditization in the world market and increased food prices as a result of the 2007-08 food crisis. Urban agriculture presents solutions to combat poverty while imparting environmental and social benefits and effectively closes the gap of food insecurity. Environmental benefits includee: decreases in the heat-island effect, mitigation of landslide events, low-impact drainage, and waste and wastewater reduction. It effectively creates a job market and keeps food distribution and processing close to the source - subsistence farming serves as a supplemental income for impoverished families who typically spend 60% of their income on food. This research promotes the establishment of community gardens and provides supportive evidence of the value of urban agriculture.

Determining the Role of Doxycycline in Preventing Maternal Immune Activation

Xiao Song
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Psychiatry and Behavioral Sciences

Appropriate functioning of microglia cells in the prenatal cerebral cortex is crucial for normal development. Recent studies have shown that maternal immune activation (MIA) during gestation increases the activation of fetal microglia, and increases phagocytosis of neural stem cells in the fetal neocortex, thus decreasing the number of neurons in fetal brains. This may contribute to the etiology of a number of neurodevelopmental disorders including autism and schizophrenia. Our study will determine if pharmacological agents administered during pregnancy attenuate the adverse impact of MIA on cortical development. Currently, we are testing the ability of doxycycline (Dox) to attenuate MIA by treating pregnant rats with LPS and Dox at the same time. Controls will include a group of animals treated with LPS only and another group treated with Dox only. Embryonic rats will be sacrificed, and their brains perfused, sectioned and immunostained so the number of neural stem cells and newborn neurons can be quantified. The results will provide insight in determining the capability of available pharmaceutical agents in preventing adverse effects of MIA on fetal brain development.

Examining the Connection Between Multiple Concussive Brain Injuries and the Early Development of Neurodegenerative Pathology

Anup N. Sonti
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Neurological Surgery

Clinical and animal studies of repetitive, concussive traumatic brain injuries (TBI), which are common in contact sports, suggest an increased likelihood of developing neurodegenerative diseases. The objective of this study is to determine whether cognitive deficits and neuropathology develop and progress up to 48 days after bilateral, multiple mild injuries in a rodent model. A detailed understanding of the temporal pattern of cognitive function and pathology can help guide therapy development. Twenty male Sprague-Dawley rats were randomly assigned to four groups: 16 (day) TBI, 16 Sham, 48 TBI and 48 Sham. All groups underwent identical surgical procedures, but TBI groups were subjected to a bilateral injury for two consecutive days. All animals were tested for cognitive function using three behavioral tasks. Immunohistology (ongoing) will be used to detect neuropathology. Behavioral abnormalities were suggested in the Metric task for the 48 day TBI group. The lack of cognitive deficits may be attributed to the selected injury paradigm, the sample size or, importantly, that cognitive deficits resulting from neuronal degeneration may require more time to manifest. Progressive neuropathology may lead to a gradual impairment of cognitive function at later (>48 days) times after multiple TBI's.

Drosophila melanogaster and *Drosophila simulans* Hybrids Contain all Somatic and Germline Cell-types Found in Non-hybrid Testis

Cindy Sotelo
Sponsor: Artyom Kopp, Ph.D.
Evolution and Ecology

The testes of the *Drosophila melanogaster* and *Drosophila simulans* hybrid are malformed, but the testes' cellular composition has not yet been established. I am determining the cellular composition and organization of cells present in the hybrid testis using antibodies to detect proteins that are both markers for specific cell-types and are critical for cell function. Preliminary data using antibodies for *Doublesex, Fasciclin III, Eyes Absent,* and *Nanos* indicate that the hybrid has the same cell-types as the parental species, but they are reduced in number. I hypothesize that the hybrid has all necessary cell-types to produce a functional testis, but that the organization of the cells is disrupted during development, which could be a contributing factor to sterility in hybrids. I plan to expand the set of antibodies being used and investigate expression throughout development to determine when the hybrid testis develops abnormalities. Future research will allow us to determine the cause of cell number reduction and ultimately, the possible causes for sterility.

Saharan Dust on Tropical Cyclone Forecasting

Nicholas J. Sowa
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Land, Air and Water Resources

The field of meteorology has made great stride in recent years in modeling. However, one of the greatest challenges remaining is forecasting the intensity and track of tropical cyclones (TCs). One area in particular that could potentially affect forecasts is the presence of dust originating from the Saharan Desert. The large amounts of dust being picked up and blown over the Atlantic Ocean from easterly winds could have numerous effects on tropical cyclone genesis, intensity, and track through dust-cloud-radiation interactions. This study aims to investigate whether current models have any deficiencies in forecasting TC paths in the presence of mineral dust. To accomplish this, model forecast results for the TCs in the years 2009-2011 from National Center for Atmospheric Research (NCAR) were compared with observations. Once any discrepancy is identified between the forecasted TC track and observations, the amount of dust in the region is studied using the aerosol optical depth generated from satellite instrumentation, specifically the Moderate Resolution Imaging Spectroradiometer (MODIS). Understanding if this particular aerosol is having an effect on TC propagation can help lead to further improvement in model forecasts.

Moore's Paradox and a Dichotomous Theory of Belief

Maxwell J. Sowell
Sponsor: Robert C. May, Ph.D.
Philosophy

Of all the paradoxes in philosophy of language, G.E. Moore's classic paradox may be the most confounding. The paradox is in how to determine the source of the absurdity of asserting *p and I don't believe that p.* I determined that the absurdity arises after making one mistaken assumption: the belief that leads to asserting *p* is indistinct from the belief that leads to asserting *I don't believe that p.* If the paradoxical sentences are equivalent in structure to their non-paradoxical equivalents, then there should be room for two different but related beliefs about *p.* I propose a modification to belief theory that allows two different categories of belief. One contains spontaneous beliefs, which are generated by evaluating evidence against belief standards in the context where the evidence appears. The other contains persistent beliefs, which resemble if-then arguments. A persistent belief is stored in the mind when one knows what the words in it means. Persistent beliefs allow us to make assertions based on understanding concepts instead of evaluating some spontaneous belief. Moorean sentences, therefore, can be utterances of substantive meaning, and only seem absurd when the two beliefs they contain are assumed to be identical.

Gall Insect Richness Increases with Size but Not Age of Big Sagebrush (*Artemisia tridentata*)

Kayla A. Spawton
Sponsor: Donald R. Strong, Ph.D.
Evolution and Ecology

Plants can be used by insects for protection and nutrition, and the composition of insect herbivore communities may change with plant size or age. The plant architecture hypothesis states insect species richness will increase with plant size. Evidence for this confounds plant size and age because larger plants tend to be older in many systems. To separate these effects, I evaluated galling insect communities on sagebrush - a shrub that dies back in a way that gives small old plants. I identified 11 gall (feeding structures for larvae) species and recorded morphological measurements of plants that varied separately in size and age. I found that most of the variation in species richness and total number of galls is due to plant size with leaf size also contributing to the variation. On the other hand, stem diameter, a proxy for plant age, has no relationship with species richness or gall abundance. Species composition was roughly proportional to foliage volume independent of age. These results suggest that patterns supporting the plant architecture hypothesis could be driven primarily by plant size and not plant age per se. Therefore, the host plant's ontogeny alone may not be important in the development of herbivorous insect communities.

Comparative Mythology in T.S. Eliot's, *The Waste Land*

Leonna Spilman
Sponsor: Gregory Dobbins, Ph.D.
English

Eliot's *The Waste Land* engages a multitude of mythological references in order to augment the poem's depiction of modern society as littered with decayed traditions of knowledge. Eliot illustrates a diagnosis of society on a scale that includes, as well as moves beyond, the western to the Indo-European tradition. In this way, Eliot challenges society's command of myth and connects this command to the decay of a symbolic form of fertility in society. I will argue that the wasteland's convolution of myth imagistically exposes modern Indo-European's convolution of previous ideologies that are manifested in myth. Specifically, the morphing of the narrator from fisher king, Eliot himself, Tiresias, and often times a voice that seams to account for all of humanity, reflects the connection that the wasteland's allusions draws between different myths. *The Waste Land* connects these myths in terms of psychological, structural and linguistic similarities as well as reflects the debris-like nature of our modern understanding of these traditions. In order to understand the Indo-European's social struggle, it is imperative that the humanities as a field examines the way that works, such as *The Waste Land* grapple with the underlying connections between Indo-European myths.

Role of PPARγ in Persistent Infection by *Brucella*

Matthew A. Stange
Sponsor: Renee Tsolis, Ph.D.
Medical Microbiology & Immunology

Brucella spp. are zoonotic bacterial pathogens that can cause a chronic infection, acquired by ingestion of contaminated food or contact with an infected animal. In chronically infected hosts, bacteria are found within macrophages. Recent research has identified a new type of macrophage involved with the healing process called the alternatively activated macrophage (AAM). We hypothesized that these newly discovered macrophages contribute to the increased *Brucella* persistence during chronic infection. Indeed, we found increased numbers of AAM in spleens of chronically infected mice. Additionally, *B. abortus* was able to survive better inside AAM *in vitro.* To understand the mechanism behind this connection, we looked at PPARγ, a receptor responsible for controlling macrophage metabolism, that showed elevated expression levels within *B. abortus*-infected AAM. To determine whether elevated PPARγ expression in macrophages promotes chronic brucellosis, we will use the Cre-lox system to generate mice lacking PPARγ expression specifically in macrophages, known as conditionally deficient mice. If we recover significantly fewer bacteria in the conditionally deficient mice, it will support our hypothesis that PPARγ upregulation in AAM contributes to increased persistence of *Brucella* in these cells. This could identify PPARγ as a therapeutic target for treatment of chronic infection.

Staurocladian Morphology

Weston T. Stauffer
Sponsor: Rick Grosberg, Ph.D.
Evolution and Ecology

Staurocladia are a genus of Hydrozoans within the phylum Cnidaria. At the distal tips of *Staurocladia's* tentacles, cnidocytes form bulbs by clustering together. Some of these bulbs of cells function as stinging cells, while others seem to serve adhesive purposes. The structure and organization of cells in the tentacle bulbs of this genus has never been observed in great detail. Here we utilize primary antibodies that bind to nerve cells, neurotransmitters, muscle tissues, and nuclei, in conjunction with fluorescent secondary antibodies, to observe and characterize the cellular structure of staurocladian tissues using confocal microscopy. The unique organization and structure of these cells reveals a great deal about how they function. In particular, the distal tips of the large, stenotele cnidocyte bearing tentacle bulbs house novel neuronal structures that may interact with light. This study provides a crucial starting point for future investigations into the functional morphology of *Staurocladia*, and its evolutionary significance.

Predicting Acute Kidney Injury Using a Novel Quantitative Analysis Method During Burn Resuscitation

Amanda Steele
Sponsor: Nam K. Tran, Ph.D.
Pathology

Burn patients are at high-risk for acute kidney injury (AKI) due to inadequate resuscitation. Serum creatinine is routinely used for diagnosing AKI, but these methods are inaccurate in critically ill patients. Plasma neutrophil gelatinase associated lipocalin (NGAL) has emerged as a potential biomarker for predicting AKI. NGAL levels and variability may better quantify AKI severity. Therefore, we have implemented a novel area under the curve (AUC) analysis method to quantify ranges of NGAL levels in comparison to creatinine for severely burned patients. We conducted a pilot observational study consisting of 15 adult patients with ≥20% total body surface area burns. NGAL and creatinine measurements were determined every 4 hours during the first 48 hours of admission. AKI was determined based on the RIFLE criteria and AUC analysis was performed using kinetic software. Discrete creatinine levels were similar between AKI and non-AKI patients and were not a good predictor of AKI. However, creatinine time below the reference interval was a significant predictor of AKI. Additionally, the AUC for NGAL above the reference interval was a significant predictor for AKI. We believe that implementation of this AUC analysis method could potentially decrease the mortality rate associated with AKI in severe burn injury.

Celebrity Culture in *The Hunger Games* and *The Fault In Our Stars*

Shauna Stewart
Sponsor: Frances Dolan, Ph.D.
English

As young adult literature has come to the forefront of the public's consciousness, thanks in part to the success of *Harry Potter, Twilight,* and *The Hunger Games* series and films, it demands critical analysis. While many argue against the legitimacy of teen-targeted fiction, the genre has expanded its readership beyond young adults. I argue that the appeal of these works lies in part in the communities that tend to crop up around them-an appeal that is related to the link between young adult literature and celebrity culture. The social commentary that young adult fiction can provide is evident in the novels I will discuss: John Green's, *The Fault In Our Stars* and Suzanne Collins's, *The Hunger Games.* Both novels address celebrity culture for teenagers and Western culture as a whole. Green's novel represents a cautionary tale about the celebrity phenomenon while Collins's novel is a prediction of a dystopian future driven by the cultural reality show obsession. In studying excerpts from these two novels we can begin to explore not only the ability of young adult literature to address social issues but also more specifically how the genre is interacting with the celebrity phenomenon.

Interactive Two Dimensional Surface

Michael Sticlaru
Sponsor: André Knoesen, Ph.D.
Electrical and Computer Engineering

The purpose of this project is to create an interactive exhibit that attracts an audience of all ages to electronics and engineering as a whole. What is a better way to appeal to such an audience than to utilize not just the visuals but also sound and touch? Rather than build a grid board consisting of only tri-colored light emitting diodes that only presents visual appeal with no interaction, we combine the lights with proximity sensors to produce a stimulating response for the user. Set with a square matrix grid, the interactive two dimensional surface uses proximity sensors to respond to the user. As the user interacts with the surface, the proximity sensors react to the reflections in infrared light, sending signals to the micro-controller which then turns on the respective light emitting diode and sound device in the grid. We will make the interactive two dimensional surface of the table holding the printed circuit boards of individual components detachable, allowing users to learn and see how the parts are put together to make the system work. The table will also be programmed with simple games such as paint, puzzle blocks, and a music mode to encourage user interaction.

"The Writer Should Never Be Ashamed of Staring": A Study of Flannery O'Connor's Form

Annemarie A. Stone
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English

What is compelling about the short story form that is not found in longer forms, like the novel? American writer and essayist Flannery O'Connor provided a curious answer to that question when she declared in *Writing Short Stories*, "Meaning is what keeps the short story from being short. . . A story is a way to say something that can't be said any other way. . . You tell a story because a statement would be inadequate." Form is surely a significant aspect for both the writer and the critic to consider in relation to meaning. O'Connor's insight compels me to also contemplate the role of authorial intent and biography in literary criticism as well as how those two pieces of literary research intersect with the intentional form and meaning of a short story. Using O'Connor's corpus - including one of her two novels, thirty-two short stories, as well as a handful of her numerous letters, essays, and lectures - as my specimen, I look at how her intended meaning may only successfully manifest in a short form.

Invertebrate Fossil Correlation to Climate Trends in Sediment Core MD02-2504 From Santa Barbara Basin in the Past 24,000 Years

Miranda M. Stripe
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Geology

Throughout the past 24,000 years, ocean oxygenation offshore Southern California has been shown to fluctuate dramatically, with higher oxygenation during cold periods (glacial, stadial) and low oxygen (hypoxia) during warm events (interglacial, interstadial). To identify patterns between invertebrate community structure and varying oxygenation levels, I quantified invertebrate assemblages in Core MD02-2504 (481 m; Santa Barbara Basin, California) between modern and 24,000 years ago. These assemblages included ostracods, molluscs, and echinoderms, where molluscs were classified to their lowest taxonomic grouping. Mollusc and ostracod densities were predicted to increase with cooler, oxygenated periods and decrease in warmer, hypoxic intervals. Strong correlation between seafloor community structure and oxygen levels were found, with greatest invertebrate abundances (0.4-12.4 fossils/cm^3) occurring during the Last Glacial Maximum (~18,000 years ago). During the rapid warming of the glacial termination and the Bølling/Allerød (12,800-14,700 years ago), assemblages became near nonexistent (<1.2 fossils/cm^3), and did not appear to recover in the brief Younger Dryas cold interval (11,500-12,800 years ago). This research indicates how marine invertebrate assemblages in the deep sea can rapidly respond to changes in climate and oxygenation. Thus, further analysis and investigation of this correlation can elucidate the relationships between invertebrate community structure and rapid climate change.

Mind Wandering and Working Memory

Chun M. Su
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Psychology

Mind wandering is a ubiquitous phenomenon in which attention shifts from external stimuli to the processing of internal thoughts and feelings. The goal of this study was to examine the relation between mind wandering and working memory, the "mental workspace" that actively holds and manipulates information. Two theoretical views of mind wandering posit diametrical predictions about the relation between mind wandering and working memory. Smallwood and Schooler (2006) argue that individuals who are high in working-memory capacity have the resources to support both task processing and mind wandering, predicting a positive relation between the two. McVay and Kane (2010), in contrast, argue that mind wandering is a failure of executive control to suppress off-task thoughts. Individuals who are high in capacity are less prone to executive failure, thus, they should mind wander less than individuals who are low in capacity, thereby predicting a negative relation between the two. 77 undergraduates completed tasks measuring their working memory capacity and a reading task in which they were assessed for off-task thoughts. We found that high capacity individuals mind wandered more than low capacity individuals. Consequently, our finding supports Smallwood and Schooler's view of mind wandering as a resource-demanding phenomenon.

Optimizing Genetically Encoded Biosensors for the Second Messengers Ca^{2+} and DAG

Linda Su
Sponsor: Julie Bossuyt, Ph.D.
Pharmacology

Calcium (Ca^{2+}) and diacylglycerol (DAG) are universal second messengers that couple various stimuli to signaling pathways that control cardiac electrical activity and contraction. They are also at the core of adverse signaling pathways leading to cardiac dysfunction. Indeed, the spatial and temporal profiles of these signals are strictly controlled in order to achieve both diversity and specificity of cellular outcomes. Recently, local nuclear Ca^{2+} signals were shown to mediate cardiac remodeling amid the global Ca^{2+} oscillations underlying contraction. These types of observations highlight the need for biosensors allowing for the detection of microdomain signaling. Here we try to optimize and assess two novel genetically encoded sensors for Ca^{2+} and DAG, GCaMP and Upward/Downward DAG. These sensors have the advantage that they can be targeted to discrete microdomains such as specific Ca^{2+} release sites, signaling scaffolds, and organelles. The ability to monitor the spatiotemporal dynamics of Ca^{2+} and DAG (even simultaneously) will be key in unraveling the complexities of the signaling processes in cardiac excitation-contraction and transcription coupling.

High-throughput Drug Combination Screening of Melanoma on GD3 Ganglioside-printed Hydrogel

Hawa Sultani
Sponsor: Emanuel Maverakis, M.D.
Dermatology

Metastatic melanoma has a high mortality rate because current FDA approved therapeutic treatments are ineffective at eliminating malignant tumor cells. Aiming to find a novel therapeutic treatment, we are characterizing melanoma cells using ganglioside markers. Ganglioside markers are composed of glyscosphyngolipids and play multiple roles in cells. The marker we are focusing on is GD3 ganglioside. For my study, I hypothesized that melanoma cells will have higher GD3 ganglioside expression than melanocytes, the progenitor of melanoma cells. To test this hypothesis, I cultured commercial melanoma (SK-MEL-5) and normal cell lines and labeled each cell line with a fluorescence marker that targets GD3+ ganglioside. In the melanoma cell line, 97.4% of the population expressed the GD3 marker, while in the normal cell line, 9.6% of the population expressed the GD3 marker. With this information, we can use the marker in further research involving the micropattern co-culture technique to examine the effect of various FDA approved drug combinations. Throughout the treatment, GD3 markers will be used as a tracker to display the effectiveness of the drug combination. This procedure will provide information about effective drug combinations and optimal dosages to be administered to metastatic melanoma patients.

"Molecular Movies" of Atomic Motion with Multi-energy Photoelectron Holography: A Theoretical Study

Xiaolan Sun
Sponsor: Charles Fadley, Ph.D.
Physics

The emerging availability of very short x-ray pulses from free-electron lasers that go down into the 10^{-15} second regime which is faster than typical atomic motions has led to the exciting prospect of using photoelectron holography to directly image molecular dissociations or reactions in real time:"molecular movies". These images are obtained by a Fourier-transform like procedure that is applied to the experimental data. In this research, we extended a recent theoretical study of the imaging of the molecule chlorobenzene by Krasniqi et al., in the Physical Review A 81, 033411 (2010) so as to look at two critical questions concerning the optimum type of data for such holographic imaging: the choice of photoelectron kinetic energy, and the use of a single energy or multiple energies. After verifying that our calculations duplicate those in this prior paper, we show that using multiple lower energies is preferable to single higher energies for image quality, a result consistent with prior photoelectron holography studies at surfaces. Although the amount of data required for multi-energy holography is roughly an order of magnitude higher than for single energy, the improvements on the images suggest this as the optimum ultimate future strategy for such dynamic imaging.

Improvements in Attentional Control with Transcranial Direct Current Stimulation

Ashley E. Symons
Sponsor: Steven J. Luck, Ph.D.
Psychology

Our visual systems are bombarded with more stimuli than our brains can process. Fortunately, we have well-developed attentional mechanisms that allow us to select the information that is most important to our goals. However, sometimes our attention is distracted by salient stimuli, such as shiny objects. The present study explored whether the ability to exert attentional control to avoid distraction can be improved with transcranial direct current stimulation (tDCS), which uses a mild electric current to alter the firing rate of neurons. Participants searched for a target circle among diamonds and identified whether the circle contained a horizontal or vertical line. On half of the trials, all items were the same color; on the other half, one diamond was a different color. Reaction time was compared between trials on which the color distractor was present and trials on which the distractor was absent. Participants completed the task under 3 conditions: before stimulation, during 20 minutes of either anodal stimulation (2.0 mA) or sham stimulation (0.1 mA), and following stimulation. Preliminary results indicate that tDCS applied to the right posterior parietal cortex can improve the ability to overcome capture of attention by salient distractors, suggesting that tDCS may boost attentional control.

Role of Nuclear Positioning in Zebrafish Lateral Line Collective Cellular Migration

Sumitra D. Tatapudy
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Molecular and Cellular Biology

The formation of the zebrafish lateral line is characterized by a kind of collective migration in which a group of cells move in a particular direction, depositing clusters of cells along migratory paths that form sensory organs. There is no information about how the positions of nuclei affect subsequent cell migration events. This study attempts to bridge this knowledge gap by exploring the role of nuclear migration in zebrafish lateral line cells. We hypothesize that a change in nuclear positioning occurs in the tip cells at the leading edge of the migratory cluster. The dominant negative approach was employed by using Gateway Recombination to create a DNA construct to over express the KASH domain, causing an excess of KASH proteins to localize to the outer membrane and outcompete endogenous KASH proteins. This perturbation is predicted to disrupt nuclear repositioning prior to cell migration. Fluorescent microscopy techniques are expected to reveal a mutant phenotype that demonstrates that nuclear repositioning is necessary for collective cell migration. As zebra fish lateral cells migrate in a collective manner similar to breast cancer metastasizing cells, results from this should inform the field of potential breast cancer drug targets.

Low Threshold Flight Response of Walnut Twig Beetle, *Pityophthorus juglandis*, to Male-produced Aggregation Pheromone

Kristina J. Tatiossian
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Entomology

Walnut twig beetles (WTB), *Pityophthorus juglandis*, are native to New Mexico, Arizona, California, and Mexico. They have recently invaded most of the western U.S. as well as Pennsylvania, Tennessee, and Virginia. WTB vector a potent fungal pathogen, *Geosmithia morbida*, that has been documented to kill a healthy walnut tree (*Juglans* spp.) in under three years. *G. morbida* infects phloem tissue surrounding WTB galleries. Numerous localized oozing infections have led to the common name of the disease: Thousand cankers disease. Male WTB initiate new galleries and produce an aggregation pheromone that can be utilized to study patterns of initial host colonization behavior. It has been previously shown by Graves and colleagues (2010) that as the number of males in a branch increases from 20 to 200, the flight response of conspecifics similarly increases. This study was conducted to determine the low threshold number of males necessary in an infested branch of northern California black walnut, *Juglans hindsii*, to initiate conspecific host aggregation.

Kreñòl: A New Language in Hispaniola?

L. Carolina Tavárez Varela
Sponsor: Cecilia M. Colombi, Ph.D.
Spanish and Portuguese

Hispaniola, known today as Haiti and the Dominican Republic (DR), was "discovered" by Columbus in 1492. French and Haitian Creole (Kreyòl) are spoken in Haiti while the DR speaks Spanish (Español). Scholars from a wide range of disciplines have approached Hispaniola to study its historical and cultural richness. However, they have not yet addressed the relationships between the languages spoken on the island or how these linguistic barriers impact the economic and social interactions between the two countries. This study investigates language interactions of Haitian Creole and Dominican Spanish speakers in the border city of Anse-à-Pitres, Haiti. The study looks at 20 hours of recorded natural speech between Dominican Spanish and Haitian Creole speakers interacting at the main market in the city. These speakers employed a newly emerging pidgin language that I call *Kreñòl*. *Kreñòl* can be defined as the verbal encounter of Haitian and Dominican civilizations. In this research I have examined the meanings that are constructed by bilingual speakers of Haitian *Kreyòl* and Dominican Español when they combine both languages to create Kreñòl.

Housing Strategies to Improve Calf Well-being During Weaning

Alexandra N. Taylor
Sponsor: Frank M. Mitloehner, Ph.D.
Animal Science

The goal of this research is to examine alternative housing systems for dairy bull calves and to assess current industry standards in terms of animal well-being and productivity. The immune function and growth rate of individually (IND) versus group (GRP) housed calves were compared througout weaning. Eighty Holstein bull calves were randomly assigned to IND or GRP housing at 4 days of age. Calves were fed 227 g of milk replacer (MR) twice-daily until weaning and offered ad libitum calf-starter throughout. Calves were weaned days 53-64 by stepwise transition off MR. Average daily gain (ADG) was calculated and GRP calves were ranked into three categories: high, mid, and low. Well-being and immune function were determined via complete blood counts, cortisol, haptaglobin, flow cytometry, immunoglobin-IgG, whole blood killing of *E. coli*, and other factors. ADG was comparable between IND and GRP calves and IND calves were less stressed than GRP calves during weaning. Within GRP, mid calves were the least immunocompromised during weaning. Results indicate that GRP is a viable option though future research is needed to assess management strategies.

Lights, Camera, Action! Studying the Effects of Wave Action on Intertidal Snail *Chlorostoma (Tegula) Funebralis* Behaviour with Underwater Cameras

Austin W. Taylor
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Environmental Science and Policy

Nearly all of our understanding of rocky intertidal ecology comes from studies conducted at low tide, but we have little understanding of processes occurring during high tide. We used a waterproof camera (GoPro) anchored in a wave-exposed intertidal environment to film the movements of the black turban snail *Chlorostoma funebralis* throughout the tidal cycle. ImageJ software was used to calculate average speed and vertical movement of snails. *C. funebralis* increased activity and moved in an upward direction for one hour surrounding the first wave of flood tide, which could suggest a chronobiological phenomena. Activity levels are low during high tide, probably to avoid dislodgment by waves. Snails may also be entering and leaving pools at high tide. No marked changes in activity occurred after the last wave of ebb tide; but snails tended to move downward, perhaps to avoid high temperature and salinity at the tidepool surface. Activity levels further decreased as low tide progressed, perhaps in response to physiological stress. This is one of the first projects to record activity of organisms in the wave-exposed intertidal at high tide, and the inexpensive methods used here are easily transferable for recording high tide activities of intertidal organisms.

Unsupervised Learning of Environments on a Simple Robotic Platform

Kevin D. Taylor
Sponsor: James Crutchfield, Ph.D.
Physics

A simple robotic agent faces the difficulty of building a complex model of behavior from a small set of sensors. Complex behaviors typically require complex models of the robot's environment, a large number of sensors, or external supervision and correction. Here I investigate the ability of a simple robot with a small set of sensors to exhibit complex behavior, through the use of unsupervised learning algorithms. Using a simulation (including simulated noise) as well as a physical robot, I assess the ability of the agent, or of multiple agents, to produce "good" behaviors, according to the chosen learning goal. The robot's behavior model is constructed by reinforcement learning algorithms, which enhance and reward "good" behavior. I compare the behavior produced by different learning algorithms when the robot is placed in different environments, and when different learning goals are specified. These new methods will shed light on the ability of a simple system to model and behave correctly in a complex environment, using learning algorithms with limited input.

The Relationship Between Breakfast Consumption and Physical Activity Levels in Healthy, Premenopausal Women

Hilary Teaford
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Nutrition

Though breakfast consumption is generally accepted as a behavior that is associated with a healthy body weight and good health, research has not fully identified the mechanisms by which breakfast eaters reap such benefits. My research compared the physical activity levels of breakfast eaters and breakfast skippers to determine whether increased amounts of exercise among eaters could help explain their overall better wellbeing. In the study, healthy premenopausal women between the ages of 20-45 who either regularly ate breakfast or regularly skipped breakfast wore an Actical accelerometer, a type of activity monitor, for one week. The Actical recorded the amount of time and energy expended in light, moderate and vigorous activity. The results indicated that compared to skippers, breakfast eaters expended significantly more energy overall in physical activity and spent more time exercising at each of the three levels of activity. Though it remains unclear whether physiological or behavioral reasons account for the differences in activity between eaters and skippers, the results of this study suggest increased exercise as one way that breakfast eaters achieve healthier body weights and enjoy better health.

Angiopoietin-like 4 in Bone Fracture: An *In Vitro* Model of Hypoxia and Differentiation

Meghan Teague
Sponsor: Clare Yellowley, Ph.D.
Anatomy, Physiology and Cell Biology

Angiopoietin-like protein 4 (Angptl4) is a multi-functional signal protein that can act locally and travel through the bloodstream. It is essential in communication between multiple organs and regulates events of angiogenesis and cell differentiation. Because disruption of the vascular supply to the bone occurs at a fracture site, we used an *in vitro* cell model to investigate the role of Angptl4 in hypoxia, differentiation, and migration of osteoblasts, all of which occur during bone fracture repair. Our hypothesis was that Angptl4 would be up-regulated under hypoxic conditions present at a fracture site. Mouse precursor osteoblasts (MC3T3-E1) were exposed to 1% oxygen and Angptl4 gene expression levels were measured for up to 48 hours. In addition, we differentiated MC3T3-E1 cells into osteoblasts. Angptl4 expression increased maximally at 2 weeks. Although Angptl4 expression increased during differentiation, addition of Angptl4 to differentiation media did not appear to increase mineralization, nor did Angptl4 affect migration of these cells. Our data suggests that osteoblasts upregulate their production of Angptl4 under low oxygen conditions such as those found at a fracture site. Further studies are required to determine whether increased production of Angptl4 under these circumstances might contribute to angiogenesis during fracture healing.

The Effects of Ovipositor Morphology on Fruit Susceptibility in *Drosophila*

Lisa Teixeira
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Evolution and Ecology

While most fruit flies in the genus *Drosophila* lay their eggs in rotting fruit, the agricultural pest *Drosophila suzukii* is capable of penetrating the skin of undamaged, ripening fruit and ovipositing there. This ability may be the consequence of the evolution of a serrated, pointed ovipositor, an innovation that occurred in the ancestor of *D. suzukii* and its sister-species, *Drosophila subpulchrella*. The relationship between ovipositor morphology and fruit susceptibility, however, has not been studied in depth. We compared the susceptibility of four fruits to *D. suzukii, D. subpulchrella* and two closely related species with non-serrated ovipositors. While all four species will lay their eggs in damaged regions of the fruits, only those with serrated ovipositors can puncture intact fruit skin. Interestingly, while both *D. suzukii* and *D. subpulchrella* can oviposit in undamaged areas of soft-skinned fruits such as raspberries, only *D. suzukii* is capable of puncturing the thick skin of grapes. Our results provide evidence that the evolution of a new type of ovipositor was associated with enhanced abilities to puncture fruit, and suggest that *D. subpulchrella*, which has not been reported as a pest outside of its native habitat, has the potential to become one.

Contributions of Maternal Parasympathetic Regulation and Young Children's Behavior to Supportive and Aversive Parenting

Julia R. ter Haar
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Psychology

Variability in maternal parasympathetic regulation has been linked to differences in emotion regulation and responsive caregiving with their young children. There is evidence that greater reduction in maternal respiratory sinus arrhythmia (RSA), an index of parasympathetic regulation, during a demanding task facilitates regulatory control of behavior and emotion while interacting with children. However, other factors also affect maternal behavior, including children's behaviors and reactions during interactions. This study examined the joint contributions of maternal parasympathetic regulation and children's behavior to supportive, controlling and negative parenting behavior during a challenging interaction. The participants were 70 mother-child dyads who were observed while mothers aided their 3½ year-old child in completing a difficult puzzle. Maternal RSA was recorded throughout the puzzle using an ambulatory electrocardiographic monitor, and during a relaxed baseline. Children's levels of competence, cooperativeness, and emotional arousal, and mothers' parenting behavior, were coded from the digitally recorded interactions. Modeling analyses are expected to reveal that mothers with weaker parasympathetic regulation engage in more controlling or negative parenting when their children are less competent, cooperative and calm during the puzzle. Conversely, greater maternal regulatory control should buffer against adverse parenting behaviors when faced with a difficult or noncompliant child.

The Development of Hippocampal Subfields: A Volumetric Analysis

Abbie Thompson
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Psychology

Episodic memory, the capacity to remember the events of our lives and their associated contextual details, critically depends upon the hippocampus. The hippocampus is comprised of several sub-regions that exhibit distinct cytoarchitecture: the dentate gyrus, subiculum and cornu ammonis subfields 1, 2, and 3. Research has demonstrated that the overall hippocampal volume shows little developmental change over childhood and adolescence; however, the anterior third of the hippocampus declines in volume while the posterior third increases in volume. Little is known about this change, except that there is continued myelination in several subfields across development. The aim of the current study is to understand the development of the subfields in the anterior and posterior portions of the hippocampus through MR imaging that collects high-resolution structural images, which allow for volumetric segmentation. It is expected that this study will replicate research that anterior and posterior extents of the hippocampus will show opposite developmental trends. This research will provide insights for future examinations on the functional implications of these developmental changes on memory.

Quantitatively Measuring the Accuracy of Tissue Slicing in *Ex Vivo* Breast Tissue Analysis

Megan Thompson
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Biomedical Engineering

Highly accurate imaging is crucial in the diagnosis and treatment of breast cancer. Novel *in vivo* imaging modalities must be compared to *ex vivo* histopathology of tissue surgically removed during mastectomies. In an ongoing study in the Molecular and Translational Imaging Laboratory at the UC Davis Medical Center, breast tissue samples are analyzed both *in vivo* and *ex vivo*. Computed tomography (CT) scans of the intact surgically removed tissue are taken. The tissue is then sliced in 2-3 mm parallel slices for *ex vivo* analysis. The tissue often distorts as a result of this slicing process. I am creating and implementing a software program which can determine the accuracy of the slicing process by quantitatively establishing the degree of tissue displacement by comparing x-rays of the individual slices to CT images of the intact sample. This displacement is expressed as a vector in mm and degrees displacement. To accomplish this, I scale and overlay the images to check the equivalence of their coordinate systems. I am also creating a GUI allowing the user to select comparable points between the two images. This data is used to compute a quantitative metric of the spatial distortion between whole and sliced tissue samples.

Fast Photon Simulation in LUX

Daniel P. Thorngren
Sponsor: Mani Tripathi, Ph.D.
Physics

The simulation of particle interactions is a vital component of detector physics. For the Large Underground Xenon Experiment (LUX), an emphasis is placed on vacuum ultraviolet photons, because these are the particles the detector is designed to directly observe. Though necessary for perceiving low-energy interactions, this focus has a downside: in high energy events, such as the Cesium-137 (662 keV gamma) events used for calibration, extremely large numbers of photons are generated. Since each photon is individually tracked, this is computationally expensive to simulate. This project seeks to expedite the process by bypassing individual photon tracking. Instead, photons are treated in groups, and their eventual destinations are calculated probabilistically. Since these photons are generated isotropically, the only initial parameter affecting their destination is where they were generated. The probability of landing in each PMT (detector) can be sampled across the detector, and interpolated to estimate it in intermediate positions. Future simulations can then use these probabilities and Poissonian statistics to predict plausible photon destinations quickly, without needing to propagate them as before. The result is substantially faster simulations of high energy events.

Adelita in *Charrería*: A Contemporary Look to the Escaramuza Attire

Denise Tirado
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Design

Charrería, the equestrian national sport with roots from sixteenth century Spain, is one of the most well known Mexican traditions that is still practiced today. The *charro*, the male performer, has become a national symbol of Mexico, and in general *charrería* is centralized on the *charro* doing nine dangerous and challenging events. However, at some point in the competition, a small group of women have their single event called the *Escaramuza*. These women ride sidesaddle at high speeds in voluminous *Adelita* dresses. These amazing dresses and their motifs have inspired me to focus on these women so they would gain more recognition for their hard work. The strict dress code of cotton-like fabrics for the sport has allowed me to "break the rules" and modernize their fabrics and motifs used on their attire to create a fashion line. My research includes studying the vibrant color combinations, dyeing, and the intricate embroidery embellishments and motifs used on the *Adelita* dresses to raise awareness of the women and this thrilling traditional sport of *charrería*.

Increased Proliferation of Intestinal Epithelial Cells In Early SIV Infection

Aicha Toure
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Medical Microbiology & Immunology

HIV disrupts the immune system by infecting and killing CD4+ T-cell, which are a pivotal component of the immune response. The gastrointestinal mucosa is an early target of HIV. The intestinal epithelium plays a critical role in the protection of the intestinal mucosa from luminal environment and enteric pathogens. Recent data from our lab showed damage to the epithelial tight junction barrier of the gut as early as 2.5 days post infection (PI). In our study we investigate whether at this early time-point of epithelial damage there is increased intestinal epithelial cell proliferation, causing mislocalization of immature epithelial cells. To assess intestinal epithelial proliferation we performed Ki67 immunohistochemical staining of ileal tissue from 2.5 day SIV infected rhesus macaques, a model for HIV infection. Ki67 is a proliferation marker expressed during mitosis. In SIV infected animals we observed proliferating cells significantly higher up the villus, as compared to uninfected controls, where proliferating cells were limited to crypt regions. These data dually suggest that the increased presence of proliferating epithelial cells in the villi are replacing the SIV damaged epithelium, but also the mislocalization of immature cells can also be contributing to decrease tight junction protein expression in early SIV infection.

Regulatory Mechanisms Underlying Stereotyped Axon Pruning in the Mammalian Visual System

Atrin Toussi
Sponsor: Hwai-Jong Cheng, M.D., Ph.D.
Neurobiology, Physiology, and Behavior

Precise neuronal connections across multiple regions of the brain constitute functional sensory system circuitry. In the mammalian visual network, information is relayed from the retina, through dorsal lateral geniculate nucleus, to primary visual cortex (V1) and then to subcortical regions. Previous studies in rodents have shown that V1 projections initially overextend to the spinal cord, and later these visual corticospinal tract (CST) axons are refined back to hindbrain in a process termed stereotyped axon pruning. The Cheng Laboratory has recently shown in mice that intrinsic spontaneous retinal waves, not extrinsic visual stimulation after eye opening, are necessary for visual CST pruning. However, it remains unknown whether these findings apply to visual development in higher order mammalian species. To address this issue, we comparatively examine visual CST development in the ferret. We performed anterograde neuroanatomical tracer injections into V1 at different ages, and our preliminary data shows that visual CST axon pruning occurs during the developmental stage of spontaneous retinal waves and prior to eye-opening. This indicates that spontaneous retinal waves are necessary in both ferret and mouse for visual CST pruning and are therefore likely to be conserved in other higher order mammalian species.

TIN2 Mutations in Dyskeratosis Congenita are Haplo-insufficient

Duy C. Tran
Sponsor: Lifeng Xu, Ph.D.
Microbiology and Molecular Genetics

The ends of eukaryotic chromosomes are composed of repetitive telomere sequences which prevent the loss of genetic information and maintain chromosome integrity. Human telomeres are associated with a protein complex, called shelterin, which regulates the activity and binding of telomerase, a multi-subunit reverse transcriptase. Expression of telomerase in highly proliferative tissue helps maintain a constant telomere length. Heterozygous mutations within one of the shelterin subunits, TIN2, or mutations within telomerase components have been identified in patients with Dyskeratosis Congenita (DC), a bone marrow condition. All DC patients have extremely short telomeres. Although the telomerase mutations impair telomerase from functioning properly, it is unknown how the TIN2 mutations affect telomere maintenance. I hypothesize that heterozygous mutations within the TIN2 gene are haplo-insufficient and thus are able to interfere with telomerase's ability to elongate the telomeres. To test this, engineered cell lines heterozygous for a TIN2 DC mutation (R282H) or homozygous for wild-type TIN2 were developed using Zinc Finger Nuclease aided homologous recombination. The engineered clones were confirmed by Southern blot analysis and sequencing. Passaging of mutant clones over time led to accelerated telomere shortening as compared to wild-type clones which suggests the haplo-insufficient nature of TIN2 mutations.

Interactive 2D Surface: Design Procedures from Prototype to Final Product

Jacqueline M. Tran
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Electrical and Computer Engineering

The purpose of this project is to create an interactive surface to stimulate the senses of touch, sight, and sound. The surface appeals to three senses through a 10x10 array of pixels, each equipped with an infrared proximity sensor and a red, green, and blue light-emitting diode (RGB LED), in conjunction with a sound synthesizer. In order to create a functional device, the design evolves through prototyping stages. First, the components are identified and wired to construct one interactive touch pixel on a solderless breadboard. The solderless breadboard allows quick changes to the design due to its temporary prototyping feature. After creating a working configuration for the pixel, a more durable second generation prototype is designed for each pixel using printed circuit board (PCB) layout design software. Prior to sending the layout to a circuit board manufacturer, we verified the design by making a simpler board using an image transfer process combined with chemical etching. We constructed the interactive touch surface and populated the PCBs by soldering each surface-mount and through-hole component. Finally, the interactive surface is integrated to a microcontroller to read the proximity sensors and control the RGB LEDs.

Investigating the Interaction Between the LEAFY COTYLEDON 1 and bZIP67 Regulators in Embryogenesis of *Arabidopsis*

John D. Tran
Sponsor: John J. Harada, Ph.D.
Plant Biology

Seed development is important in the life of angiosperm plants. The capabilities of seeds to store proteins and nutrients, and promote desiccation tolerance of the embryo, make seeds an essential stage in the development of angiosperms. We are interested in embryogenesis during seed development in the plant *Arabidopsis*. This research investigates one of the vital regulators of embryogenesis, LEAFY COTYLEDON 1 (LEC1), which is a transcription factor that plays a central role in the regulation of embryo development. Mutation in the LEC1 gene leads to defects in broad aspects of the maturation process, and thus it is regarded as a master regulator of embryogenesis. We are also interested in bZIP67, another transcription factor in embryo development. Data suggests that bZIP67 may interact with LEC1 to form a protein complex. Our goal is to determine if bZIP67 physically interacts with LEC1 and understand all the subunits that form the protein complex by conducting a series of yeast hybrid experiments. The significance of this study will broaden our understanding of embryogenesis regulation.

Mao Zedong: Challenging Calligraphy within Strict Conventions

Daniel A. Trejo
Sponsor: Katharine P. Burnett, Ph.D.
Art History

Calligraphy (*shufa*) is an ancient art form that is widely celebrated in China. It has flourished for over 3,000 years and strives to make the written script appear aesthetically pleasing. Chinese Calligraphy was very important to the literati (*wenren*) in imperial China, because it was a representation of an official's sophistication. After the fall of the Qing dynasty along with the discontinuation of the civil services examinations, Mao Zedong's Communist ideals spread years after. Old traditions such as classical calligraphy were discouraged from being practiced. However, paradoxes emerged in Chairman Mao's beliefs as he examined traditional models for his own calligraphy. This study analyzes and critiques a selection of Mao Zedong's calligraphy in light of his ancient models, as a means to help explain Mao's intentions as he contradicted his own beliefs. It further explains how innovative Mao's calligraphy was, and how it was perceived in China during his lifetime.

Time Flies When Your Visual Field Shifts to the Left

Hunter R. Trice
Sponsor: Eve A. Isham, Ph.D.
Psychology

Traditionally, space and time are considered as related but not necessarily dependent entities. However, a framework known as A Theory of Magnitude (ATOM) suggests that the brain measures time by using a common number-line like magnitude system that is spatially arranged, ascending in value from left to right (Walsh, 2003). To test this, we followed an experimental procedure by Frassinetti (2009) and asked the participants to judge the duration of a visual event (systematically varied at 1600,1800,2000,2200,2400 ms) before and after a spatial-adaptation session. During the adaptation phase, the participants wore prismatic goggles that shifted their visual field 30 degrees to the left or the right of normal vision. Our results showed that the participants judged the event to be shorter when they were left-adapted and longer when right-adapted ($p<.03$). These findings are consistent with the ATOM theory of the mental number line. That is, when left-adapted, the brain is restricted to 'seeing' smaller, more negative values whereas when right-adapted, the brain sees larger values on the number line, resulting in an underestimation and overestimation of time, respectively. These exciting results serve as groundwork for our investigation of how the brain calculates time.

Evaluating the Effectiveness of Two Packaging Designs to Nullify the Impact of High Humidity on Glucose Test Strip Performance

Anh-Thu T. Truong
Sponsor: Richard F. Louie, Ph.D.
Pathology

To assess the effectiveness of two packaging designs (vial versus foil) for protecting POC glucose and lactate test strips from high humidity stress. Obtaining accurate medical test results becomes a challenge in complex emergencies and disaster settings where temperature and humidity may exceed test reagent storage and operating limits. Stressed strips were exposed to a mean humidity of 97.4% (0.6 SD, n=2,035) in a Tenney BTRC environmental chamber. At 24, 72, and 168 hour (1 week) time points, strips were removed randomly from the stress chamber and tested in pairs versus unstressed strips (n=10 each, 3 trials). Human blood samples spiked to glucose concentrations of 60, 100, and 250 mg/dL were tested. (IRB #294372-4) Student's t-test for paired differences was applied. There were no statistically significant differences between glucose results obtained with stressed versus unstressed test strips for each packaging type. However, three stressed strips from vials and seven foil-sealed test strips failed to report results. Both vial and foil packaging approaches provide efficient protection of glucose and lactate test strips against high humidity for a period of up to one week.

Post-harvest Methyl Bromide Fumigation Against the Brown Marmorated Stink Bug, *Halyomorphas halys* (Stál)

Lance V. Truong
Sponsor: Frank G. Zalom, Ph.D.
Entomology

The brown marmorated stink bug (*Halyomorpha halys*) (BMSB) is an invasive insect native to Asia that has become a serious pest of many fruit and vegetable crops in the Eastern United States. It has recently been detected in California. Restrictions are established that prevent export of certain commodities where BMSB has been found to countries where the pest has yet to be detected without post-harvest treatment to eliminate live insects. The goal of my research is to evaluate post-harvest control of BMSB with methyl bromide (MB), a fumigant accepted by trading partners for the post-harvest treatment of many commodities for insect pests. My fumigation experiments are being conducted at the Contained Research Facility on the UC Davis campus, a Biosafety Level 3 facility, in a temperature-controlled environmental chamber. BMSB used to establish the colony in the CRF, were obtained from the USDA-ARS Kearneysville, WV laboratory. Experimental fumigation treatments of different BMSB life stages at various MB concentrations conducted at 30°C for 2 hours are anticipated to identify dose responses at increasing MB concentrations."

Purification of 2-nitrotoluene Dioxygenase from Evolved Strains of *Acidovorax* sp. JS42 Capable of Growth on 3-nitrotoluene

Richard Truong
Sponsor: Rebecca E. Parales, Ph.D.
Microbiology and Molecular Genetics

Nitroaromatic compounds are toxic, stable compounds that have been designated as priority pollutants by the EPA. The bacterial strain *Acidovorax* sp. JS42 can completely degrade two such compounds, nitrobenzene and 2-nitrotoluene, using 2-nitrotoluene dioxygenase (2NTDO) to catalyze the initial oxidation step. Variants of strain JS42 have recently been evolved to grow on 3-nitrotoluene, and sequence analysis showed that the 2NTDOs in these evolved strains acquired amino acid substitutions in or near the active site of the enzyme. Our overall objective is to purify 2NTDO from wild-type JS42 as well as from the mutant strains and compare the substrate specificities of the enzymes. Our strategy is to construct recombinant plasmids carrying the 2NTDO genes, express the genes in *Escherichia coli*, and purify the proteins by standard column chromatography. To date, we have generated several mutant constructs and have successfully purified wild-type 2NTDO and one of the mutant enzymes. Once we have all of the purified enzymes, we will perform enzyme assays to determine substrate preferences of the wild-type and mutant forms of 2NTDO.

Discovery of Anti-cancer Compounds Against Lung Cancer Using Releasable One-bead-one-compound Combinatorial Chemistry

Sarah Truong
Sponsor: Kit S. Lam, M.D., Ph.D.
Biochemistry and Molecular Medicine

We have been using releasable one-bead-one compound combinatorial chemistry to discover anti-cancer agent. We first prepared encode releasable OBOC small molecule library on TG beads with library compound tethered to the outer layer via a disulfide linker and coding tags in the interior of the beads. Compound-beads were loaded into a 6 cm diameter Petri dish containing a 10,000-wells microfabricated poly dimethylsiloxane microbead cassette, such that over 90% of the microwells were each filled with only one compound-bead per well. Lung cancer cells (A549) suspended in Matrigel (4°C) were then layered over the bead-loaded microbead cassette. At room temperature, gelation occurred and the beads together with cells were immobilized within the Matrigel. After 24 hours of incubation at 37°C, dithiothreitol was added to trigger the release of library compounds. 48 hours later, MTT reporter assay was used to identify circular zones of reduced cell death surrounding each positive bead. These candidate compounds will be resynthesized in solution to confirm their cytotoxic effect against A549 lung cancer cells. Further optimization and characterization on these compounds would be our future research aims.

Inner Demons: Evaluating Health Disparities Among the Homeless Population Involving Addiction

Alexandra Truxton
Sponsor: Cristiana Giordano, Ph.D.
Anthropology

During the 1970's and 80's there was an influx of mentally ill individuals released on to the streets as the result of state funded psychiatric clinics being closed. The initiation of "skid row" communities, coupled with the lack of low-income housing and deteriorating welfare programs led to modes of self-medication for undiagnosed disorders with the use of "street drugs" as opposed to prescribed medication and facilities. Aside from the struggles of "street life" and the demoralizing effects of congregate housing, the homeless community is widely affected by the stigmatization of drug use and alcoholism. Individuals are frequently acclimated into the desocializing discourse of an addict with out proper attention to the varying factors that have led or perpetuated particular situations. While working in a temporary shelter located in Northern California, I utilized participant observation and informal and semi-structured interviews to reveal the disparities associated with seeking medical treatment, rehabilitation resources, and lack of care when devising treatment plans for those in the homeless population. The focus of this research is to recognize the origin of disparities, the stigmatization and discourse that has led them to become institutionalized protocols, and holes in the systems that are allowing the issue to persist.

Effect of Social Skills Intervention on the Rating of Social Competency of Children and Adolescents with Higher-Functioning Autism Spectrum Disorders

Fiona Tsang
Sponsor: Marjorie Solomon, Ph.D.
Psychiatry and Behavioral Sciences

Higher-functioning children and adolescents with Autism Spectrum Disorder (ASD) were divided into two groups: those who participated in a social skills training program for 19 weeks (n = 14) and those who did not take part in the social intervention (n = 9). Parents and participants completed the Social Skills Rating System (SSRS) to assess the social skills of the participants before the start of the intervention (Visit 1), at the completion of the intervention (Visit 2), and an average of 4 months after the intervention (Visit 3). Results indicated a significant difference in social skills rating for all participants from Visit 1 to Visit 2, but no significant findings were found for Visit 2 to Visit 3. It is not clear whether the improvement in social skills from Visit 1 to Visit 2 was due to the intervention itself or to developmental maturation of the participants. Analysis also showed that the children rated themselves significantly greater in social competency than did their parents, indicating an overestimation of their social abilities. Future studies should account for participation in other interventions and other methodological improvements for clearer interpretation of results.

Characterization of the Structure of TIR and NB Domain of Plant Immune Receptors

Raymond Tsao
Sponsor: David Wilson, Ph.D.
Molecular and Cellular Biology

From a growing population estimated to reach 9 billion by 2050 to the global climate change, there is anything but a paucity of challenges in agriculture. Plant disease is economically costly and presents a threat to global food security by reducing crop yields-the situation necessitates developing cost-effective and ecologically sound tools to protect crop plants. To do so requires a better understanding of plant immune responses, and in particular, plant-pathogen interactions and how these critical interactions lead to disease resistance remains an issue. We examine the activation of the nucleotide binding, intra-cellular leucine-rich repeats (NB-LRR) immune receptor N from a mechanistic viewpoint. Using structural biology techniques our lab seeks to generate crystal structures of the Toll-interleukin 1 receptor homology domain (TIR) and NB domain in order to build a model immune receptor so that we may better understand the recognition of pathogens. Additionally, progress in the path of expressing the immune receptor protein in *E. coli* will be described.

Investigating the Role of MMP13 in Osteoarthritic COMP Degradation

Joanna V. Turkiewicz
Sponsor: Dominik Haudenschild, Ph.D.
Orthopaedic Surgery

Cartilage oligomeric membrane protein (COMP) is a 524 kDa extracellular matrix protein found in cartilage, tendons, and ligaments. Matrix metalloproteinase 13 (MMP13) is a major protease capable of degrading extracellular matrix proteins such as type II collagen. Both MMP13 and COMP fragments are present in the synovial fluid of Osteoarthritis patients. The purpose of this study is to determine whether matrix metalloproteinase 13 (MMP13) is degrading the COMP and, if so, at what specific sites it is cleaving COMP. To answer this question, we first ran a Western Blot of MMP13-treated purified COMP to test whether we could find COMP fragments of the same size as those present in the synovial fluid of osteoarthritis patients. Our results show that MMP13-digested COMP fragments correlate very well with those in OA synovial fluid. Our aim is to produce a concentrated amount of this fragment sufficient for protein sequencing to identify the specific site of COMP cut by MMP13. Identification of this cleavage site will give us the information necessary to grow recombinant COMP fragments like those found in OA synovial fluid and study the altered function of these fragments in comparison with intact COMP.

The Association of the Locus Coeruleus and Error Processing Using Pupillometry

Terence L. Tyson
Sponsor: Joy J. Geng, Ph.D.
Psychology

The Locus Coeruleus (LC) is a brainstem structure that mediates norepinephrine (NE) production and two modes of behavior: task-specific exploitation of known environmental statistics and exploration of uncertain environments. These two modes of behavior can be correlated with pupil diameter. Pupil diameter is thought to be larger during exploratory behaviors and smaller during exploitation of task-specific behaviors. In our paradigm, participants had to respond to particular targets that would either be presented on the left or right side of the fixation point with a distracter in the opposite location. We hypothesized that there would be an increase in pupil diameter when participants were presented with a novel association between the target object and its brightness during a visual search task. We expected these changes in the pupil diameter to be accompanied by longer reaction times and lower accuracy. We found that reaction times increased and accuracy decreased during moments of uncertainty when pupil diameter also increased.

Development of Novel Minichromosome Technologies via Centromere-mediated Haploid Induction

Guillaume Urtecho
Sponsor: Connie Champagne, Ph.D.
Molecular and Cellular Biology

Advances in chromosome engineering have created the possibility of using minichromosomes to allow breeders to transfer complex traits across many strains. However, current methodologies of making minichromosomes are inefficient and laborious. My project aims to address this issue by providing a novel, universal method of creating minichromosomes using GFP-Tailswap, a transgenic strain of *A. thaliana* that expresses an altered version of the centromeric protein CENH3. In crosses made with GFP-Tailswap and wild-type, elimination of the mutant genome has been observed, resulting in haploid progeny containing only the wild-type genome. Preliminary results suggest that in addition to full elimination of the haploid inducer genome, random chromosomal fragmentation can occur. When these fragmented chromosomes contain centromeres, minichromosomes can be inherited by the haploid progeny at random. Haploid inducer lines containing centromeres labeled with herbicide resistance have been engineered, allowing the nascence of minichromosomes to be reported within haploid progeny. If successful, this research project will provide a simple method of generating minichromosomes. Furthermore, because the protein responsible for haploid induction and chromosomal fragmentation is functionally conserved amongst all eukaryotes, this method of minichromosome generation can potentially be applied to virtually any other plant species.

SMC-6 is Not Essential for Double-Strand Break Repair on the X Chromosome of *C. elegans* Males

Mike V. Van
Sponsor: JoAnne Engebrecht, Ph.D.
Molecular and Cellular Biology

Meiosis generates haploid gametes for sexual reproduction. During prophase I of meiosis, double-strand breaks (DSBs) are formed and are essential for the exchange of genetic material between homologous chromosomes and proper chromosome segregation. An error-free pathway that is favored in the repair of meiotic DSBs is homologous recombination, which can use either the homolog (inter-homolog; IH) or sister chromatid (inter-sister; IS) as a template for repair. In species containing differentiated sex chromosomes such as the single X chromosome of *Caenorhabditis elegans* males, DSBs on hemizygous regions of the sex chromosome cannot be repaired through IH recombination due to the absence of a homolog. As a result, these DSBs are postulated to be repaired via IS recombination. In *C. elegans* hermaphrodites, Structural Maintenance Chromosome (SMC) 6 plays a role in the repair of DSBs via IS recombination. I hypothesized that SMC-6 is essential for the repair of DSBs on the male X chromosome through IS recombination. Using an RNAi approach, I depleted SMC-6 in feminized male worms and scored X chromosome fragmentation at diakinesis. My results reveal that the X chromosome of *smc-6* (RNAi) male worms is not fragmented, suggesting that repair of DSBs on the male X chromosome is *smc-6*-independent.

The Role of Spirituality versus Religion in Successful Aging

Saskia M. Van Donk
Sponsor: Naomi Janowitz, Ph.D.
Religious Studies

The percentage of the American population that is above age 65 is increasing rapidly. Given this impending increase in older individuals, the topic of "successful aging" is becoming more important. "Successful aging" could entail a wide variety of concepts; this paper, however, will focus on the maintenance or achievement of a sense of identity and integrity. Psychologists are exploring the roles religiosity and spirituality play in successful aging, especially because of their pertinence to these topics of identity and integrity. The study of religion within the field of psychology is contentions and problematic due to disparate perceptions and understandings of religion within the field of psychology. This paper will explore how psychologists grapple with this problem of integrating religion and psychology, focusing on how modern psychologists have found one solution in using the term "spirituality" as opposed to "religion". This construct incorporates the notions of self, soul, identity and integrity that are emphasized in psychology, but de-emphasizes the unhealthy adherence to fundamental values imposed from an outside source that some psychologists associate with "religion". Yet, this solution is also problematic because the notion of "spirituality" excludes the sentiment of adherence to a tradition and truth, and commodifies and individualizes religion.

The Effects of Volunteerism on Positive Youth Development in 4-H Youth

Kristin Villanueva
Sponsor: Kali Trzesniewski, Ph.D.
Human and Community Development

Promoting positive youth development (PYD) is the goal of many youth programs. However, youth leaders vary in their knowledge about how to instill positive traits and help lead youth to have positive outcomes. As a result, PYD programs may not be living up to their potential by not insuring that leaders are well-trained and believe in the programs they deliver. The goal of the present research is to test the effects of volunteer leader knowledge, buy-in and skills on youth outcomes, using a PYD program called 4-H Thrive that is currently being delivered through the 4-H club program in California. Data from youth and volunteers throughout California was collected in the Fall of 2011 (Time 1) and Spring of 2012 (Time 2). At both time points, youth responded to questions about their growth mindset, self-esteem, stress, goal management, and positive youth development indicators. At Time 1, volunteers reported their buy-in regarding the potential efficacy of the Thrive program, their knowledge of the curriculum, and their skills as a volunteer. Preliminary results suggest that youth with volunteers that have greater buyin, knowledge, and skills have more positive outcomes than youth with volunteers that are lower on buyin, knowledge, and skills.

Factors Associated with the Approval and Denial of Temporary Restraining Orders Sought in the Yolo County Superior Family Court

Hector E. Villasenor
Sponsor: Lisa R. Pruitt, J.D.
School of Law

My colleagues and I, as part of a Davis Honors Challenge class, analyzed 93 temporary restraining order (TRO) applications filed in Yolo County Superior Family Court in 2012. We did so in order to determine the factors that tended to lead to the granting or denial of the TROs, which all related to intimate or family violence. Our goal was to provide information that would inform the Yolo County Family Justice Center (YCFJC) regarding the factors most likely to lead to the granting of TROs so that YCFJC could better serve its clients. We gathered many data points from the TRO applications, data points selected on the basis of similar prior studies that investigated the influence of demographic factors, gender, and firearm possession on TRO approval rates. I will present the data collected in relation to the demographic background of the filer and the individual against whom the TRO was filed, with a particular emphasis on the description of abuse and the outcome of adjudication. Our analysis will be complete in March, so I will be able to present our findings at the conference.

Collecting Depth of Interactions Information Using Phosphor Coated Crystals

Varsha Viswanath
Sponsor: Simon R. Cherry, Ph.D.
Biomedical Engineering

PET scanners detect two collinear gamma photons that are emitted simultaneously in opposite directions when a positron and electron annihilate. Because of the increasing prevalence of PET in preclinical imaging, scanners with enhanced spatial resolution are in demand. In small-animal scanners, where ring diameters are small to ensure high sensitivity, the spatial resolution degrades because of parallax error that occurs towards the edges of the scanner, attributable to the uncertainty in the spatial location of the gamma interaction in the scintillator. By determining the depth of interaction, or where the gamma ray arrives within the scintillator, we can correct for parallax error. We propose a relatively simple, low-cost method: coating crystals with a phosphor that absorbs scintillation photons and reemits photons at an alternate wavelength. The extra time associated with the photon-phosphor interaction, where the phosphor is chosen to have a longer decay time than the scintillator, translates to an increase in the decay time of the recorded pulse. We hope to optimize the shape, thickness, and material of the phosphor coating to maximize the difference in decay times between the front and back ends of the crystal, while still preserving the energy resolution of the system.

Clinal Variation of Aggressive Behavior in *Drosophila melanogaster*

Alexandre Vo
Sponsor: David J. Begun, Ph.D.
Evolution and Ecology

The genetic basis of aggressive behavior can be studied in model systems. In *Drosophila melanogaster* multiple genes control aggression. Population genomic data suggest that different alleles of these genes may have risen due to latitudinal adaptation of the species over time, a pattern known as clinal variation. However, there is no evidence supporting the idea that aggressive behavior varies between natural populations. Therefore, I will be investigating whether northern and southern *D. melanogaster* populations from a North American cline differ in aggression levels. The study will consist of a phenotypic assay that measures the frequency of fighting within each population. Fighting will be measured in coliseums in which two males contend for food and a female. If there is a difference in the level of aggression between populations, I will test the hypothesis that variation in a candidate aggression gene explains population differences. After introducing each population's version of the gene into a genetically null line of *D. melanogaster*, I will repeat the phenotypic assay and conclude whether the gene is sufficient in replicating the natural populations' aggression frequencies. This study is important because it addresses the genetic and evolutionary mechanisms of the divergence in aggressive behavior between regional populations.

Combining Nitrification Inhibitors and Fertilizers in Mitigating N_2O Emissions in Corn (*Zea Mays* L.)

Jordon Wade
Sponsor: William Horwath, Ph.D.
Land, Air and Water Resources

Nitrous oxide (N_2O) is a greenhouse gas (GHG) more potent than CO_2.[-] Agricultural soils are estimated to be responsible for 52% of California's annual N_2O emissions. These emissions can be mitigated by adopting alternative management practices. Additionally, excessive nitrogen fertilization can result in the leaching of nitrate (NO_3^-) and subsequent contamination of groundwater. The objective of the study was to examine the effects of varying fertilizers and nitrification inhibitors on GHG emissions. Measurement of CO_2 and N_2O fluxes, soil nitrogen content, plant biomass, and yield were taken in a corn field using several forms of commonly-used fertilizers and two nitrification inhibitors. Preliminary data indicates that nitrification inhibitors decrease N_2O emissions in treatments with urea-ammonium-nitrate (UAN) fertilizer and increase emissions in treatments with aqueous ammonia fertilizer. The nitrification inhibitors also result in higher yields for both UAN and aqueous ammonia treatments over those treatments without an inhibitor. Nitrification inhibitors also increased recovery of nitrogen, suggesting decreased N losses due to leaching. This preliminary data suggests that the use of nitrification inhibitors is an effective strategy in mitigating GHG emissions while increasing yield.

Why Zebras Have Stripes: Still a Mystery

Hannah Walker
Sponsor: Tim Caro, Ph.D.
Wildlife, Fish and Conservation Biology

Black-and-white striping in zebras has attracted attention for centuries, yet scientists still do not understand its biological purpose. We investigated three hypotheses for the function of zebra stripes: (1) stripes deter biting flies, (2) stripes advertize dangerousness to predators (aposematism), and (3) stripes confuse predators. 1. Utilizing four museum collections, we measured skin thicknesses and hair lengths of zebra, wild equid, and African herbivore pelts. If stripes deter biting flies from landing, we expected zebras to be sensitive to flies, having thinner skins and shorter hairs than non-striped equids and co-residing herbivores. 2. If stripes act as a warning signal, we expected zebras to be better armed than other species. We measured tooth lengths in zebras, wild equids, and African herbivore museum skulls, expecting longer and sharper incisors and canines in zebras. 3. If stripes confuse predators, we surmised that predators would fail to capture fleeing zebras, and that stripes of neighboring zebras would appear aligned as herds fled. We therefore analyzed web-based videos of predator behavior and zebra flight behavior, predicting predator misjudgment and stripe convergence in fleeing herds. Results will be presented with a discussion that narrows the pool of prevailing hypotheses for why zebras have black-and-white stripes.

Qualitative and Quantitative Differences in Volatile Organic Compounds from Four California Oak Species

Lauren M. Walker
Sponsor: Mary Louise Flint, Ph.D.
Entomology

The goldspotted oak borer (GSOB, *Agrilus auroguttatus*), an invasive beetle, has killed tens of thousands of oak trees (*Quercus* spp.) since its introduction into San Diego Co., California from southeastern Arizona circa 2000. Oak mortality has been more frequently observed in red oaks (Section *Lobatae*: coast live oak, *Quercus agrifolia* Née; California black oak, *Q. kelloggii* Newb.) and a taxonomically intermediate oak species (Section *Protobalanus*: canyon live oak, *Q. chrysolepis* Liebm.) than in white oak (Section *Quercus*: Engelmann oak, *Q. engelmannii* Greene). Death of trees is caused by larval stage feeding, which occurs primarily at the phloem/xylem interface in the trunks and branches; adults feed on leaves. Many herbivorous insects such as GSOB use plant volatiles to locate their hosts. To investigate the potential volatile cues that GSOB adults use to locate oak trees, we extracted and analyzed foliar volatiles from four Southern California oak species by using gas chromatography-mass spectrometry (GC-MS). Our results indicate that oak foliage contains many monoterpenes, sesquiterpenes, and other compounds that differ both qualitatively and quantitatively among the four Southern California oak species. Results will be discussed in the context of GSOB infestation levels across the oak species in Southern California woodlands.

Confidence Without Consciousness: Confidence Ratings May Reflect Implicit Error Detection During a Time Judgment Task

Tiffany A. Wall
Sponsor: Eve A. Isham, Ph.D.
Psychology

Action-related temporal awareness is assessed by asking the observers to report when they perform an action. However, Banks and Isham (2009, 2010) illustrated that irrelevant information could influence these temporal reports. This finding suggests that direct introspection may not be a reliable method to assess for temporal awareness of action. We tested whether an implicit measure, namely confidence rating, could better assess for temporal awareness. The participants pressed a button and received and a post-action tone systematically delayed at 0, 20, 40, 60 ms. The observers reported the perceived time of action, or the perceived time of action intent, as well as rated how confident they were of the accuracy of their temporal report. Consistent with Banks and Isham, the perceived time of action shifted with the time of the tone, further emphasizing that subjective reports could be influenced by external factors. Importantly, confidence ratings shited with the error in the time-of-intent judgement, but not during the time-of-action judgement. This suggests that while it is unavoidable for the observers to map the perceived time of action onto the time of the tone, implicitly in some cases the participants knew that this mapping was erroneous. Our results contribute to the further understanding of action-related temporal awareness.

The Effects of Vitamin D on the Regulation of Infant Airway Immunity

Theodore T. Wang
Sponsor: Lisa A. Miller, Ph.D.
Anatomy, Physiology and Cell Biology

Asthma is a chronic inflammation of the airway, affecting over 300 million people in the world and 20 million in the U.S. alone. Although vitamin D (VitD) deficiency in children has been linked to allergic asthma, the biological mechanisms of this relationship are poorly understood. Here we expose non-human primate infant and adult airway epithelial cells to VitD and examined the effects on immune responses linked to the allergic asthma phenotype. Adult and infant airway epithelial cells were grown, with VitD (10-1000nM), for four weeks submerged and one week at air liquid interface conditions. The gene expression of various cytokines associated with the proinflammatory and allergic responses was examined with RT-PCR. Proinflammatory gene expression of IL6, IL8, and TNF-alpha did not show any significant changes due to the concentration of VitD. Thymic stromal lymphopoietin (TSLP) is an important cytokine in the allergic response. Addition of VitD in infant epithelial cell cultures significantly decreased TSLP expression whereas TSLP in adult epithelial cells was highly variable regardless of VitD treatment. Our data suggests that VitD is important in the regulation of allergic but not inflammatory responses in the infant airway epithelium. Future studies will focus on understanding TSLP regulation in epithelial cells.

Engineering of Lignocellulolytic Fungal Strain for Optimization of Biofuels Production from Cellulosic Materials

Rebeccah Warmack
Sponsor: Julia Fan, Ph.D.
Biological and Agricultural Engineering

By employing the metabolisms of a lignocellulolytic fungus and a fermentative bacterium, our lab proposes a novel platform for the production of cellulosic biofuels. This system requires cellulase production, enzymatic hydrolysis, fermentation and separation occurring in a single step. The process requires a mixed culture in which the fungus degrades cellulosic substrates to hydrolysis products which the fermentative bacterium can utilize in the production of biofuels. In order to ensure that the biofuels end-products are not taken back up by the lignocellulolytic organism, a fungal strain was created to be deficient in both copies of the gene coding for the alcohol dehydrogenase enzyme (*adh*), by crossing single knockout parent strains of each gene copy. The novel strain was then characterized under environmental conditions mimicking the nutritional levels of the mixed culture, using glucose and ethanol. The ethanol utilization rates measured via High Performance Liquid Chromatography (HPLC) indicated superior product (ethanol) retention levels in the engineered double knockout compared to both single knockouts (*adh1, adh2*) and wild type strains. This discovery allows for the optimization and maximization of biofuels production from the mixed culture.

Analysis of Bacteria-Killing Assay Using Chicken Plasma Samples

Matthew F. Warren
Sponsor: Kirk C. Klasing, Ph.D.
Animal Science

The bacteria-killing assay is essential to analyze the efficiency of immune function of the plasma or whole-blood of a studied organism. The quantifiable data from a bacteria-killing assay can provide researchers a means for developing questions for future studies that relate to immune function. In-bred lines of *Gallus gallus domesticus* broiler chickens, housed at the UC Davis Avian Hopkins Facility, were used for collecting blood samples. The competence of the plasma samples to kill a nonpathogenic strain of *Escherichia coli* 8739 was assessed by mixing with CO_2 independent media at a 1:10 dilution and incubated at 41°C for 30 minutes. 75 μL of the solution was spread on Tryptic Soy Agar (TSA) plates, using micro-beads. Samples are incubated at 41°C for 24 hours and mature bacteria colonies are counted. It is assumed that the plasma will destroy invasive bacteria and yield proteins that can be isolated for analysis and the surviving colonies can be further analyzed. About a 70% - 90% bacteria-killing rate for the samples is expected. This will indicate that the immune system is functioning normally and the birds were receiving sufficient nutrients for homeostatic requirements.

Efficacy of Drip Irrigation-applied Chemical and Biological Treatments in the Control of Soilborne Pathogens of California Processing Tomatoes

Julia Wasielewski
Sponsor: Johan Leveau, Ph.D.
Plant Pathology

Processing tomatoes are a key crop of the California central valley. However, they are afflicted by many soilborne plant pathogens, including fusarium and verticillium wilts. This project attempts to manage these soilborne pathogens using treatments applied through drip irrigation. Two field trials were set up in commercial grower fields in Solano and Yolo Counties in 2011 and 2012. Biological treatments (Serenade Soil, Actinovate, Tenet, SoilGard, and soil-incorporated composted chicken manure), chemical treatments (Vapam, Ridomil Gold SL, and Quadris), and combinations of them, were applied four times every three weeks starting at planting. Disease incidence and severity were rated visually at the end of the season, and the fruit yields were quantified. Soil samples were taken throughout the season, and the total culturable bacteria and fungi were quantified. No significant difference in disease incidence was found between treatments. However, at two sites, composted chicken manure had significantly higher yields (up to 50% greater). Additionally, DNA from the soil samples is being prepared for Illumina 16S sequencing in order to profile the bacterial community in an effort to understand why manure increased yield.

Narrative Voice and Madness

Julia B. Webb
Sponsor: Greg Dobbins, Ph.D.
English

The narrators of Vladimir Nabokov's, *Pale Fire* and Samuel Beckett's, *The Unnamable* are both, arguably, insane. In a novel, insanity is represented by misrepresentations, confusions, and/or self-imposed censorship. Madness then becomes a function of speech, or more specifically, narration, in which the form is a critical part of understanding their madness. Both *Pale Fire* and *The Unnamable* are not just narrated, but 'written' by the narrator, so one might ask - does the act of writing help reduce madness, as a form of self-expression, or intensify it, as a form of obsession? In the case of Charles Kinbote editing becomes a way for him to live out his fantasy, while the narration in *The Unnamable* starts to fall apart at the end, until it is nothing but tangential, run-on sentences. These texts and how they represent insanity have less to say about insanity itself, and more to say about our view of insanity.

Rapid Analysis of Melon Aroma

Sharon Wei
Sponsor: Florence Zakharov, Ph.D.
Plant Sciences

As fruit ripen a variety of chemical and physical changes occur within the fruit including development of characteristic aroma. In climacteric fruit, maturity at harvest is an important factor influencing the flavor quality. For example, harvesting not fully ripe melons has a large impact on sugar, volatile content and texture of the fruit. Traditionally, the analysis of the volatiles constituting the aroma profile is performed using gas-chromatographer often coupled with a detector (e.g. gas-chromatography mass-spectrometry, GC-MS). However, these instruments are expensive, and the analysis is labor-intensive and time-consuming. An instrument able to rapidly analyze the fruit aroma would benefit breeding, production, and postharvest studies in the future. In our study, we assessed the ability of an ultra-fast gas-chromatographer coupled with a surface acoustic wave sensor (UFGC-SAW, also called zNose™) to discriminate melons based on their aroma profile. We analyzed three melon cultivars (*Cucumis melo.* L. reticulatus group) harvested at five different maturity stages. In addition, the results from UFGC-SAW were compared to those obtained from traditional GC-MS.

Beyond Traditional Implicit Associations Tests: How Body Motion Reveals the Continuous and Dynamic Nature of Racial Bias

Grant Weiss
Sponsor: Jeff Sherman, Ph.D.
Psychology

Since the 1990's, Implicit Association Tests (IAT) have been one of the predominate tools enabling social psychologists to provide a descriptive analysis for implicit associations and racial bias. Currently, most IAT's merely give us a snapshot of the underlying mechanisms. They only require participants to push a button to indicate a choice. In order to provide richer detail about the underlying mechanisms of the implicit activations that result from a participant's reaction to concept stimuli a more dynamic and statistically continuous paradigm is needed. In two experiments, the procedures for the Flower-Insect IAT and the Black-White IAT were changed from requiring participants to use the traditional button pressing response to moving a computer mouse, all mouse movements were tracked by MouseTracker software. The spatial and temporal properties resulting from the trajectories created by the aid of the mouse tracking software not only support traditional IAT data about racial bias, but also provide a richer framework for understanding it. A better glimpse into the dynamic real-time properties of the cognitive phenomena involved when stimuli activate implicit associations provide a stronger foundation for seeing detail about biases and stereotypes, putting current research into previously under-explored territory.

Magmatic Evolution of the Smartville Complex, Sierra Nevada Foothills, CA

Jan J. Weninger
Sponsor: Charles E. Lesher, Ph.D.
Geology

The northern Sierra Nevada foothills of California were the site of oceanic plate subduction, volcanism, crustal accretion, rifting and magmatic intrusion throughout the Mesozoic Era (200-100 million years ago). Numerous plutons were exposed by uplift and erosion; however, their differentiation histories and ultimate sources are not well understood. This project aims to unravel the magmatic evolution of two mafic intrusions of the Smartville Complex cropping out in the vicinity of Oregon House, CA. The intrusions are wehrilite (olivine + clinopyroxene), gabbro (calcic plagioclase + clinopyroxene ± olivine, orthopyroxene and hornblende), diorite (sodic plagioclase + clinopyroxene + hornblende) and hornblende pegmatite. Preliminary results obtained by optical and wavelength dispersive microscopy indicate that these mineral assemblages crystallized from evolving silicate magmas at depths of ~5-6 kilobars. Clinopyroxene has MgO, TiO_2 and Na_2O contents of 14-16 wt.%, 0.03-0.44 wt.%, and 0.09-0.32 wt.%, respectively, typical of tholeiitic/boninitic magmas found in modern island arc environments. These results support the current tectonic model for the Smartville Complex involving rifting of the Jurassic volcanic arc. Ongoing geochemical studies will provide constraints on the mantle source for primary magmas of the Smartville Complex, as well as the thermal and chemical evolution of magmas following emplacement in the crust.

Circuitry and Software Application in a Real-time Glucose Biosensor

Marie J. West
Sponsor: Michael Delwiche, Ph.D.
Biological and Agricultural Engineering

The advanced biofuels industry looks to harness the energy contained in plant biomass. Glucose released from cellulose of plant cell walls can be directly converted to transportation fuel. This conversion requires additional research before its processes can be economically competitive with fossil fuels. A critical factor in the investigation of the biomass conversion processes (saccharification) is the researcher's ability to rapidly analyze solubilized sugars. Presently, most sugar analysis methods are laborious, costly, and fail to provide real-time data, thereby slowing research progress. This project will address the design, construction, and testing of an amperometric glucose biosensor. This biosensor utilizes electrochemical properties of a saccharification reaction, three electrodes, potentiostat circuitry, and a custom-designed user interface to continuously measure glucose content in a sample. Glucose oxidase enzymes are immobilized on a probe tip that oxidizes glucose in a solution. This oxidation generates a current proportional to the glucose concentration. The current is made possible and captured by a potentiostat circuit composed of op-amps and electrodes. The signal is filtered and interpreted into concentration data via a LabVIEW generated user interface. By providing real-time concentration data, the biosensor will maximize efficiency and minimize costs in research towards the realization of advanced biofuels.

Biotechnological Tools for the Bioremediation of Se Compounds in Soil

Nathaniel M. Westrick
Sponsor: Abhaya M. Dandekar, Ph.D.
Plant Sciences

Selenium (Se) is a well known antioxidant in humans when taken in the correct dose, however, an over abundance of selenium is toxic to humans and other small animals as is seen with the Kesterson Effect. This phenomena, first studied in 1982 at the Kesterson National Wildlife Refuge in the San Joaquin Valley, demonstrates Se's ability to bioaccumulate in small ponds and lead to deformations in aquatic animals. The goal of this project is to demonstrate the ability of transgenic tomato plants with sulfur volatilization capabilities to successfully phytoremediate toxic Selenium compounds from soil. Recently our lab has effectively transformed Solenum lycopersicum (tomato) to produce the sulfur volatile Dimethyl Sulfide (DMS); a sulfur volatile not typically emitted by tomato. Selenium belongs to the same chemical group as sulfur and is often interchangeable with many sulfur compounds. For example, plants in sulfur deficient environments can substitute selenium to secure primary metabolism. Scientist have proven that selenium can replace sulfur in sulfur volatiles such as DMS, producing Dimethyl Selenide. In order to facilitate the experiment, transformed and wild-type samples of Solenum lycopersicum will be analyzed for their capacity to volatilize selenium from soil.

Evaluation of the Endangered Konocti Manzanita at Clear Lake State Park

Karen Whitestone
Sponsor: Daniel Potter, Ph.D.
Plant Sciences

Many manzanita species are endemic to a small region, contributing to California's extensive plant diversity. Konocti manzanita (*Arctostaphylos manzanita* ssp. *elegans*) is a shrub endemic to California's North Coast Ranges. This subspecies differs from more common *A. manzanita* ssp. *manzanita* based on the presence of glandular hairs on the ovary and fruit. Data collected for this study reveals both subspecies occur at Clear Lake State Park. However, park personnel do not possess data on exactly where Konocti manzanita grows or how to identify it, which may put Konocti manzanita at risk during park maintenance activities. The California Native Plant Society (CNPS) lists Konocti manzanita as a rare and endangered plant (list 1B.3). To avoid further endangering this subspecies, it is important to maintain a sustainable seed bank of local populations at Clear Lake. This study maps locations of both manzanita subspecies using ArcGIS, to demonstrate their spatial separation where they co-occur. In addition, this study examines the validity of the distinguishing characters between subspecies, using specimens from Clear Lake State Park and the Jepson Manual key of California vascular plants. The subspecies identification assistance and maps will aid park personnel when making habitat management decisions.

The Effect of *Mentha pulegium* Root Exudates on the Fairy Shrimp *Streptocephalus*

James A. Whitney
Sponsor: Louie Yang, Ph.D.
Entomology

The toxic invasive weed *Mentha pulegium* presents a potentially underestimated threat to the health of California wildlands, particularly seasonally wet areas such as vernal pools. In order to assess the potential threat to the inhabitants of Californian vernal pools from *M. pulegium,* I am testing the effects of allelopathic root exudates produced by *M. pulegium* on a native species of fairy shrimp, thought to be *Streptocephalus sealii*. In order to do so, *Streptocephalus* eggs were reared in increasing concentrations of *M. pulegium* essential oils. Increasing amounts of extract were associated with increased mortality, leading to a second experiment in which *Streptocephalus* was hatched in ground water exposed to *M. pulegium* root exudates. No significant effect on mortality or hatch rate was detected in preliminary trials, but further testing is in progress to determine the effect of *M. pulegium* on *Streptocephalus* in an environment closer to that of an actual vernal pool.

Ball Bearing Arpeggiator

Ryan P. Wilkerson
Sponsor: André Knoesen, Ph.D.
Electrical and Computer Engineering

Music is innate to humans and there are an infinite ways to combine sounds into music. We wanted to create an interactive way to make music that would utilize fundamental concepts of electrical engineering while being engaging to all audiences. Our project was to make an arpeggiator, or note sequencer, using ball bearings. To operate, the user places metal ball bearings in receptacles which are sequentially scanned and illuminated. The arpeggiator will then produce a note sound or chord of notes based on the location of the ball bearings. This allows for the creation of complex rhythms and musical sequences as multiple sounds can be simultaneously played depending on where the bearings are placed. In addition to the receptacles, there are also buttons which can be used to change the instrument being replicated and knobs that allow the user to change the speed the notes are played and volume of the notes being produced.

Bridging the Disconnect: Understanding the Factors of Patient Satisfaction

Breanna J. Williams
Sponsor: Daniel Potter, Ph.D.
Plant Sciences

More than 450,000 people die from breast cancer every year worldwide, and nearly 40,000 of those deaths are female patients in the United States alone. Many of the women who succumb to this disease are not able to diagnose and treat their disease early in the process, or receive proper health care during the harshest stages of the cancer. Breast cancer research is a multi-billion dollar industry, yet thousands of women continue to suffer every year due to certain variables that affect their relationships with their doctors. The purpose of this project is to conduct and use first person interviews to examine and address the disconnection between breast cancer patients and their physicians. We will research how various cultural, legal, and economic factors affect the quality of healthcare that women receive from their physicians. We hope to publish our findings along with facts and guidelines for patients, medical students, and physicians to help resolve this disconnect.

Statistical Approaches to Occupation Type in a Mid-Holocene Site in Mendocino County, CA

Samuel J. Williams
Sponsor: Teresa E. Steele, Ph.D.
Anthropology

Decisions regarding the classification of the use of an archaeological site often prove difficult to make as many sites are singular locations lacking a sister site for comparison. Differentiating between short-term, long-term, and permanent occupation sites is a daunting task due to differential taphonomy and interpretation of a given set of material remains. Occasionally a site may be part of a series of related sites, which gives a unique opportunity to compare taphonomic processes both at the individual site as well as across the collection of related sites. Here, we examine two faunal assemblages from a late-Holocene series of occupations along the Mendocino County coast of northern California. One site, CA-MEN-829, has been tentatively assigned as a long-term occupation site. A second site, Bird Runner, is possibly contemporaneous and has a similar faunal assemblage. Using CA-MEN-829 as a baseline, we use a statistical analysis to ascertain whether or not the faunal assemblages of these two sites differ in the relative abundances of their species and then attempt to reject the null hypothesis that the two sites are indistinguishable. Although the analysis is in progress, this methodological approach promises to establish a valuable paradigm for the analysis of future sites.

Comparison of Sorting and Napping Sensory Profiling Methods Using Mineral Water, Related to Chemical Attributes and Consumer Preference

Christine L. Wilson
Sponsor: Hildegarde Heymann, Ph.D.
Viticulture & Enology

Ca^{2+}, Mg^{2+}, and Na^{+} are minerals found in commercial waters at "clinically important" levels Additionally, some European mineral waters such as "San Pellegrino" and "Kaiser Friedrich" have much higher mineral contents than American commercial bottled waters like "Arrowhead" and "Pure Hawaiian". We are interested in whether these differences in mineral content lead to perceptual differences in the 'taste' of the water and in people's liking for the waters. Our hypothesis is that waters with higher mineral content will differ in 'taste" from waters with lower mineral content and that the higher mineral content waters will be liked less. The actual mineral content of each brand will be determined using a Inductively-coupled Plasma Mass Spectrometry (ICP/MS). A sensory panel will determine whether regular water drinkers can tell differences in commercial bottled waters from different countries and with differing mineral contents. The sensory evaluation techniques used are sorting and napping. They are both based on the principal of perceptual mapping, where panelists' perceived similarities or dissimilarities of the products are communicated through relative placement in physical space. In addition to these mapping methods, a hedonic evaluation will be performed, which will illuminate the level of preference for each product.

Evaluating Affective Response to Social Rejection and Acceptance as a Function of Reward Motivation

Marley Windham-Herman
Sponsor: Amanda E. Guyer, Ph.D.
Human and Community Development

The ways in which young adults interpret social acceptances and rejections are very complex, yet we can elucidate these processes by examining them as a function of personality and temperament such as reward motivation. In turn, this may improve interventions for social anxiety. In the present study, participants (N=50; 50% male, 18-22 years old) were first asked to anticipate future social evaluation by peers and later to respond to bids of either acceptance or rejection by those same peers in an experimentally simulated online "chatroom." Participants were led to believe that they would be matched and have a chance to interact with an actual peer from among the set that had evaluated them. Subjective response to rejection/acceptance will be compared between participants who scored either high or low on the Behavioral Activation System (BAS) Reward Responsiveness scale. BAS is believed to regulate acquisitive motions or goal seeking actions. The BAS Reward Responsiveness score is one of four measures used in the BIS/BAS scale (Carver, C. S., & White, T. L., 1994). Subjects will be placed into below-median and above-median groups based on BAS Reward Responsiveness scores and collectively evaluated for affective response to social evaluation.

Framing Religious Heritages: Negotiating Traditional Space in Three South Indian Temples

Mitchell A. Winter
Sponsor: Archana Venkatesan, Ph.D.
Religious Studies

Narratives of religious heritage surrounding temple complexes in current day Tamil Nadu, India often serve to uphold statements of authenticity by conflating elite Brahmanical culture with notions of a linear inheritance of traditional knowledge. I will argue that because the formal stage for the performances of Brahmanical religious heritage have traditionally been confined to the temple (*koyil*) setting, the political and religious narratives born from these temples reflect an intimate connection with their own local mythologies and modes of cultural transmission. This project focuses on three temple complexes (Brihadisvara, Nagesvara, Airavatesvara) in the Thanjavur-Kumbakonam region of Tamil Nadu, in the heart of the historically Śaiva south, and will engage in a dialectical exchange that frames the question of "heritage" in relation to claims of authenticity. Using personal testimonies and observations gathered from a month-long study abroad program in Pondicherry and supplementing them with Mary Hancock's, *The Politics of Heritage from Madras to Chennai*, I will focus on the disjunctive feelings of place and space that arise due to the heritages engendered by these sites of worship. This project reflects the problematic ways religious sites in south India are categorized in the "heritage-scape" based on their perceived cultural capital.

Exploration into Conservation of Alternative Splicing Mechanisms in the Evolution of Sexual Determination in Insects

Margaret A. Wittman
Sponsor: Artyom Kopp, Ph.D.
Evolution and Ecology

One of the first developmental processes almost all organisms undergo is sexual determination and differentiation. Insects are no exception and are an excellent tool to use in studying sex determination pathways due to their ease of genetic manipulation. Within the insect clade, there are hemimetabolous and holometabolous insects. One of the distinguishing features between these two groups is the way in which sex is determined. Within holometabolous insects, like bees and fruit flies, a DMRT family protein, *doublesex* (*dsx*) is alternatively spliced to produce sexually dimorphic traits between males and females. The female-specific isoform of dsx produces females-specific traits and the male-specific isoform produces male-specific traits. Such a feature is not observed within hemimetabolous insects like cockroaches, dragonflies, and aphids. Although much is known about the alternative splicing mechanism within holometabolous insects, it is unclear what is going on within hemimetabolous insects. By way of degenerate PCR and RACE, I will explore insects within the hemimetabolous lineage to discover when this mechanism arose. Furthermore, I will test if male and female insects produce different *dsx* isoforms. Should I receive a positive result, I will expand the number of insect species in my study and explore how *dsx* splicing arose.

Interactive Two Dimensional Surface

Angel Wong
Sponsor: André Knoesen, Ph.D.
Electrical and Computer Engineering

The purpose of this project is to create an interactive exhibit that attracts an audience of all ages to electronics and engineering as a whole. What is a better way to appeal to such an audience than to utilize not just the visuals but also sound and touch? Rather than build a grid board consisting of only tri-colored light emitting diodes that only presents visual appeal with no interaction, we combine the lights with proximity sensors to produce a stimulating response for the user. Set with a square matrix grid, the interactive two dimensional surface uses proximity sensors to respond to the user. As the user interacts with the surface, the proximity sensors react to the reflections in infrared light, sending signals to the microcontroller which then turns on the respective light emitting diode and sound device in the grid. We will make the interactive two dimensional surface of the table holding the printed circuit boards of individual components detachable, allowing users to learn and see how the parts are put together to make the system work. The table will also be programmed with simple games such as paint, puzzle blocks, and a music mode to encourage user interaction.

Quantitative Trait Loci (QTL) Mapping of a High Temperature Germination Locus in Lettuce

Michael M. Wong
Sponsor: Kent J. Bradford, Ph.D.
Plant Sciences

Lettuce (Lactuca sativa) production in warm climates can face difficulties in crop establishment from seed due to inhibition of germination at high temperatures (termed seed thermoinhibition). Germination of seeds of the lettuce cultivar "Salinas" is inhibited at temperatures above 27°C while seeds of PI251246, a primitive accession, can germinate to as high as 35°C. A cross between Salinas and PI251246 was used to generate a mapping population to study the seed thermoinhibition trait. Quantitative Trait Locus (QTL) analysis from the F8 mapping population revealed a major QTL (*Htg 9.1*) associated with seed thermoinhibition on chromosome 9. Currently, fine mapping is being performed to pinpoint the QTL region and identify candidate gene(s) causing lettuce seed thermoinhibition. In addition, mRNA sequencing analysis is being conducted to examine differential regulation of candidate genes in the genomic regions associated with the QTL. Identification of genes responsible for seed thermoinhibition and insight into their regulation can potentially lead to breeding thermotolerant lettuce to improve crop production.

In Epileptic Animals Medial Septal Stimulation Improves Spatial Memory Function

Rebecca Wong
Sponsor: Gene G. Gurkoff, Ph.D.
Neurological Surgery

According to the Center for Disease Control, epilepsy affects over 2 million individuals in the United States and over 65 million world-wide. As many as one-third of all epilepsy patients suffer from chronic cognitive deficits. The hippocampus is a region in the brain that plays a critical role in learning and memory. Previous studies have demonstrated that pilocarpine-induced seizures cause cell death, hippocampal dysfunction, and cognitive dysfunction. Studies have also shown that pilocarpine also causes a reduction in the hippocampal theta oscillatory rhythm (5-12 Hz). We hypothesized that deep brain stimulation to restore theta oscillations would improve cognitive function in pilocarpine-treated rats. Following seizures, we observed a significant decrease in hippocampal theta power on the Barnes maze spatial learning task. After stimulation of the medial septum in the theta range, there was an increase in theta power and significant improvement in cognitive performance. Therefore deep brain stimulation to restore theta oscillations is a potential substitute for pharmacotherapy to treat patients who suffer chronic deficits related to epilepsy.

Analysis of the Effect of R-loop Formation on Nucleosome Occupancy

Spencer S. Wong
Sponsor: Janine M. LaSalle, Ph.D.
Medical Microbiology & Immunology

Prader-Willi Syndrome, an autism-spectrum disorder, results from a paternal deletion of the imprinted region 15q11-13. The paternal allele of 15q11-13 undergoes a large-scale chromatin decondensation in neurons. The decondensation is dependent on the transcription of small nucleolar RNA elements (snoRNAs) which are coded in this region, but the mechanism of decondensation is unknown. We hypothesize that formation of R-loops (RNA:DNA hybrids) in 15q11-13 contributes to these chromatin changes. Using a novel system, we predict that a G-skew region on episomes will form R-loops and deplete nucleosomes when transcription is induced. Through RT-qPCR, we show that the episomes can be transcriptionally regulated with doxycycline. Using this model episome system, we measured changes in nucleosome occupancy by employing ChIP against the H3 histone protein. We found that nucleosome occupancy decreased when transcription was induced to form a G-rich RNA, forming an RNA:DNA hybrid. Finally, we confirm that R-loops are present upon induction of transcription by DRIP-qPCR for transcribed regions. Our findings demonstrate that cotranscriptional R-loop formation leads to reduction of nucleosomes across the R-loop forming region. We argue that transcription can alter the chromatin of the template DNA in a sequence-dependent manner.

Unintended Consequences of Plant Competitor Removal Experiments in the Field: Plants Without Neighbors Experience Greater Herbivory

Katherine E. Wood
Sponsor: Sharon Y. Strauss, Ph.D.
Evolution and Ecology

To assess the impact of competition and other plant-plant interactions in the field, researchers typically remove neighboring plants from a focal one. In doing so, neighbor removal experiments may also inadvertently affect herbivory rates, as we have observed in past field experiments. Thus, gains in performance resulting from neighbor removal may be offset by increased herbivory. I did a meta-analysis of published papers and synthesized results across a range of studies in order to address if neighbor removal experiments in the field increase herbivory rates. Herbivory is not always explicitly reported in texts that are more focused on plant-plant interactions than plant-herbivore interactions, but herbivory rates can be deduced from data tables and graphs. Looking across diverse habitat ranges, species compositions, and experiment methodology through a meta-analysis allows us to interpret large-scale ecological patterns in plant neighbor removal experiments that are otherwise overlooked. My preliminary results suggest that neighbor removal often leads to increased herbivory. These results imply that neighbor removal studies of competition need to account for altered herbivory levels to accurately quantify the effect of competition on plant performance.

Correlation Between West Nile Virus Persistence and Relative Fitness of House Sparrow Hosts

Rachael Wood
Sponsor: William Reisen, Ph.D.
Pathology, Microbiology and Immunology

Although numerous investigations have sought to replicate West Nile Virus's (WNV, family *Flaviridae*) overwintering mechanism, few have proposed biologically relevant methods. The virus's primary mode of overwintering still requires considerable clarification. Our research focuses on the relative physical and immunochemical fitness of House Sparrows (*Passer domesticus*) as it relates to the ability of the pathogen to persist within host tissues. A fine distinction exists among levels of host fitness; too robust an immune system will likely eliminate the pathogen and end transmission, but too weak an immune system will allow the pathogen to kill the host, also resulting in transmission cessation. Using bactericidal assays, PRNTs, blood samples, and general health assessments, physical and immune fitness was measured for all sparrows immediately prior to and periodically following experimental infection with WNV. Experimental immune suppression and subsequent viremia assays will indicate how changes in host fitness affect viral recrudescence. Variance in factors such as health, immune response, and co-infection with other parasites are expected to influence viral persistence. Preliminary results were indicative of gradients in population fitness that determined levels of viremia, severity of infection, and host survival. Viral persistence, therefore, may be dependent upon specific levels of host fitness.

Cutting the TALE Down to Size

Eureka Wu
Sponsor: Enoch Baldwin, Ph.D.
Molecular and Cellular Biology

Xanthomonas bacterial Transcription Activator-Like Effector (TALE) proteins take control of plant host cell's transcription program by binding to host promoter sequences, thereby activating disease stimulating genes. TALEs recognize DNA sequences through variable tandem 33-35 residue repeats. Each repeat specifies one base-pair of the DNA target sites, and the order of particular repeat types allows TAL protein be targeted to any DNA sequence. This programmability has made TAL proteins extremely useful in genomic engineering because DNA cleavage, transcriptional regulation and epigenetic modification can be directed to desired chromosomal sites. The goal of this study is to identify TALE fragment sizes that retain full DNA binding activity and are suitable for *in vivo* biochemical and structural investigations. We used the Polymerase Chain Reaction (PCR) to generate fragments of various lengths for cloning. After ligation into a vector and transformation the fragment identities were confirmed using restriction digests and gel electrophoresis. Next, we will produce proteins and measure their binding activities. Using the fully active fragments for *in vitro* studies of TALE DNA binding and specificity, we will modify their abilities to recognize and bind to new DNA sequences in order to control gene expression and chromosomal structure in cells and organisms.

Genomic Variation in *Drosophila simulans Wolbachia*

Chenling Xu
Sponsor: Michael Turelli, Ph.D.
Ecology and Evolution

Many arthropods host *Wolbachia*, maternally transmitted bacteria that influence host reproduction. By manipulating host reproduction and increasing host fitness, *Wolbachia* can spread quickly through host populations. Some strains of *Wolbachia* in *Drosophila simulans* cause cytoplasmic incompatibility (CI), i.e. high embryo mortality in crosses between infected males and uninfected females. This genomic study looks at pooled Next-Generation Sequencing data of a CI-causing strain, *wRi* (initially found in Riverside, California) and a non-CI-causing strain *wAu* (initially found in Australia). Samples of 20-30 infected flies were taken from four populations in northern and southern US and Australia. Our goal is to identify genomic variation, such as single nucleotide polymorphisms, copy number variants, insertions and deletions. Differences between *wRi* and *wAu* will help identify potential genetic markers associated with the CI phenotype. We also seek genetic markers associated with variation in CI level, an important phenotype that can currently be measured only by time-intensive laboratory crosses. Quantifying within-strain *Wolbachia* genomic variation, along with mitochondrial sequence variation, allows us to learn more about the population history of *wRi* and *wAu* in *D. simulans*. These data can be used to test predictions from *Wolbachia*-host coevolution models.

Portable Patient Monitoring Device

Zhengchi Yan
Sponsor: André Knoesen, Ph.D.
Electrical and Computer Engineering

As society moves forward into the 21st century, we are faced with a scarcity in affordable quality healthcare. Imagine if you could assess your medical health from the comfort of your own home before going to the hospital, saving both time and money. Our project aims to address this need with a portable, non-invasive medical monitoring device that patients can use at home to monitor their health around the clock. Our goal is to capture heart rate, temperature, and EKG data. With these three measurements, patients can detect a variety of conditions including fevers and abnormal heart rates and rhythms. Using ultrasonic communications the device transmits medical data on demand to a computer for analysis. This device can also supplement or replace bulky, expensive medical equipment in remote locations where hospital quality care may not be available. With our device we hope to provide an all-in-one device that can give patients back their freedom and gives medical professionals an easy way to monitor their patients.

Proton Exchange Membrane (PEM) Hydrogen Fuel Cell Interdigitated-Parallel Design and Performance

Anahita T. Yazdi
Sponsor: Jae Wan Park, Ph.D.
Mechanical and Aerospace Engineering

In recent years, focus has been shifted to alternative and renewable energy sources to supplant the outgoing carbon based energy model. This is due to a number of factors, ranging from population growth to climate concerns. Specialized use fuel cells are of particular interest in mobile and residential applications because of the ease of integrability into modern society. Fuel cell performance, production, and storage are some of the major challenges in further development. The main focus in the Green Transportation Laboratory (GTL), operated by Professor Park, is improving the performance of a Proton Exchange Membrane (PEM) hydrogen fuel cell. The current project investigates the affect of gas diffusion layer (GDL) properties on performance, including initial porosity, GDL thickness, and degree of wetproofing. This study uses a cell design that can switch between interdigitated and parallel flow-field, which allows for determination of the dependency of GDL performance on flow field. Using the McClellan Neutron Research Center (MNRC) facility, we will also study in-plane neutron tomography of the cell to characterize liquid water distribution in the GDL which affects the performance. This research will provide a better understanding of fuel cell operation, and may offer ideas for higher performance cell designs.

The Influence of Chaotic and Non-chaotic Environments on Self Regulation

Hoi Ting Yeung
Sponsor: Lenna Ontai, Ph.D.
Human and Community Development

Using data from the Healthy Kids Project (N=65), the current study explores the relationship between the home environment and children's self-regulation during preschool. The Bio- Ecological Model suggests that development occurs through complex interactions between the individual and the immediate environment (Brofenbrenner, 1994). However, few studies have investigated the way that environment influences self -regulation. This study can provide insights into ways of improving the environment to provide early intervention to help children regulate their behaviors. Living in a chaotic environment can lead to low self-regulation. Matheny and colleagues (1995) characterized "chaotic environment" as having a high level of background noise, being crowded and lacking routine, which contribute to stress. Previous research has related family chaos to children's low self-regulation (Valiente et al., 2007). We predicted (1) that a highly unstructured and chaotic environment will be associated with low self-regulation, and that (2) a structured environment will be associated with higher self-regulation. These hypotheses will be tested by analyzing the My Child at Mealtime Questionnaire (Ontai et al., 2010), with subscales of chaotic structure and routine structure, and the Children's Behavior Questionnaire (Rothbart et al., 2001), with a self-regulation composite score.

Control of Hyphal Diameter in Plant Pathogenic Fungi

Jenna Yoshisato
Sponsor: Thomas Gordon, Ph.D.
Plant Pathology

Fusarium circinatum is a fungal pathogen that causes a disease known as pitch canker in pines. To cause disease, a fungus must decrease the diameter of the hyphal tip in order to penetrate plant cell walls and grow into plant tissue. This suggests that more virulent strains of *F. circinatum* may be better able to decrease their hyphal diameter than strains that are less virulent on a pine host. Considering this possibility, we aimed to determine the smallest pore size through which a given strain can grow and the extent to which these capabilities correlate with virulence on Monterey pine (*Pinus radiata*). We tested this by measuring how well isolates of differing virulence could grow through sterile membrane filters of specified pore sizes, based on the area of growth above and below the filters. The results show that the more virulent strains can grow through smaller pore sizes than strains that are less virulent. Thus, it appears that the capacity to alter hyphal diameter is a factor that influences virulence of *F. circinatum* on pine.

Characterizing Heritable Variation in the Ability of *F. circinatum* to Colonize Corn to Evaluate the Evolutionary History of a Pine Pathogen

Cassandra A. Young
Sponsor: Thomas R. Gordon, Ph.D.
Plant Pathology

Fusarium circinatum is a fungal pathogen that causes a disease of pines known as pitch canker. *Fusarium circinatum* is closely related to species that are associated with grasses, and has recently been shown to infect grasses under natural conditions. These findings suggest that *F. circinatum* may have recently diverged from grass colonizing ancestors. To better understand the evolutionary history of *F. circinatum* studies were undertaken to characterize heritable variation in its ability to colonize corn, a member of the grass family. Four isolates were included in each test. Seedling colonization was evaluated by soaking seed in a spore suspension of the pathogen, sowing seed in potting mix and harvesting seedlings three weeks later. All isolates were recovered at the same frequency from roots, but they differed in the extent to which they colonized shoot tissue. Isolates were also included in corn ear inoculation tests. Inoculations were accomplished by inserting toothpicks colonized by *F. circinatum* through the husk into developing kernels. Based on the number of kernels surrounding the inoculation site that were infected, all isolates colonized ears to a similar extent. Because seedling colonization appears to reveal more variation, it will be used to screen a larger set of isolates.

Identification of Apoptosis under Mxd3 Overexpression in Medulloblastoma

Jay Yu
Sponsor: Elva Díaz, Ph.D.
Pharmacology

Medulloblastoma is the most common malignant brain tumor in children. The transcription factor, Mxd3, plays a critical role in medulloblastoma development by influencing the transcription of specific genes important for proliferation. Previously, it has been shown that Mxd3 is up-regulated in medulloblastoma. Furthermore, Mxd3 knockdown resulted in reduced cell proliferation. However, despite its proliferation property, prolonged expression of Mxd3 eventually resulted in cell death. We hypothesize that apoptosis, the process of programmed cell death, is triggered as a result of persistent Mxd3 overexpression. To test this hypothesis, we will first confirm the up-regulation of selected genes associated with known apoptosis pathways by using quantitative reverse transcription PCR (qRT-PCR). Then, using TUNEL and Caspase apoptosis assays, we will test for apoptosis activities in response to Mxd3 activation. This study will validate potential transcriptional targets of Mxd3 and provide a better understanding of the role of Mxd3 in cell death in medulloblastoma.

The Effect of Plate Motion on Slab Dip in Subduction Zones

Christina Zabalza
Sponsor: Magali Billen, Ph.D.
Geology

Subduction zones are tectonic plate boundaries where one plate sinks beneath another into the mantle. The geometry (dip) of the subducting plate (slab) is thought to vary due to different physical processes that affect plate kinematics, such as lateral motion of the plate boundary (trench) or sinking-induced suction forces on the slab. Dip, depth, and velocity data from eight subduction zones were used to look for correlations between these parameters to test the hypothesis that one of these physical processes dominantly controls slab dip. First, we compared plate kinematics predicted by four plate reconstruction models and seven plate motion reference frames. Based on this, we chose to use the MORVEL plate reconstruction model in a no-net-rotation reference frame to perform velocity calculations for the subducting and overriding plates (i.e., trench motion) and the convergence. A recent compilation of shape data (Slab1.0) was used to find slab dip along the trenches at different depth ranges: 0-100 km, 100-410 km, and 410-670 km. The results suggest there is no correlation between dip and plate motion or convergence. This indicates that models for subduction zone dynamics must be non-steady state to take into account the time dependent behavior of subducting plate dip.

The Significance of OEP80 for Chloroplast Biogenesis

Andrew R. Zareie
Sponsor: Kentaro Inoue, Ph.D.
Plant Sciences

OEP80 is a beta barrel chloroplast outer membrane protein essential for embryonic development of the model plant *Arabidopsis thaliana*; embryos of *oep80*-null mutants show a lethal phenotype. However the role of OEP80 in post-embryonic development is unknown. We hypothesize that OEP80 is essential for chloroplast biogenesis thus is a prerequisite for plant development after embryogenesis. In order to test this, we wished to rescue the lethal phenotype of an *A. thaliana OEP80* knockout during embryogenesis while permitting analysis of the mutant phenotype during later stages of development. To this end, we have transformed a heterozygous mutant for an OEP80 knockout with a construct encoding OEP80 with the seed-specific promoter, P_{ABI3}. (P_{ABI3}::OEP80). By genomic PCR, we identified seedlings of two independent lines that carry the P_{ABI3}::OEP80 transgene and are homozygous for the *OEP80* knockout. These two lines display two distinct phenotypes. The first are variegated, white, and small and the second contain anthocyanin and are small. Further studies are being taken to conclude the true phenotype for the true *OEP80* knockout.

Niños Sanos Familia Sana Gender BMI Comparison

Gloria Zavala
Sponsor: Lucia Kaiser, Ph.D.
Nutrition

According to the World Health Organization, obesity and overweight has risen to become a global problem. The Niños Sanos Familia Sana (Healthy Children, Healthy Family) project is a multi-component, five-year intervention designed to prevent childhood obesity in the California Central Valley. The target population is Mexican-origin families who are at high risk of obesity and other nutrition-related health problems. In the medical aspect of this project, children ages 3-8 years were weighed and measured. Percentage of children who are overweight or obese, based on their body mass index (BMI), will be presented. From the Central Valley (San Joaquin and Firebaugh in Fresno County), 287 children (125 boys and 162 girls) will be included in the sample. BMI status will be compared to see if gender is a factor related to childhood obesity. Taking gender into consideration is important because it allows us to see if different prevention strategies might be needed for boys and girls.

Household Food Insecurity and Child Food Patterns in the Niños Sanos, Familia Sana Study

Rosio Zavala
Sponsor: Lucia Kaiser, Ph.D.
Nutrition

California's Central Valley is reported to be one the poorest regions nationwide and demonstrates high levels of food insecurity. Through the continuous lack of access to nutritious food, there is a high prevalence of obesity among Mexican-origin children in the Central Valley. Niños Sanos, Familia Sana (Healthy Children, Healthy Family) is a five-year multi-component project designed for the prevention of childhood obesity in Mexican-origin 3-8 year old children. By following procedures from *Guide to Measuring Household Food Security, Revised 2000 and Measuring Children's Food Security in U.S. Households, 1995-1999*, researchers interviewed parents about the level of household food insecurity during the last three months. Parents as well filled out questionnaires regarding the frequency of their children consumption of 26 common Hispanic food items. The results will help one observe if there is a correlation between food insecurity and the foods children in the households consumed in sessional time periods.

Mechanisms of Catalytic Esterification of Cellulose with Polycarboxylic Acids

Cunyi Zhao
Sponsor: Gang Sun, Ph.D.
Textiles and Clothing

3,3',4,4';-benzophenone tetracarboxylic acid (BPTCA), a polycarboxylic acid, could directly react with cotton cellulose to form ester bonds with sodium hypophosphite (NaH_2PO_2) as a catalyst. The multiple ester bonds formed between the polycarboxylic acid and cellulose established a crosslinked structure which could provide wrinkle free functions to cotton fabrics and is an environmentally friendly approach with using formaldehyde. However, the catalytic mechanism about this reaction has never been studied in previous research. In this study, we investigated the functions of this catalyst and compared with various phosphate salt compounds to understand the catalytic mechanism of the reaction and find the most efficient and alternative catalyst. The preliminary results indicated that the amount of the catalyst was directly related to the amount of ester bonds form within cellulose and several other sodium phosphate salts were not as effective in catalyzing the reaction. The special catalytic effect of sodium hypophosphite will be discussed in the presentation. By finding the most efficient catalyst, the temperature can be lower and more energy will be saved in industrial process. Fourier transform infrared spectroscopy (FTIR) and thermogravimetric analyzer (TGA) are used to analyze the chemical structure of cellulose treated by BPTCA with catalysts.

Assessing Changes in Midgut Permeability During Blood Meal Digestion in *Anopheles stephensi* Using Fluorescent Beads

Danielle L. Zumpano
Sponsor: Shirley Luckhart, Ph.D.
Medical Microbiology & Immunology

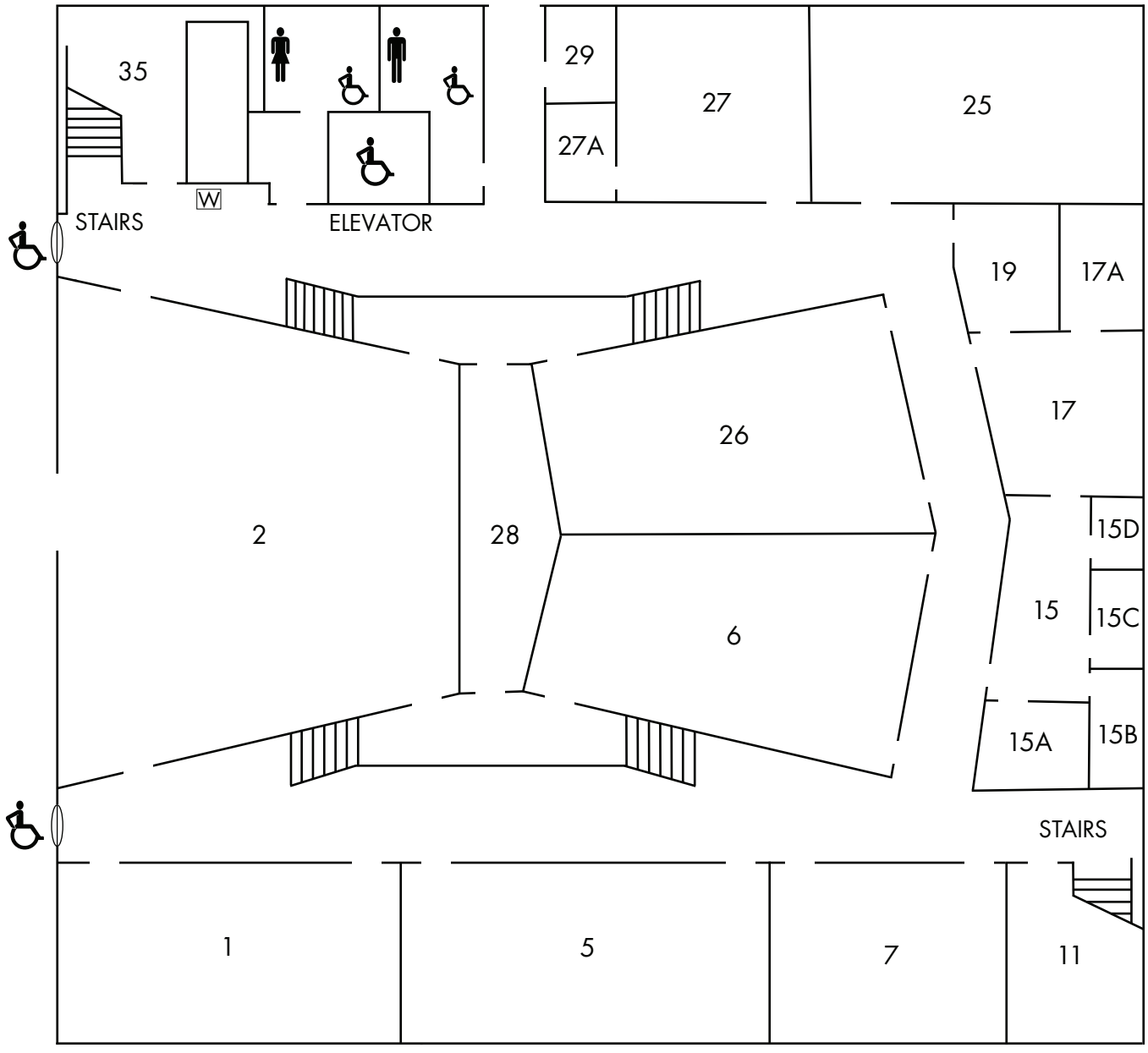
When a female anopheline mosquito feeds upon a malaria-infected human, it ingests red blood cells (RBCs) containing malaria parasites. Of the infected RBCs, a few contain male and female gametocytes, which fuse in the mosquito midgut to form motile ookinetes. Ookinetes then cross the midgut epithelium to form a vegetative oocyst under the basal lamina of the midgut. Oocysts generate sporozoites, which migrate to the mosquito salivary glands and are injected into a human host, thereby completing the malaria life cycle. The process of blood digestion may be altering the permeability of the midgut, potentially making it easier for ookinetes to infect the mosquito. This study assessed changes in mosquito midgut permeability during blood meal digestion using a novel technique - fluorescent beads that diffuse across the midgut. Mosquitoes were fed three separate blood meals containing different bead sizes and the size and the number of fluorescent beads that crossed the midgut barrier were measured over the course of blood meal digestion. I hypothesized that midgut permeability is increased during blood digestion and facilitates *Plasmodium* infection. If this is the case, then increasing the midgut barrier through genetic manipulation could dramatically reduce malaria transmission.

Profiling Volatiles to Identify Concealed Damage in California Almonds

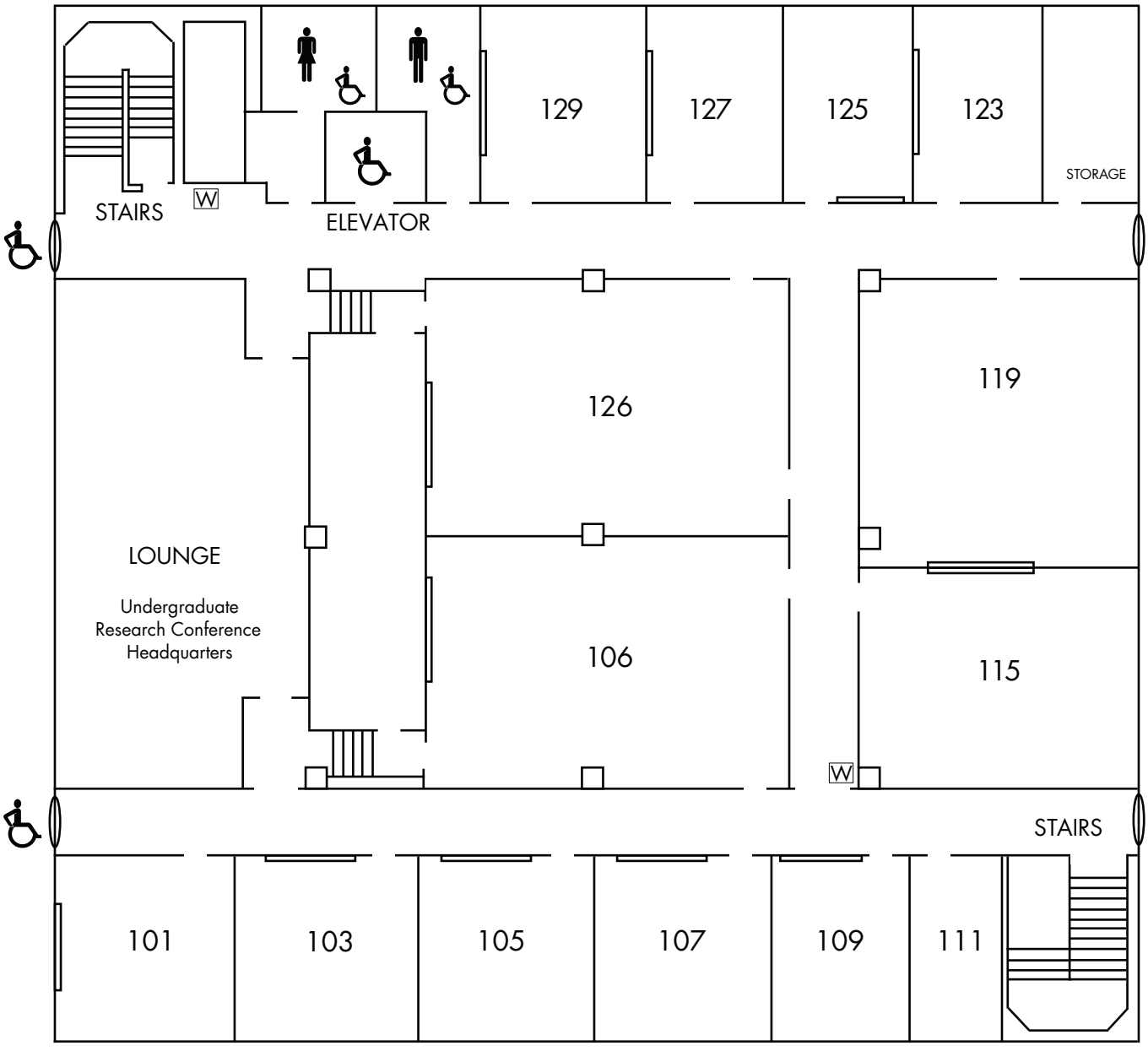
David Zuskov
Sponsor: Alyson Mitchell, Ph.D.
Food Science and Technology

Concealed damage (CD) can occur in almonds exposed to elevated moisture and temperature while stockpiled in the field. The damage is not apparent in raw almonds but appears as a dark color upon roasting. Additionally, CD results in the formation of a bitter compound(s) during roasting; causing consumer rejection and a loss for the industry in terms of product and monetary value. The goal of this project was to identify volatile markers present in raw CD almonds in order to provide the industry with a screening tool for identifying concealed damage prior to almond roasting. Herein, almonds were exposed to CD conditions (10-12% moisture content at 45°C). Almond kernels were split in half and ½ were roasted (120°C for 90 min). Volatiles were compared in raw and roasted almonds using headspace SPME GC-MS (HP 6890 GC and 5973 MS, Palo Alto, California) analysis over a course of 7 days. Preliminary results indicate that Acetic acid, 4-hydroxy-2-Pentanone, 2,3-Butanediol, [S-(R*,R*)]-2,3-Butanediol, R-(-)-1,2-propanediol may be markers of CD in raw almonds.

WELLMAN HALL
FLOOR MAP
Lower Level



WELLMAN HALL
FLOOR MAP
1st Floor



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= Front of Classroom

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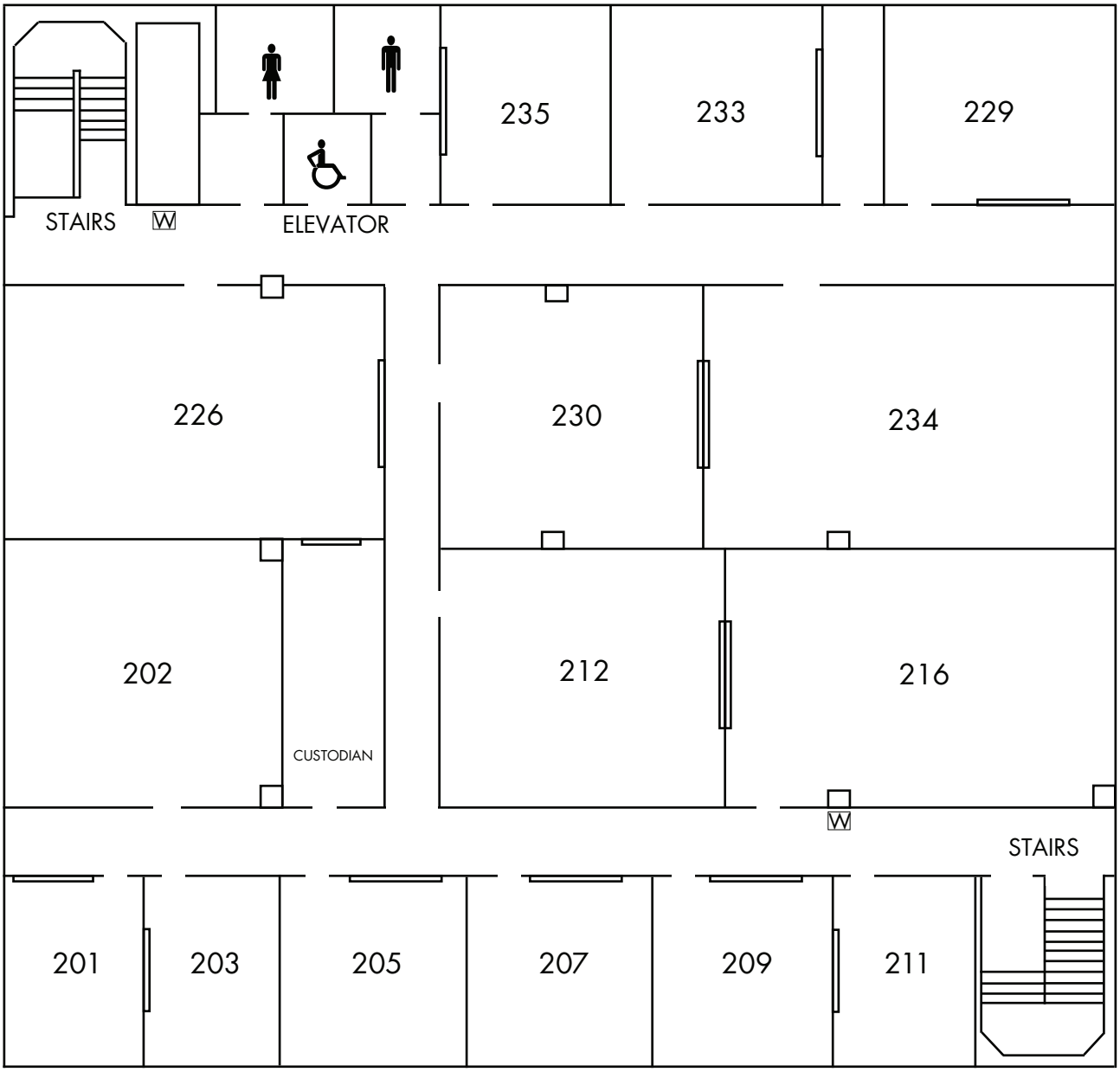
WELLMAN HALL FLOOR MAP 2nd Floor



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