25th Annual Undergraduate Research, Scholarship & Creative Activities Conference

Poster Sessions
Friday, April 25, 2014
3–6 p.m.
Freeborn Hall

Arts Exhibit
Friday, April 25, 2014
3–6 p.m.
Freeborn Hall

Oral Sessions
Saturday, April 26, 2014
1–6 p.m.
Wellman Hall Rooms

Sponsored by:
Undergraduate Education and the Division of Student Affairs

UCDAVIS

25th Annual Undergraduate Research, Scholarship & Creative Activities Conference

WELCOME 2014

Dear Colleagues, Presenters and Guests,

Welcome to the 25th annual UC Davis Undergraduate Research, Scholarship and Creative Activities Conference. This two-day event brings together students from each of our colleges and divisions to showcase the unique community of research and learning at UC Davis.

I am very proud of the fact that in its 25-year history, the conference has grown dramatically. Nineteen students participated in the original conference in 1990; this year, more than 500 students will present their research. This phenomenal growth indicates the value UC Davis places on fostering undergraduate research, and demonstrates the quality of our students and the faculty who support, teach and mentor them.

The opportunities for undergraduate research at UC Davis are excellent, reflecting our university's emphasis on working toward solutions for the most pressing global problems. Undergraduates receive mentoring not only in their home departments, but also from faculty in our professional schools, including the School of Medicine and the School of Veterinary Medicine. Our students work in laboratories seeking new treatments for cancer, Alzheimer's and neurotrauma, participate in developing agricultural solutions to world hunger, and contribute to engineering projects from prosthetics to alternative energy sources. Student research extends into all disciplines, helping to improve our world by forging a better understanding of critical issues such as human rights and development. Research in the humanities and arts promotes better understanding of ourselves as human beings, and shares that knowledge through literature and the performing and fine arts. We are all fortunate to be part of a university with such diverse research interests and boundless creative energy.

Let me take this opportunity to commend the work of the Undergraduate Research Center, which hosts this conference every year. Thank you to our mentors for their commitment to undergraduates and congratulations to all our student presenters on their research.

Sincerely,

Linda P.B. Katehi
Chancellor

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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 (CAMP); Davis Honor's Challenge; Interdisciplinary Agriculture Medicine Science Technology Engineering and Mathematics (iAMSTEM); 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).

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AGENDA

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3–6 p.m., Freeborn Hall

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4–5 p.m. ..... *Poster Session B*

5–6 p.m. ..... *Poster Session C*

Arts Exhibit: Friday, April 25, 2014

3–6 p.m., Freeborn Hall, Concurrent with Poster Session

3–6 p.m. ..... *Arts Exhibit*

Oral Sessions: Saturday, April 26, 2014

1–6 p.m., Wellman Hall

12–1 p.m. ..... *Presenter Check-in*

East Entrance, Wellman Hall

1–2:30 p.m. ..... *Oral Session 1*

3–4:30 p.m. ..... *Oral Session 2*

5–6 p.m. ..... *Oral Session 3*

Sponsored by:
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Macway, Emily ..... Session A ..... Poster 65 ... 3:00 p.m. ..... Freeborn
Madrid, Nicolas ..... Session B ..... Poster 75 ... 4:00 p.m. ..... Freeborn
Maerz, Megan ..... Session A ..... Poster 94 ... 3:00 p.m. ..... Freeborn
Magee, Andrew ..... Session B ..... Poster 20 ... 4:00 p.m. ..... Freeborn
Mahomed, Mavish ..... Session 2 ..... Oral .. 3:45 p.m. ..... 26 Wellman
Mai, Jing ..... Session A ..... Poster 43 ... 3:00 p.m. ..... Freeborn
Majju, Jagdish ..... Session A ..... Poster 32 ... 3:00 p.m. ..... Freeborn
Malek-Salehi, Shawyon ..... Session 1 ..... Oral .. 1:15 p.m. ... 106 Wellman
Malins, Kevin ..... Session 1 ..... Oral .. 1:45 p.m. ... 126 Wellman
Mann, Phil ..... Session 1 ..... Oral .. 1:45 p.m. ... 226 Wellman
Maqsud, Mehreen ..... Session C ..... Poster 35 ... 5:00 p.m. ..... Freeborn
Marino, Regina ..... Session C ..... Poster 63 ... 5:00 p.m. ..... Freeborn
Marquez, Alexandro ..... Session B ..... Poster 24 ... 4:00 p.m. ..... Freeborn
Mawla, Alex ..... Session 1 ..... Oral .. 1:30 p.m. ... 212 Wellman
McCartney, Mitchell ..... Session 3 ..... Oral .. 5:30 p.m. ... 106 Wellman
McFadden, Reilly ..... Session 3 ..... Oral .. 5:30 p.m. ... 226 Wellman
McIntosh, Scott ..... Session B ..... Poster 99 ... 4:00 p.m. ..... Freeborn
Medina, Arek ..... Session A ..... Poster 29 ... 3:00 p.m. ..... Freeborn
Mehari, Avi ..... Session C ..... Poster 38 ... 5:00 p.m. ..... Freeborn
Melnik, Mikhail ..... Session 3 ..... Oral .. 5:15 p.m. ... 126 Wellman
Mercado-Rodas, Dulce ..... Session A ..... Poster 44 ... 3:00 p.m. ..... Freeborn
Michaiel, Jonathan ..... Session A ..... Poster 53 ... 3:00 p.m. ..... Freeborn
Mikell, Carlos ..... Session 1 ..... Oral .. 1:30 p.m. ... 119 Wellman
Mikhailova, Alexandra ..... Session 1 ..... Oral .. 2:00 p.m. ... 126 Wellman
Miller, Lillian ..... Session 2 ..... Oral .. 3:30 p.m. ..... 6 Wellman
Mlonchina, Viktoriya ..... Session B ..... Poster 49 ... 4:00 p.m. ..... Freeborn
Molander, Melody ..... Session B ..... Poster 87 ... 4:00 p.m. ..... Freeborn
Monroy, Robert ..... Session A ..... Poster 3 ... 3:00 p.m. ..... Freeborn
Moore, La Quan ..... Session C ..... Poster 59 ... 5:00 p.m. ..... Freeborn
Moreno, Elizabeth ..... Session A ..... Poster 24 ... 3:00 p.m. ..... Freeborn
Moreno-Gonzalez, Maria ..... Session 2 ..... Oral .. 3:00 p.m. ... 234 Wellman
Moskaluk, Alexandra ..... Session A ..... Poster 77 ... 3:00 p.m. ..... Freeborn
Moya, Jackelyn ..... Session B ..... Poster 48 ... 4:00 p.m. ..... Freeborn
Mulcahy, Justin ..... Session C ..... Poster 81 ... 5:00 p.m. ..... Freeborn
Munton, Frances ..... Session 1 ..... Oral .. 1:15 p.m. ... 229 Wellman
Murphy, Katherine ..... Session A ..... Poster 90 ... 3:00 p.m. ..... Freeborn
Myers, Victoria ..... Session A ..... Poster 93 ... 3:00 p.m. ..... Freeborn
Nail, Stephanie ..... Session A ..... Poster 50 ... 3:00 p.m. ..... Freeborn
Naranjo, Anna ..... Session C ..... Poster 99 ... 5:00 p.m. ..... Freeborn
Naughton, Marisa ..... Session C ..... Poster 66 ... 5:00 p.m. ..... Freeborn
Ndama, Mbowoi Faith ..... Session 2 ..... Oral .. 3:45 p.m. ... 106 Wellman
Nelson, Andrew ..... Session 3 ..... Oral .. 5:45 p.m. ... 226 Wellman
Nesbit, Ryan ..... Session A ..... Poster 47 ... 3:00 p.m. ..... Freeborn
Nguyen, Alexander ..... Session A ..... Poster 88 ... 3:00 p.m. ..... Freeborn
Nguyen, Lee ..... Session B ..... Poster 32 ... 4:00 p.m. ..... Freeborn
Nieves, Desiree ..... Session C ..... Poster 47 ... 5:00 p.m. ..... Freeborn
Nittur, Vinay ..... Session 2 ..... Oral .. 3:15 p.m. ... 126 Wellman
Obester, Alyssa ..... Session C ..... Poster 85 ... 5:00 p.m. ..... Freeborn
O'Connor, Claire ..... Session D .. Arts Exhibit 3 ... 3:00 p.m. ..... Freeborn
Odufalu, Jonathan ..... Session A ..... Poster 18 ... 3:00 p.m. ..... Freeborn
Olide, Everardo ..... Session A ..... Poster 66 ... 3:00 p.m. ..... Freeborn
Ordaz, Angel ..... Session 2 ..... Oral .. 3:45 p.m. ..... 6 Wellman
Ordaz, Rafael ..... Session 3 ..... Oral .. 5:30 p.m. ... 126 Wellman
Owen, Joseph ..... Session A ..... Poster 23 ... 3:00 p.m. ..... Freeborn
Pace, Kayla ..... Session C ..... Poster 51 ... 5:00 p.m. ..... Freeborn
Padilla, Mikela ..... Session C ..... Poster 46 ... 5:00 p.m. ..... Freeborn
Pandey, Rahul ..... Session A ..... Poster 16 ... 3:00 p.m. ..... Freeborn
Paranial, Matthew ..... Session C ..... Poster 33 ... 5:00 p.m. ..... Freeborn
Patel, Dillon ..... Session C ..... Poster 32 ... 5:00 p.m. ..... Freeborn
Patel, Vedang ..... Session A ..... Poster 52 ... 3:00 p.m. ..... Freeborn
Pavick, Hydie ..... Session C ..... Poster 50 ... 5:00 p.m. ..... Freeborn
Perez, Francisco ..... Session C ..... Poster 44 ... 5:00 p.m. ..... Freeborn
Pernas, Badrdin ..... Session C ..... Poster 78 ... 5:00 p.m. ..... Freeborn
Phan, Athena ..... Session 3 ..... Oral .. 5:30 p.m. ..... 6 Wellman
Phan, Justin ..... Session B ..... Poster 42 ... 4:00 p.m. ..... Freeborn
Phan, Tran ..... Session C ..... Poster 100 ... 5:00 p.m. ..... Freeborn
Piryaei, Tara ..... Session C ..... Poster 56 ... 5:00 p.m. ..... Freeborn
Pittman, Scott ..... Session 2 ..... Oral .. 3:30 p.m. ... 234 Wellman
Platero, Alexander ..... Session C ..... Poster 26 ... 5:00 p.m. ..... Freeborn

Plutino, Linda ..... Session 2 ..... Oral .. 3:45 p.m. ... 234 Wellman
Pollitt, Stephanie ..... Session B ..... Poster 1 ... 4:00 p.m. ..... Freeborn
Polterock, Hannah ..... Session B ..... Poster 88 ... 4:00 p.m. ..... Freeborn
Preciado, Gladys ..... Session 2 ..... Oral .. 4:00 p.m. ... 233 Wellman
Pretell, Pamela ..... Session 1 ..... Oral .. 1:30 p.m. ... 233 Wellman
Prokop, Sofia ..... Session B ..... Poster 95 ... 4:00 p.m. ..... Freeborn
Pueyo Svoboda, Natalie ..... Session C ..... Poster 13 ... 5:00 p.m. ..... Freeborn
Putinar, Corina ..... Session B ..... Poster 89 ... 4:00 p.m. ..... Freeborn
Pyon, Marianne ..... Session A ..... Poster 45 ... 3:00 p.m. ..... Freeborn
Qu, Roy ..... Session 1 ..... Oral .. 1:45 p.m. ... 119 Wellman
Quach, Joanna ..... Session A ..... Poster 78 ... 3:00 p.m. ..... Freeborn
Rainbolt, Chadwick ..... Session 1 ..... Oral .. 2:15 p.m. ... 202 Wellman
Randhawa, Amritpal ..... Session 1 ..... Oral .. 1:45 p.m. ... 106 Wellman
Rangel, Maria ..... Session B ..... Poster 57 ... 4:00 p.m. ..... Freeborn
Raven, Lindsey ..... Session 2 ..... Oral .. 3:15 p.m. ... 229 Wellman
Raza, Ahmad ..... Session 2 ..... Oral .. 3:45 p.m. ... 230 Wellman
Rease, Morgan ..... Session C ..... Poster 86 ... 5:00 p.m. ..... Freeborn
Recinos, Jimmy ..... Session 2 ..... Oral .. 4:00 p.m. ... 234 Wellman
Resseguie, Elodie ..... Session C ..... Poster 73 ... 5:00 p.m. ..... Freeborn
Reves, Paula ..... Session 1 ..... Oral .. 1:30 p.m. ... 234 Wellman
Reynado, Zachary ..... Session C ..... Poster 19 ... 5:00 p.m. ..... Freeborn
Rienecker, Kira ..... Session 1 ..... Oral .. 2:00 p.m. ... 216 Wellman
Rivera, Elias ..... Session B ..... Poster 51 ... 4:00 p.m. ..... Freeborn
Robinson, Elise ..... Session 2 ..... Oral .. 3:30 p.m. ... 126 Wellman
Rodríguez, Tomás ..... Session B ..... Poster 9 ... 4:00 p.m. ..... Freeborn
Rodriguez, Selina ..... Session 2 ..... Oral .. 4:00 p.m. ... 216 Wellman
Rodriguez Sainz, Luis ..... Session A ..... Poster 31 ... 3:00 p.m. ..... Freeborn
Roland, Jeremy ..... Session A ..... Poster 103 ... 3:00 p.m. ..... Freeborn
Ronne, Eric ..... Session C ..... Poster 17 ... 5:00 p.m. ..... Freeborn
Rosenberg, Danielle ..... Session 2 ..... Oral .. 4:15 p.m. ... 234 Wellman
Rothmann, Samuel ..... Session 1 ..... Oral .. 1:45 p.m. ... 234 Wellman
Rupasinghe, Mark ..... Session B ..... Poster 79 ... 4:00 p.m. ..... Freeborn
Saeed, Gheed ..... Session 3 ..... Oral .. 5:15 p.m. ... 216 Wellman
Sagun, John ..... Session B ..... Poster 81 ... 4:00 p.m. ..... Freeborn
Sahota, Kamalpreet ..... Session B ..... Poster 38 ... 4:00 p.m. ..... Freeborn
Salazar, Raul ..... Session A ..... Poster 33 ... 3:00 p.m. ..... Freeborn
Salimi, Mona ..... Session 2 ..... Oral .. 4:00 p.m. ... 230 Wellman
Salunkhe, Varsha ..... Session 1 ..... Oral .. 2:00 p.m. ... 106 Wellman
Santoso, Michelle ..... Session 1 ..... Oral .. 1:45 p.m. ... 212 Wellman
Sartori, Federica ..... Session A ..... Poster 2 ... 3:00 p.m. ..... Freeborn
Scott, Andrew ..... Session A ..... Poster 48 ... 3:00 p.m. ..... Freeborn
Seguro, Charmaine ..... Session A ..... Poster 76 ... 3:00 p.m. ..... Freeborn
Sepulveda, Guadalupe ..... Session 2 ..... Oral .. 4:00 p.m. ..... 26 Wellman
Shafique, Haroon ..... Session 3 ..... Oral .. 5:45 p.m. ... 126 Wellman
Shamim, Baubak ..... Session C ..... Poster 8 ... 5:00 p.m. ..... Freeborn
Sharad, Deepika ..... Session B ..... Poster 25 ... 4:00 p.m. ..... Freeborn
Sharafian, Hannah ..... Session 2 ..... Oral .. 4:00 p.m. ... 115 Wellman
Sharma, Shreya ..... Session 1 ..... Oral .. 2:15 p.m. ..... 26 Wellman
Shehadeh, Saliem ..... Session 3 ..... Oral .. 5:30 p.m. ... 216 Wellman
Shi, Shuang ..... Session C ..... Poster 87 ... 5:00 p.m. ..... Freeborn
Shidara, Kie ..... Session 2 ..... Oral .. 3:45 p.m. ... 226 Wellman
Shieh, Marcy ..... Session C ..... Poster 58 ... 5:00 p.m. ..... Freeborn
Shihadih, Diyala ..... Session A ..... Poster 89 ... 3:00 p.m. ..... Freeborn
Shrestha, Pratichhya ..... Session A ..... Poster 99 ... 3:00 p.m. ..... Freeborn
Sim, Joong Hoon ..... Session B ..... Poster 14 ... 4:00 p.m. ..... Freeborn
Singh, Navi ..... Session B ..... Poster 37 ... 4:00 p.m. ..... Freeborn
Singh, Vikram ..... Session A ..... Poster 97 ... 3:00 p.m. ..... Freeborn
Sinha, Abhinav ..... Session C ..... Poster 71 ... 5:00 p.m. ..... Freeborn
Siu, Edward ..... Session A ..... Poster 9 ... 3:00 p.m. ..... Freeborn
Smith, Belle ..... Session B ..... Poster 13 ... 4:00 p.m. ..... Freeborn
Smullin, AnnaLisa ..... Session 2 ..... Oral .. 3:45 p.m. ... 126 Wellman
Soderberg, Stephanie ..... Session B ..... Poster 5 ... 4:00 p.m. ..... Freeborn
Sohal, Mandeep ..... Session 2 ..... Oral .. 4:00 p.m. ... 202 Wellman
Song, Xiao ..... Session 1 ..... Oral .. 2:15 p.m. ... 216 Wellman
Sonti, Anup ..... Session 3 ..... Oral .. 5:15 p.m. ... 202 Wellman
Sosa, Vincent ..... Session D .. Arts Exhibit 4 ... 3:00 p.m. ..... Freeborn
Staley, Simon ..... Session C ..... Poster 75 ... 5:00 p.m. ..... Freeborn
Stanackzai, Nahira ..... Session 3 ..... Oral .. 5:45 p.m. ... 216 Wellman
Steele, Daniel ..... Session B ..... Poster 31 ... 4:00 p.m. ..... Freeborn
Stephens, Richard ..... Session 1 ..... Oral .. 1:30 p.m. ... 126 Wellman
Sticlaru, Michael ..... Session B ..... Poster 76 ... 4:00 p.m. ..... Freeborn
Stout, Michael ..... Session 1 ..... Oral .. 1:30 p.m. ... 106 Wellman
Strelioff, Mac ..... Session A ..... Poster 56 ... 3:00 p.m. ..... Freeborn
Su, Chun ..... Session B ..... Poster 62 ... 4:00 p.m. ..... Freeborn
Su, Yang-Denis ..... Session A ..... Poster 79 ... 3:00 p.m. ..... Freeborn
Sugahara, Haruka ..... Session 1 ..... Oral .. 1:45 p.m. ..... 6 Wellman
Sultani, Hawa ..... Session B ..... Poster 21 ... 4:00 p.m. ..... Freeborn
Sun, Hong ..... Session C ..... Poster 7 ... 5:00 p.m. ..... Freeborn
Sun, Kyle ..... Session 3 ..... Oral .. 5:15 p.m. ... 212 Wellman
Suri, Rasnapreet ..... Session C ..... Poster 53 ... 5:00 p.m. ..... Freeborn
Tam, Clarissa ..... Session 2 ..... Oral .. 4:00 p.m. ... 106 Wellman
Tamayo, Jesse ..... Session C ..... Poster 84 ... 5:00 p.m. ..... Freeborn

Tanida, Kent.....Session 2 .....Oral .. 4:00 p.m. ... 229 Wellman
Taravati, Keyon.....Session A ..... Poster 13 ... 3:00 p.m. ..... Freeborn
Taylor, Jack.....Session 2 .....Oral .. 4:00 p.m. ... 119 Wellman
Taylor, Ryan.....Session 3 .....Oral .. 5:15 p.m. ..... 26 Wellman
Teng, Oyang .....Session 3 .....Oral .. 5:30 p.m. ... 202 Wellman
Thanasuwat, Burinrutt .....Session 2 .....Oral .. 4:00 p.m. ..... 6 Wellman
Thomas, Jackson .....Session B ..... Poster 78 ... 4:00 p.m. ..... Freeborn
Thornton-Dunwoody, Alex...Session C ..... Poster 76 ... 5:00 p.m. ..... Freeborn
Tibbett, Emily.....Session A ..... Poster 22 ... 3:00 p.m. ..... Freeborn
Tien, Jason .....Session C ..... Poster 34 ... 5:00 p.m. ..... Freeborn
Tobin, Angela .....Session B ..... Poster 77 ... 4:00 p.m. ..... Freeborn
Tominaga, Ryoma.....Session C ..... Poster 67 ... 5:00 p.m. ..... Freeborn
Torres, Valeria .....Session A ..... Poster 25 ... 3:00 p.m. ..... Freeborn
Toussi, Atrin .....Session C ..... Poster 5 ... 5:00 p.m. ..... Freeborn
Tran, Andy .....Session A ..... Poster 19 ... 3:00 p.m. ..... Freeborn
Tran, Connie.....Session C ..... Poster 42 ... 5:00 p.m. ..... Freeborn
Tran, Duy.....Session 1 .....Oral .. 2:00 p.m. ... 119 Wellman
Tran, Jacqueline.....Session A ..... Poster 80 ... 3:00 p.m. ..... Freeborn
Tran, John.....Session 2 .....Oral .. 4:15 p.m. ... 216 Wellman
Tran, Michelle.....Session B ..... Poster 17 ... 4:00 p.m. ..... Freeborn
Tran, Nhon.....Session B ..... Poster 92 ... 4:00 p.m. ..... Freeborn
Truong, Lisa .....Session B ..... Poster 12 ... 4:00 p.m. ..... Freeborn
Truong, Rose Hong.....Session 2 .....Oral .. 4:00 p.m. ... 126 Wellman
Tsai, Catherine.....Session 1 .....Oral .. 2:00 p.m. ... 234 Wellman
Tsao, Li .....Session 2 .....Oral .. 4:15 p.m. ... 106 Wellman
Turner, Lauren .....Session 3 .....Oral .. 6:00 p.m. ... 216 Wellman
Tuyen, Kenney.....Session A ..... Poster 11 ... 3:00 p.m. ..... Freeborn
Urtecho, Guillaume .....Session 1 .....Oral .. 2:00 p.m. ... 226 Wellman
Van, Mike.....Session 1 .....Oral .. 2:15 p.m. ... 119 Wellman
Vaughn, Ariel .....Session 3 .....Oral .. 5:30 p.m. ..... 26 Wellman
Vissers, Caroline .....Session 2 .....Oral .. 4:15 p.m. ... 126 Wellman
Viswanath, Varsha .....Session B ..... Poster 82 ... 4:00 p.m. ..... Freeborn
Vittalbabu, Chandrashekar .Session A ..... Poster 46 ... 3:00 p.m. ..... Freeborn
Vue, Mai .....Session C ..... Poster 83 ... 5:00 p.m. ..... Freeborn
Wai, Alex.....Session B ..... Poster 30 ... 4:00 p.m. ..... Freeborn
Wall, Tiffany .....Session A ..... Poster 60 ... 3:00 p.m. ..... Freeborn
Wancewicz, Benjamin .....Session B ..... Poster 11 ... 4:00 p.m. ..... Freeborn
Wang, Cathy.....Session 1 .....Oral .. 2:00 p.m. ... 212 Wellman
Wang, Deyu.....Session B ..... Poster 36 ... 4:00 p.m. ..... Freeborn
Wang, Jason .....Session C ..... Poster 101 ... 5:00 p.m. ..... Freeborn
Wang, Yijie.....Session A ..... Poster 42 ... 3:00 p.m. ..... Freeborn
Warner, Isabel.....Session A ..... Poster 21 ... 3:00 p.m. ..... Freeborn
Warren, Matthew.....Session 2 .....Oral .. 4:00 p.m. ... 226 Wellman
Washburn, Eden .....Session A ..... Poster 49 ... 3:00 p.m. ..... Freeborn
Watterson, Joanna.....Session 2 .....Oral .. 4:15 p.m. ... 202 Wellman
Weiner, Marina.....Session D .. Arts Exhibit 5 ... 3:00 p.m. ..... Freeborn
Weinstein, Ilyssa.....Session 2 .....Oral .. 4:15 p.m. ... 233 Wellman
Whitten, Cy .....Session A ..... Poster 54 ... 3:00 p.m. ..... Freeborn
Williams, Amanda.....Session 2 .....Oral .. 3:30 p.m. ... 229 Wellman
Williams, Clara .....Session C ..... Poster 20 ... 5:00 p.m. ..... Freeborn
Williamson, David.....Session 3 .....Oral .. 5:30 p.m. ... 212 Wellman
Wilson, Paige.....Session A ..... Poster 6 ... 3:00 p.m. ..... Freeborn
Winter, McKenzie.....Session B ..... Poster 34 ... 4:00 p.m. ..... Freeborn
Winter, Mitchell .....Session 1 .....Oral .. 2:15 p.m. ... 230 Wellman
Woldeyesus, Rahwa .....Session A ..... Poster 8 ... 3:00 p.m. ..... Freeborn
Wong, Johnny.....Session B ..... Poster 15 ... 4:00 p.m. ..... Freeborn
Wong, Matthew .....Session B ..... Poster 98 ... 4:00 p.m. ..... Freeborn
Wong-Sing, Candace .....Session C ..... Poster 62 ... 5:00 p.m. ..... Freeborn
Wood, Katherine.....Session 2 .....Oral .. 4:15 p.m. ... 119 Wellman
Wood, Richard.....Session A ..... Poster 68 ... 3:00 p.m. ..... Freeborn
Wulf, Krystal .....Session A ..... Poster 59 ... 3:00 p.m. ..... Freeborn
Xie, Zhimin .....Session 1 .....Oral .. 1:30 p.m. ..... 6 Wellman
Yamasaki, Youki .....Session A ..... Poster 12 ... 3:00 p.m. ..... Freeborn
Yao, Jia.....Session A ..... Poster 41 ... 3:00 p.m. ..... Freeborn
Yao, Zi .....Session B ..... Poster 94 ... 4:00 p.m. ..... Freeborn
Yasui, Jennifer.....Session 3 .....Oral .. 5:45 p.m. ..... 26 Wellman
Yau, Tammy.....Session B ..... Poster 22 ... 4:00 p.m. ..... Freeborn
Yee, Melody.....Session 1 .....Oral .. 1:30 p.m. ... 229 Wellman
Yin, Isabel .....Session C ..... Poster 41 ... 5:00 p.m. ..... Freeborn
Yip, Derek .....Session C ..... Poster 89 ... 5:00 p.m. ..... Freeborn
Youngblood, Timothy.....Session A ..... Poster 95 ... 3:00 p.m. ..... Freeborn
Zaidi, Sokena.....Session B ..... Poster 93 ... 4:00 p.m. ..... Freeborn
Zareie, Andrew .....Session C ..... Poster 24 ... 5:00 p.m. ..... Freeborn
Zavala, Gloria.....Session A ..... Poster 40 ... 3:00 p.m. ..... Freeborn
Zavala, Rosio .....Session A ..... Poster 39 ... 3:00 p.m. ..... Freeborn
Zhang, Cindy.....Session B ..... Poster 43 ... 4:00 p.m. ..... Freeborn
Zhou, Daoshun .....Session C ..... Poster 40 ... 5:00 p.m. ..... Freeborn
Zhou, Linlin.....Session 2 .....Oral .. 4:15 p.m. ..... 26 Wellman
Zhu, Kaishan.....Session 3 .....Oral .. 5:45 p.m. ... 212 Wellman

6 Wellman Hall · Moderator: Julie Schoenung

1:00 PM Gage M. Caffery – Mechanical Engineering
Absence of Thermal Expansion Mismatch Strengthening in Cryomilled Al-B_4C

1:15 PM Kayla Kuhl – Chemical Engineering
Analysis of the Chemical Hazards of Materials Found in Hard Drives

1:30 PM Zhimin Xie – Chemical Engineering
Hazard Assessments of Titanium Dioxide Nanoparticle Coatings in Textile

1:45 PM Haruka Sugahara – Materials Science and Engineering
Investigation of Precipitation Kinetics in Aluminum 2139 Alloy

2:00 PM Ryan C. Cohn – Chemical Engineering
Differential Scanning Calorimetry Study on Precipitation Behavior in Ultrafine Grained Aluminum Alloys/Composites

26 Wellman Hall · Moderator: Raja K. Sivamani

1:00 PM Alejandro P. Aguirre – Biological Sciences
The Role of the JNK Signaling Pathway in the Anopheles stephensi Anti-Malarial Immune Response

1:15 PM Marie C. Belen – Biochemistry & Molecular Biology
Examining the Effects of C-Jun N-Terminal Kinase (JNK) Signaling on the Lifespan of Anopheles stephensi and Anopheles gambiae Mosquitoes

1:30 PM Nevena G. Georgieva – Biochemistry & Molecular Biology
Shellfish Allergy: An in Depth Analysis of the Protein Tropomyosin

1:45 PM Christine S. Kai – Biochemistry & Molecular Biology
How Do MAPK Phosphatases Influence Anopheles gambiae Innate Immune Signaling?

2:00 PM Gokulesh A. Killer – Neurobiology, Physiology & Behavior
The Influence of Lipoproteins on Human Sebocyte Lipogenesis and Inflammatory Response

2:15 PM Shreya Sharma – Biochemistry & Molecular Biology
Bovine Milk Peptides Stimulate Lipogenesis and Inflammatory Response in Human Sebocytes

106 Wellman Hall · Moderator: R. Holland Cheng

1:00 PM Natasha L. Cowan – Neurobiology, Physiology & Behavior
Reconstitution of HIV-1 Env Into Nanolipoprotein Particles

1:15 PM Shawyon Malek-Salehi – Chemistry
Structural Characterization of a Novel Clade C HIV Env Immunogen Illustrates Conformational Changes Upon CD4m Binding

1:30 PM Michael J. Stout – Biochemistry & Molecular Biology
Echovirus 1 Entry Requires Binding of the Bent, Inactive Conformation of $\alpha 2\beta 1$ Integrin

1:45 PM Amritpal S. Randhawa – Genetics
Probing Structural Elements of HIV-1 Env-Based Trimeric Immunogens via Single Particle Reconstruction

2:00 PM Varsha S. Salunkhe – Biochemistry & Molecular Biology
Purification of HIV-1 Env Trimer for Incorporation Into Nanolipoprotein Discs

119 Wellman Hall · Moderator: R. Lifeng Xu

1:00 PM Connor J. Beebout – Microbiology
RNF212 Is Involved in Meiotic Checkpoints

1:15 PM Mahtab M. Danai – Pharmaceutical Chemistry
Mechanism of Chromosome Rearrangement by Exchanges Between Short Repeated Sequences

1:30 PM Carlos L. Mikell – Genetics
A Screen to Identify Genes That Inhibit Ectopic Loci Interactions

1:45 PM Roy W. Qu – Microbiology
Dyskeratosis Congenita TIN2 Mutant Causes Telomere Shortening by Inhibiting Telomerase

2:00 PM Duy C. Tran – Biochemistry & Molecular Biology
Investigation of Defective Telomere Maintenance Caused by Dyskeratosis Congenita-Associated Heterozygous TIN2 Mutations

2:15 PM Mike V. Van – Biochemistry & Molecular Biology
Influence of Sexual Reproduction Mode on the Behavior of Sex Chromosomes During Meiosis in Caenorhabditis Species

126 Wellman Hall · Moderator: Trish Berger

1:00 PM Sarah J. Bronstein – Biological Sciences
Effects of Diet-Induced Obesity on the Expression Patterns of Omentin-1 in Growing Mice

1:15 PM Trent Ichiuji – Animal Science
Determining Sexual Maturity via Testicular Seminiferous Tubule Diameter

1:30 PM Richard W. Stephens – Neurobiology, Physiology & Behavior
Endogenous Cocaine-Amphetamine-Regulated Transcript (CART) Mediates Glucagon-Like Peptide 1 (GLP-1) Inhibition of Gastric Emptying

1:45 PM Kevin J. Malins – Neurobiology, Physiology & Behavior
Histaminergic Modulation of Syrian Hamster Neuronal Activity Persists at Low Temperature and Stimulation Levels

2:00 PM Alexandra Mikhailova – Neurobiology, Physiology & Behavior
At 35°C Recovery of Neural Signaling After Oxygen Glucose Deprivation is Greater in Hippocampal Slices From Hibernating vs. Non-Hibernating Hamsters

202 Wellman Hall · Moderator: Michael Mulhearn

1:00 PM Ramya Bhaskar – Physics
Image Analysis of Interacting Galaxies in the Deep Lens Survey

1:15 PM Gabriel S. Bonilla – Physics
Angular Correlation Functions of High Energy Hadrons in PbPb, pPb, and pp Simulations

1:30 PM Daine L. Danielson – Physics
Viability of a Fourier Approach to the Neutrino Mass Hierarchy Problem in WATCHMAN

1:45 PM Benjamin Godfrey – Physics
Radiation Hardness Testing Using Arduinos

2:00 PM Aaron Hsu – Mathematics
You Shall Not Pass: Bound States of a Quantum Particle on a Half-Infinite Lattice

2:15 PM Chadwick Rainbolt – Physics
Analysis of Z°jet Production in Pythia vs. Fastjet pp at $\sqrt{s_{NN}}$ = 7 TeV

212 Wellman Hall · Moderator: Raymond L. Rodriguez

1:00 PM Evan Chua – Microbiology
Investigation of Risk Factors for T2DM Global Health Disparities

1:15 PM Megan H. Howes – Biomedical Engineering
Clinical Impact of Sample Interferences on Glucose Monitoring Systems

1:30 PM Alex Mawla – Neurobiology, Physiology & Behavior
Clearing the Smoke: The Cognitive, Neuroanatomical, and Functional Impact of Cannabis Use in Schizophrenia

1:45 PM Michelle R. Santoso – Biological Sciences
Chronic Exposure to Cigarette Smoke Enhances Proliferation of Airway Epithelial Cells by Engaging the Ceramide-Generating Machinery

2:00 PM Cathy Wang – Statistics
The Alzheimer's Disease Neuroimaging Initiative: The Relationship Between Subjective Memory Complaints and Other Patterns of Cognitive Impairment

216 Wellman Hall · Moderator: Janine LaSalle

1:00 PM Roy Chu – Biotechnology
Investigating Genomic Differences Between Neurons and Astrocytes in the Brain

1:15 PM Jason Compton – Neurobiology, Physiology & Behavior
Neurorescue Effects of Early Gestation Placenta-Derived Multipotent Stem Cells on Primary Cortical Neurons

1:30 PM Garrett Hall – Neurobiology, Physiology & Behavior
Expression of Potassium Voltage Gated Ion Channels in Adult Born Neurons

1:45 PM Christopher J. Little – Neurobiology, Physiology & Behavior
Determining the Roles of the Components of Schwann Cell Differentiation Medium

2:00 PM Kira D. Rienecker – Genetics
Corticotropin Releasing Hormone Gene Methylation in Human Placenta Samples From Pregnancies at Risk for Autism Spectrum Disorders

2:15 PM Xiao Song – Neurobiology, Physiology & Behavior
Effects of Lentivirus on the Activation States of Microglia

226 Wellman Hall · Moderator: Anne B. Britt

1:00 PM Jesus Banderas – Plant Biology
Characterization of the Arabidopsis thaliana Gene PBL13

1:15 PM Ryan A. Hamstengel – Biotechnology
Identifying Cell Death Related Transcripts in Irradiated Arabidopsis Tissue

1:45 PM Phil Mann – Statistics
Evolution of Phytochrome Interacting Factors: Statistical Inference of Diversifying Selection

2:00 PM Guillaume Urtecho – Genetics
Development of Novel Minichromosome Technologies in A. thaliana

229 Wellman Hall · Moderator: Scott Shershow

1:00 PM Manasa Davuluri – English
Talking Dirty: The Social Effect of Stand-up Comedy and Sexual Discourse

1:15 PM Frances Munton – Comparative Literature
Hard-Boiled Masculinity and the Oppression of the Feminine

1:30 PM Melody C. Yee – Neurobiology, Physiology & Behavior
Asian and Asian American Women in Academia: Institutional Oppression and Its Effects on Health

1:45 PM Ramneet Basra – Exercise Biology
Shifa Community Clinic's Healthy Breast Program: Promoting Breast Health and Overcoming Barriers in South Asian and Middle Eastern Women

2:00 PM Nigina Jalilova – Russian
Shifa Community Clinic's Healthy Breast Program: Promoting Breast Health and Overcoming Barriers in South Asian and Middle Eastern Women

230 Wellman Hall · Moderator: Vicki Smith

1:00 PM David A. Belcher – Political Science
Effective Methods to Reduce Voter Ignorance

1:15 PM Danielle N. Derman – Communication
Topic Avoidance and Relational Satisfaction

1:30 PM Rachael E. Duke – Linguistics
The Usage and Function of German Hashtags on Twitter and Their Effect on Langauge Change

1:45 PM Joshua S. Gelfat – American Studies
Lists, Quizzes, Nostalgia, and Journalism? BuzzFeed: "The Millennial Generation's Newspaper"

2:00 PM Jordan L. Lowery – Political Science
Voter Suppression: Effectiveness of Section 5

2:15 PM Mitchell A. Winter – Linguistics
The Global Order of Symbolic Capital: UNESCO and the Discourse of World Heritage

233 Wellman Hall · Moderator: Jessica Bissett Perea

1:00 PM Anna-Tanya E. Honey – Linguistics
Scent of Tea: A Study of Chinese Tea Culture Through Poetry

1:15 PM Rebecca G. Ewert – Sociology
Dressing Up: The Production and Performance of Gender Through Drag

1:30 PM Pamela Pretell – Native American Studies
The Powwow at UC Davis

1:45 PM Justen H. Deaton – Native American Studies
Decolonizing Methodologies in Indigenous Hip Hop

2:00 PM Fabian Iglesias – History
Nationalism Through the Ballet Folklórico de México: Marginalization and Appropriation of Indigenous Dances in México

234 Wellman Hall · Moderator: Naomi Janowitz

1:00 PM Kaleena Bergfors – Religious Studies
Blurred Vision: Redefining Ethics and Meaning in Times of Cultural Crisis

1:15 PM Marianne G. Glaser – Religious Studies
Neurotheology: This Is Your Brain on God

1:30 PM Paula Reves – Religious Studies
Childless Hope: Examining Assisted Reproductive Technologies in Ultra-Orthodox Judaism

1:45 PM Samuel Rothmann – Religious Studies
The Protestant Reformation, the Development of Individualism, and Americanism

2:00 PM Catherine Tsai – History
Religious Policies During the Kōminka Movement in Colonial Taiwan, 1937-1945

6 Wellman Hall · Moderator: Wolf-Dietrich Heyer

3:00 PM Lorita Boghospor – Cell Biology
Identification and Visualization of Giardia Ventral Disc Proteins

3:15 PM Monique Chavez – Cell Biology
Examining the Genome-Wide Mutation Spectra and the Role of Translesion Synthesis Polymerases in Saccharomyces cerevisiae

3:30 PM Lillian Miller – Biochemistry & Molecular Biology
Analysis of Aristotle's Prophecy of Synergy Involving Protein Translocation via Hsp93 and Hsp70 in the Toc/Tic Pathway

3:45 PM Angel Ordaz – Neurobiology, Physiology & Behavior
DMRT1 is Required for Male Sex Determination in Zebrafish

4:00 PM Burinrutt Thanasuwat – Biochemistry & Molecular Biology
Exploring the Interaction of NLR and Chaperon Protein Using Purified Proteins

7 Wellman Hall · Moderator: Frances Dolan

3:00 PM Laurel Carney – English
Pleading the Belly: Death, Pregnancy and Fiction in Early Modern England

3:15 PM Theo Carruthers – English
Controlled Delight: Literary Techniques and Action in Lolita

3:30 PM Annika J. Cunningham – English
Chaucer's Chessboard: Reading Spaces in The Book of the Duchess

3:45 PM Allegra C. Harrison – History
Alehouses and the Public Sphere in Britain 1707-1830

4:00 PM Hannah N. Sharafian – Dramatic Art
A House Divided: Gender Division and Architectural Specificity in Susan Glaspell's The Verge and Alison's House

26 Wellman Hall · Moderator: R. Holland Cheng

3:00 PM Noeli C. Acoba – Biotechnology
Characterization of xylR in Synechococcus elongatus

3:15 PM Brandon J. Anson – Biological Sciences
Post Translational Modifications Induce Diverse Conformational Changes in Nucleoplasmin Mediating Histone Storage and Deposition Activities

3:30 PM Qiran Gu – Biological Sciences
The Application of RGD Peptides in Enhancing Oral Vaccine

3:45 PM Mavish Mahomed – Biochemistry & Molecular Biology
Isothermal Titration Calorimetry and X-Ray Crystallography to Understand the Binding of Camphor to P450cam

4:00 PM Guadalupe E. Sepulveda – Biochemistry & Molecular Biology
Expanding the MALDI-TOF MS Library to Include Actinomyces, a Bacterium Encountered in Companion Animal Abscesses

4:15 PM Linlin Zhou – Biological Sciences
Chemically Regulated Genetic Logic Gates Based on HDV Ribozyme

106 Wellman Hall · Moderator: Alfred Huo

3:00 PM Joan Chiou – Biotechnology
cMyc-Xa21: Another Resource for Studying XA21-Mediated Immunity

3:15 PM Kyle Lambert – Biotechnology
Understanding Seed Germination Through Differential Expression Analysis of Lettuce RNA-Seq Data

3:30 PM Vu V. Le – Biochemistry & Molecular Biology
cMyc-Xa21: Another Resource for Studying Rice Plant Immunity

3:45 PM Mbowoi Faith Ndama – Biological Sciences
cMyc-Xa21: Another Resource for Studying Rice Plant Immunity

4:00 PM Clarissa H. Tam – Biotechnology
Seed Thermoinhibition in Lettuce

4:15 PM Li Tsao – Pharmaceutical Chemistry
A Wall-Associated Kinase in Rice Confers Resistance to Bacterial Blight

119 Wellman Hall · Moderator: Peter C. Wainwright

3:00 PM Chelo Jane Datinguinoo – Genetics
Metamorphic Hormone Expression in Exaggerated Drosophila prolongata Forelegs

3:15 PM Rebecca L. Ehrlich – Evolution, Ecology and Biodiversity
Male Courtship Adjustments in Response to Female Signals

3:30 PM Daniel A. Friedman – Genetics
Changes in Gene Regulatory Sequences Are Responsible for the Evolution of Sex-Specific Characters

3:45 PM Aaron M. Goodman – Evolution, Ecology and Biodiversity
Like Goes With Like, Katy Did It! Correlation Between Substrate Selection and Body Color of Neotropical Katydids (Orthoptera: Tettigoniidae)

4:00 PM Jack C. Taylor – Biochemistry & Molecular Biology
Fecundity Decrease in Drosophila simulans in the Absence of Wolbachia

4:15 PM Katherine E. A. Wood – Evolution, Ecology and Biodiversity
Testing the Janzen-Connell Hypothesis for Explaining High Biodiversity in a Tropical Rainforest

126 Wellman Hall · Moderator: Soichiro Yamada

3:00 PM Alexandra Blee – Biochemistry & Molecular Biology
The Force Sensitive Protein Complex of Epithelial Cell-Cell Adhesions

3:15 PM Vinay R. Nittur – Neurobiology, Physiology & Behavior
A New Approach to Measuring Skeletal Muscle: 3D Volumetric Analysis Using PET/CT Imaging

3:30 PM Elise Robinson – Biomedical Engineering
A Method for Blood Biomarker Amplification Using High-Intensity Focused Ultrasound

3:45 PM AnnaLisa M. Smullin – Biomedical Engineering
Imaging Particle Deposition in Airways

4:00 PM Rose Hong Truong – Biomedical Engineering
Traction Force Analysis of Epithelial Cell-Cell Junctions

4:15 PM Caroline B. Vissers – Animal Science
Effects of Pore Size on Mechanical Properties and Osteoblast Behavior in Bioglass Composite Scaffolds

202 Wellman Hall · Moderator: Kermit L. Carraway

3:00 PM Antonio Cuevas – Biochemistry & Molecular Biology
Regulation of (Non-Canonical Wnt Signaling/ Dvl) by the E3 Ligase Nrdp1 in Glioblastoma

3:15 PM Daniel A. Curiel – Biochemistry & Molecular Biology
The Nrdp1 E3 Ubiquitin Ligase is an Endoplasmic Reticulum Stress Response Protein

3:30 PM Monica T. Hwu – Biochemistry & Molecular Biology
Zinc Finger as Gene Therapy for Angelman Syndrome

3:45 PM Rayan N. Kaakati – Neurobiology, Physiology & Behavior
Cell Surface Ligands for Potassium Channels

4:00 PM Mandeep Sohal – Neurobiology, Physiology & Behavior
Effect of Type 2 Diabetes on the Proteasome in Mouse Skeletal and Cardiac Muscle

4:15 PM Joanna B. Watterson – Neurobiology, Physiology & Behavior
Investigating Protein Isoforms of Ube3a, an Important Ubiquitin-Protein Ligase Implicated in Angelman's Syndrome

212 Wellman Hall · Moderator: Maria L. Marco

3:00 PM Arielle A. Crews – Wildlife, Fish & Conservation Biology
Climate Change Impacts on Wildlife: Diet Preferences of Woodrats During Drought Conditions

3:15 PM Sonja Glasser – Entomology
Eavesdropping Parasites: Do Blue Orchard Bee Nest Volatiles Attract Parasites?

3:30 PM Natalie Goddard – Wildlife, Fish & Conservation Biology
Population Genetics of the California Gray Fox (Urocyon cinereoargenteus)

3:45 PM Kaitlyn H. Krebs – Animal Science
Inactivation of STEC in Ground Beef Using the MSDD Non-Thermal Technology

4:00 PM Yelizaveta O. Luchkovska – Neurobiology, Physiology & Behavior
Understanding the Microbial and Yeast Diversity in Olive Fermentations

216 Wellman Hall · Moderator: Stacey L. Harmer

3:00 PM Zachary A. Bendiks – Microbiology
Creation of Chimeric Genes to Test the Clock Function of Sunflower Putative CCA1 Homologs

3:15 PM Nhu N. Chu – Biochemistry & Molecular Biology
Understanding the Roles of RVE3 and RVE5 in the Arabidopsis Circadian Clock

3:30 PM Ramona Hihn – Environmental Science & Management
Venation Density and Genetics in Populus trichocarpa

3:45 PM Jason Kao – Exercise Biology
Identifying the Function of LEUNIG in Tomato Leaf Development via RNA interference

4:00 PM Selina M. Rodriguez – Biochemistry & Molecular Biology
Genetic Analysis of a Recently Identified Suppressor Mutation of the Arabidopsis Ovule Mutant, INO-4

4:15 PM John D. Tran – Plant Biology
Investigating the Interaction Between the LEAFY COTYLEDON1 and bZIP67 Regulators in Embryogenesis of Arabidopsis

226 Wellman Hall · Moderator: Sara Thomasy

3:00 PM Allison Calderon – Animal Science
Characterization of Corneal Endothelial Dystrophy in Boston Terriers

3:15 PM Van M. Doan – Psychology
Effects of Frataxin Deficiency on Mouse Forepaw Grip Strength

3:30 PM Nina Liu – Exercise Biology
Extending Osteochondral Allograft Viability Through Delayed Primary Response Gene Transcription

3:45 PM Kie Shidara – Exercise Biology
Examination of Cellular Activity for Preserving Cartilage Cell Viability During Allograft Storage

4:00 PM Matthew F. Warren – Animal Science
Interactions Between Lymphoid Tissues and Antigenic Challenge in Cockatiels (Nymphicus hollandicus)

229 Wellman Hall · Moderator: Andre Knoesen

3:00 PM David J. Killeen – Electrical Engineering
Laser Harp

3:15 PM Lindsey A. Raven – Electrical Engineering
Automated Spotlight Tracker

3:30 PM Amanda M. Williams – Electrical Engineering
Automated Spotlight Tracker

3:45 PM Joshua C. Garrison – Electrical Engineering
2D Interactive Surface

4:00 PM Kent T. Tanita – Electrical Engineering
2D Interactive Surface

230 Wellman Hall · Moderator: Bettina Ng'weno

3:00 PM Saba Alemnew – International Relations
Playing Favorites? The New York Times Portrayal of the Palestinian-Israeli Conflict

3:15 PM Haydee Dominguez – Political Science
Understanding Russia's Relationship With Syria and Iran

3:30 PM Nicolai A. Haddal – Philosophy
Tracking the 2013 Guantanamo Bay Detainee Hunger Strike

3:45 PM Ahmad S. Raza – Political Science
Understanding Uncertainty: Pakistan's Role in the Afghan War

4:00 PM Mona Salimi – Anthropology
Black Aryans?: A Study of Iranian National History From the Perspective of Enslaved Africans and Their Descendants in Iran

4:15 PM Mariam Aejaz – International Relations
Anti-Drone Discourse as the Moderation of Violence

233 Wellman Hall · Moderator: Giovanni Peri

3:00 PM Melissa Castillo – Chicana/Chicano Studies
U.S. Citizen Children and Their Undocumented Parents: A Study of the Effects of Mexican Parents' Deportations on Their American Children

3:15 PM Sulin Chowdhury – Economics
Natural Disasters and Child Health: Observations From Cyclone Sidr

3:30 PM Aileen Devlin – Economics
The Welfare Effect of the EITC

3:45 PM Hannes M. Einsporn – Political Science
A Comparative Study of Refugees' and Asylum Seekers' Access to Employment – Germany, Sweden, and the United Kingdom

4:00 PM Gladys E. Preciado – Community Health
Living in the Fruit Bowl and Only Getting the Twigs: Exploring the Lack of Healthcare Access in a Rural Farmworker Community

4:15 PM Ilyssa M. Weinstein – Economics
Do H-1B Visa's Respond to Labor Demand in the United States

234 Wellman Hall · Moderator: Katrina Jessoe

3:00 PM Maria I. Moreno-Gonzalez – Human Development
Physical Exercise as a Coping Strategy for Male and Female College Freshmen

3:15 PM Shadd N. Cabalatungan – Sociology
Consequences of College Drinking on the Academic and Social Lives of Non-Drinking Students

3:30 PM Scott A. Pittman – History
Scared to Death: Public-Private Surveillance Networks and the Red Scare in California Higher Education

3:45 PM Linda Plutino – Economics
Foreign Students and Transfer From Community Colleges to Four-Year Universities

4:00 PM Jimmy Recinos – English
Activism Across Time at UC Davis

4:15 PM Danielle Rosenberg – Managerial Economics
Insights Into Alumni Giving at UC Davis

6 Wellman Hall · Moderator: James McClain

5:00 PM Andrew K. Baskin – Sustainable Agriculture and Food Systems
Unethically Sustainable? Feeling the Forest From the Trees With Ethically Informed Systemics

5:15 PM Sasha Leidman – Geology
GIS Analysis of the Water Balance of Lake Vanda, Antarctica

5:30 PM Athena Phan – Geology
Exploring the Influence of Porosity on Microbial Preservation in Iron Rocks With Computed Tomography and Scanning Electron Microscopy

26 Wellman Hall · Moderator: Ting Guo

5:00 PM Yanice Benitez – Chemistry
State-to-State Imaging Photodissociation Study of CO_2 Molecules: Correlations Between $CO(\upsilon)$ and $O(^1D)$, $O(^1S)$ Photofragments

5:15 PM Ryan Taylor – Chemical Physics
Investigation of Enhancement of X-Rays by Nanoparticles With Electron Paramagnetic Spectroscopy

5:30 PM Ariel E. Vaughn – Chemistry
Synthesis of μ_3-Oxo-Centered Transition Metal Complexes

5:45 PM Jennifer A. Yasui – Civil Engineering
Detecting Subsurface Damage in Structures Using Embedded Multilayered Thin Film Sensors

106 Wellman Hall · Moderator: Cristina E. Davis

5:00 PM Malinda Cheung – Chemical Engineering
Methods for Capturing the Volatile Chemical Odor Profile of Citrus Infection

5:15 PM Virginia K. Hartz – Mechanical Engineering
Hardware Redesign for Mobile GC/DMS Detection of Huanglongbing Disease in Citrus

5:30 PM Mitchell M. McCartney – Chemistry
The Scent of Citrus Infection: Using Volatile Organic Compounds to Identify Diseased Trees

119 Wellman Hall · Moderator: William Ristenpart

5:00 PM Gil Benezer – Biochemical Engineering
Phase Behavior of Aqueous Agarose/Sodium Dodecyl Sulfate Systems

5:15 PM Evan M. Forman – Chemical Engineering
Controlled Release of Drugs From Core-Shell Nanoparticles

5:30 PM Christopher J. Guido – Chemical Engineering
A Solutal Fingering Instability During Capillary Imbibition in Porous Media

126 Wellman Hall · Moderator: Rob Berman

5:00 PM Angela Avitua – Neurobiology, Physiology & Behavior
Characterizing Cognitive Outcome in a Novel Traumatic Brain Injury in Pediatric Rats

5:15 PM Mikhail Melnik – Biochemistry & Molecular Biology
Deep Brain Stimulation Improves Coherence of Theta Oscillations and Cognition following Traumatic Brain Injury

5:30 PM Rafael Ordaz – Neurobiology, Physiology & Behavior
Deep Brain Stimulation Restores Cognitive Function in Pilocarpine-Induced Status Epilepticus Rats

5:45 PM Haroon Shafique – Neurobiology, Physiology & Behavior
Assessment of Motor and Cognitive Function in a Rodent Model of Sports-Related Concussion

202 Wellman Hall · Moderator: TBA

5:00 PM Diana C. Lee – Biochemistry & Molecular Biology
Clinical Electrophysiological Studies of 3,4-Diaminopyridine and Acetylated Diaminopyridine

5:15 PM Anup N. Sonti – Cell Biology
Investigating the Effects of Minocycline on Cognition and Neurodegeneration Following Bilateral, Concussive Brain Injuries

5:30 PM Oyang Teng – Biological Sciences
Multiple Pathways of Gene Duplication in Salmonella enterica

5:45 PM Shanie Landen – Biological Sciences
A Natural Free-Fatty Acid That Binds and Activates PPAR-Delta and Induces a Greater Metabolic Adaptation to Exercise

212 Wellman Hall · Moderator: Bagher Modjtahedi

5:00 PM Haofeng Vincent Chen – Economics
2D Interactive Surface

5:15 PM Kyle Sun – Managerial Economics
An In-Depth Look at the Driving Forces Behind Illegal File-Sharing

5:30 PM David M. Williamson – Landscape Architecture
Sharing Facilities: Guidelines to a Model Facility for Both Skateboarders and Other Users

5:45 PM Kaishan Zhu – Economics
The Impact of Capital Inflows From China on the U.S. Housing Bubble

216 Wellman Hall · Moderator: Noha Radwan

5:00 PM Gizem Basar – International Relations
The Middle East and Muslim Women in U.S. Media Representations

5:15 PM Gheed Saeed – Communication
The Middle East and Muslim Women in U.S Media Representations: An Analysis of the Term Arab in the New York Times in the Years 1930-1939

5:30 PM Saliem W. Shehadeh – Middle East/ South Asia Studies
The Middle East and Muslim Women in U.S. Media Representations: Arab Tales: Deconstructing Imperialist Narratives in the New York Times

5:45 PM Nahira Stanackzai – International Relations
The Middle East and Muslim Women in U.S. Media Representations

6:00 PM Lauren N. Turner – International Relations
The Middle East and Muslim Women in U.S. Media Representations: Muslim Women in Contemporary U.S. Media

226 Wellman Hall · Moderator: Richard G. Coss

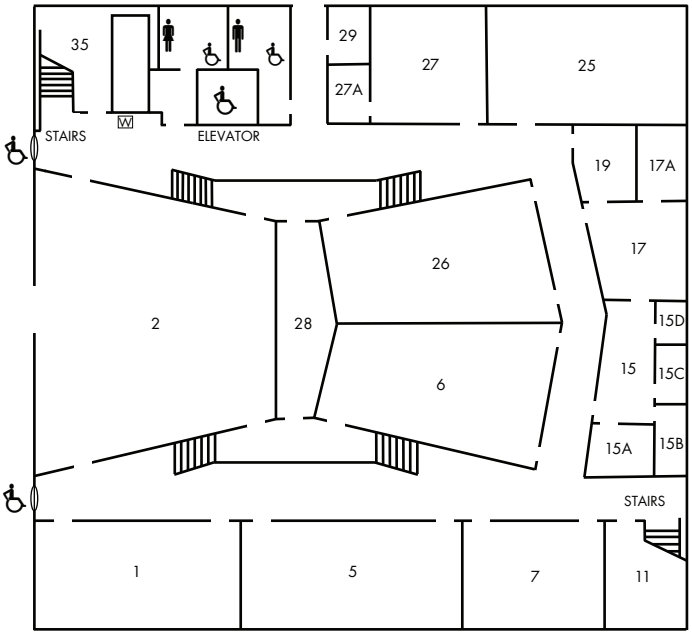
5:00 PM Cailey T. Cavanaugh – Animal Biology
Wild White-Faced Capuchin Monkeys (Cebus capucinus) Distinguish Predatory and Nonpredatory Snakes as Infants

5:15 PM Elizabeth J. Goldman – Psychology
The Power of Infant Statistical Learning and Correlated Cues on Visual Learning

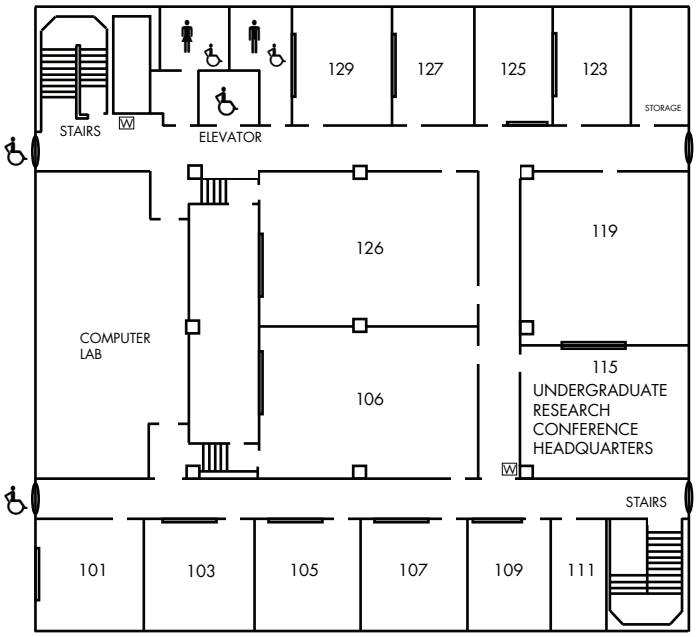
5:30 PM Reilly P. McFadden – American Studies
Sword and Shield: A Critical Look at the Collision of Rape Laws and Rape Culture in the United States That Punishes Female Sexuality

5:45 PM Andrew P. Nelson – Psychology
Infant Face Perception and Discrimination of Dynamic Faces

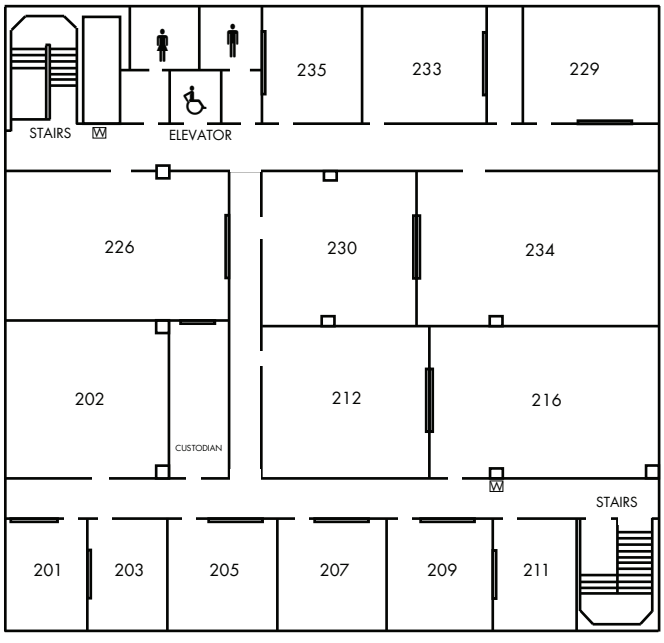
Lower Level



1st Floor



2nd Floor



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ABSTRACTS

In planta Virus-Based Expression of Artificial mircoRNAs Targeting the Potato Psyllid, *Bactericera cockerelli*

Subhadra Acharya
Sponsor: Bryce Falk, Ph.D.
Plant Pathology

Silencing genes by RNA interference has great potential to be useful in controlling plant pests and pathogens. Previous research has shown that recombinant TMV (*Tobacco mosaic virus*) containing insect sequence inserts can infect then generate small interfering RNAs in a variety of plant species. Delivery of sequences through recombinant TMV induces target-specific RNA interference in insects that feed on these plants, resulting in reduced progeny compared to plants infected with recombinant TMV containing GFP. We have cloned artificial microRNAs (amiRNAs) targeting the ATPase gene of *Bactericera cockerelli* into an agroinfection-compatible *Tomato mottle virus* expression vector. *Nicotiana benthamiana* and *Nicotiana tabacum* were infiltrated with the *Tomato mottle virus* expression vector, and plant tissues were analyzed by Northern blots, showing successful amiRNA production. Additionally, *in-vitro* transcripts of amiRNAs were placed in sucrose solution between parafilm membranes stretched across a psyllid cage for a feeding test. After the psyllids fed, I extracted the psyllids' RNA and performed reverse transcription PCR and quantitative real time PCR to determine expression levels of the ATPase gene. Results so far indicate that amiRNAs may down-regulate target genes in psyllids compared to negative controls. We will perform more real time PCR analysis on more psyllids for further conformation.

Characterization of *xylR* in *Synechococcus elongatus*

Noeli C. Acoba
Sponsor: Shota Atsumi, Ph.D.
Chemistry

The bacterium *Escherichia coli* have the ability to consume xylose and use the gene *xylR* as a way to change the metabolism of *E. coli*. Previous work in our group has been done to genetically engineer the cyanobacterium *Synechococcus elongatus* to consume and use the unnatural metabolite xylose as an energy source for the production of biofuels and valuable chemicals. Bioinformatic studies have identified a gene similar to *xylR* within the genome of *S. elongatus*. By gaining more information about how this *xylR* homologue affects *S. elongatus*, our group may improve xylose consumption and utilization in our model organism for the production of biofuels and other chemicals. To execute the characterization, plasmids for the overexpression of *xylR* as well as a plasmid that knocks out *xylR* were created and cassettes were integrated into the genome of both wildtype *S. elongatus* as well as the xylose-consuming mutant. The confirmation of the integration of these genes into the chromosome is accomplished with three techniques: PCR, gel electrophoresis, and genomic sequencing. Analysis of phenotypic changes after integration of these plasmids will provide greater understanding about the effects of *xylR* on xylose utilization of *S. elongatus* for the production of renewable biofuels and chemicals.

Anti-Drone Discourse as the Moderation of Violence

Mariam Aejaz
Sponsor: Omnia El-Shakry, Ph.D.
History

Drones have increasingly been spotlighted in both media and academic research as a new form of warfare that raises new ethical quandaries-mainly, the indiscriminate right to kill. The general focus of these discourses revolves around the distinction between civilians and militants, the inefficiency of drones, and counter-terrorism initiatives. These are key components of anti-drone discourse, which I believe need to be analyzed within a larger contemporary context to be understood. My research will explore how anti-drone discourse complements the usage of drones in anti-terrorism initiatives. The first part of my research will examine the relationship of a diverse range of anti-drone discourses to the moderation of state violence, in the context of modern colonialism and liberal humanist projects. As the discussion surrounding drones is intensifying, drone victim testimonies are becoming prevalent both in media outlets and in government hearings. The second part of my research will critically examine the context in which the drone victim is reproduced to give testimony, the discourses that are utilized, and the role that testimony plays within the US government. Mobilizing congressional hearings, anti-drone discourse in mainstream and alternative media, and classified governmental reports, I will explore the ways in which anti-drone discourse functions to moderate violence.

Dissociation in Child Abuse Survivors and Abuse Severity: A Longitudinal Study

Diane M. Aguilar
Sponsor: Gail Goodman, Ph.D.
Psychology

For a subset of abused children, heightened dissociative tendencies serve as a coping response to experienced trauma (American Psychiatric Association, 1994; Carlson et al., 1997). Unfortunately, heightened dissociative symptomology can often continue into adulthood and interfere with daily functioning. There has been limited longitudinal research, however, analyzing whether continuing dissociative problems are directly predicted by the original childhood dissociation. There is also limited information on the relation between childhood or adult dissociative tendencies, on the one hand, and the severity of documented child abuse, on the other hand. The present study attempts to fill these gaps by analyzing data from participants (n = 30) who were originally interviewed between the ages of 3-17. They were referred to a child abuse evaluation hospitalization unit, Under the Rainbow (UTR) program, as part of a study on memory and maltreatment, and then interviewed again 20 years later (Eisen, Qin, Goodman, & Davis, 2002). Implications for child abuse survivors' outcomes in adulthood will be discussed.

The Role of the JNK Signaling Pathway in the *Anopheles stephensi* Anti-Malarial Immune Response

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

Malaria is a mosquito-borne disease caused by parasites of the *Plasmodium* genus. An infected female mosquito of the *Anopheles* genus can bite someone and inject the parasites into their blood. An uninfected mosquito can then bite that person, become infected, and proceed to transmit the parasites to other people. The use of insecticides and anti-parasitic drugs as strategies for controlling the spread of malaria are becoming ineffective due to increasing resistance. An alternative to controlling malaria involves modifying the mosquito immune system to kill the parasite before it can be transmitted to humans. I investigated the role of the JNK cellular signaling pathway in the mosquito innate immune response and its potential as a target for modification. I tested this hypothesis by over-expressing the JNK gene in cultured mosquito cells, then measuring the expression of antimalarial genes. Next, I inhibited JNK expression by morpholinos in live mosquitoes and measured the expression of antimalarial genes after parasite infection. Additionally, parasitic development was assayed in infected mosquitoes after JNK inhibition. The results indicate that JNK is involved in the mosquito immune response and regulates parasite development in the mosquito, and is thus a potential target for genetic modification.

Development of Sexually Dimorphic Sensory Systems in *Drosphila prolongata*

Mubasher Ahmed
Sponsor: Artyom Kopp, Ph.D.
Evolution, Ecology & Biodiversity

Chemosensory bristles are peripheral nervous system (PNS) structures on the foreleg of *Drosophila* that have a variety of functions, which include allowing males to detect species-specific pheromones secreted by the female cuticle. *Drosophila prolongata* is a poorly described species in which the males possess a greatly expanded set of such chemosensory bristles on their first legs relative to females. Thus, this species provides an excellent model by which to study how development of the central nervous system (CNS) reflects sexual dimorphism in the PNS. The gene *senseless* is known to play a key role in PNS development, and the genes *doublesex* and *Sex combs reduced* are implicated in the development of the CNS. To investigate the expression of these genes during development, we performed immunohistochemical staining on the developing legs and basal ganglia of wandering *D. prolongata* larvae. Preliminary immunohistochemistry data shows that *Sex combs reduced* expression in the ganglia of *D. prolongata* males is localized to a band adjacent to the site of connection to the first leg discs. This band is absent in female tissue samples, suggesting that *Sex combs reduced* is specifying the fate of CNS tissue in a sexually dimorphic manner.

Social and Non-Social Cues Direct Attention of Object Statistics in 12-Month-Old Infants

Sohyun Ahn
Sponsor: Susan Rivera, Ph.D.
Psychology

We know that infants can use social cues to direction attention (Carpenter, Nagell, Tomasello, 1998). But are social cues better than non-social cues? The purpose of this experiment was to examine how effectively 12 month old infants respond to different cues. 36 infants watched videos on a Tobii eye-tracker. A central cue directed infants to a target object. The cues were either social (a woman looking towards the target) or non-social (a rectangle rotating towards the target). First looks were recorded to determine if the infants first looked to the target or the distractor. A proportion was calculated for each infant by dividing the number of trials in which the infant first looked to the target by the total number of trials the infant completed. A single sample t-test was run on this proportion for each condition. The proportion was significantly greater than chance for both the and social and non-social conditions, $t(17)=3.36$, $p<0.01$ and $t(17)=3.39$, $p<0.01$, respectively. An independent samples t-test revealed that the proportion of correct first looks did not differ by condition, $t(34)=-0.14$, $p=0.89$. This indicates that both cues can direct attention, but a social cue is not more effective than a non-social cue.

Assessment of the Geothermal Viability of Surprise Valley Through the Chemical Analysis of a Previously Unmapped Basalt Structure

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

Surprise Valley, near Lake City in Modoc County, California, is a fault-bound valley containing active hot springs, and is being investigated for future geothermal energy exploration. Recently, drought exposed a previously unmapped exposure of basalt flows in a dried up salt flat. However, the timing and origin of the basaltic eruptions are unclear. The project's goal is to determine the chemical properties of the basalt flows to deduce their source, post depositional chemical alteration, and structural setting. Examination of both hand samples and thin sections via microscopy was implemented to determine mineral composition, vesicularity, and grain size. These characteristics, combined with data on the basalts' major and trace element composition, provide guidelines on their formation. Preliminary chemical analysis indicates a larger content of phosphorus, rubidium, titanium, and potassium than in mid-ocean ridge basalts, showing possible similarity to recorded values for Hays Mountain basalts. Comparison of our data to published sources will correlate these basalts to regional volcanic history, thus constraining this event's age, as well as determining their viability as a heat source for present day geothermal activity, and ultimately the area's geothermal resource potential.

Playing Favorites? The *New York Times* Portrayal of the Palestinian-Israeli Conflict

Saba Alemnew
Sponsor: Amber Boydstun, Ph.D.
Political Science

Media framing has proved to influence readers' perception of international conflicts (Evans 2010). Thus, the tone of articles on the Palestinian-Israeli conflict likely influences readers' perceptions of the conflict. Yet, there is little research on the balance of American media coverage on this conflict. This study examines the tone of *New York Times* coverage of the Palestinian-Israeli conflict. How balanced is the coverage? Has the balance changed over time? This quantitative study uses a random sample of 292 *New York Times* articles on the Palestinian-Israeli conflict, ranging from 1984 to 2013. Stories were coded for tone, directionality, and frames. The Palestinian-Israeli conflict is a significant international issue, making it especially important to know whether Americans receive balanced coverage from a reputable news source like the *New York Times*. This study provides insight to United States' media coverage of the Palestinian-Israeli conflict, and thus, any potential biases that are being cued to the American public.

Colorectal Cancer Screening Uptake Among South Asian and Middle Eastern in a Safety-Net Clinic: Shifa Community Clinic

Yazan Amro
Sponsor: Mohit Mittal, M.D.
Internal Medicine

The American Cancer Society estimates that there will be 136,830 new cases of colorectal cancer in 2014. Shifa Community Clinic distributes Fecal Immunochemical Test (FIT Kits) in an attempt to catch these cases in their early stages. To improve the efficiency of distribution, an easier method of retrieval for these tests was developed by providing the tests in pre-stamped envelopes for patients to return. Since January 2013, this test has been given out to over 140 patients. By distributing these tests and collecting the results, Shifa Clinic has been able to acknowledge several factors related to colorectal cancer screening. Results have been gathered from over 80 patients, out of which only about 5% were found to have positive results. A significant amount of the patients neglected to send back the test. This study aims to utilize this data gathered to understand disparities in colorectal cancer screenings. This study analyzes factors such as age group and ethnicity of the patients who got a positive result and seeks to find a correlation between the patients' socio-demographics and their compliancy.

Post Translational Modifications Induce Diverse Conformational Changes in Nucleoplasmin Mediating Histone Storage and Deposition Activities

Brandon J. Anson
Sponsor: R. Holland Cheng, Ph.D.
Molecular & Cellular Biology

Nucleoplasmin (Npm), a histone chaperonin known to store H2A-H2B dimers, then exchange them with sperm basic proteins onto chromatin during fertilization based on Npm's post-translational modification state. Phosphorylation is a key factor in initiating histone binding, though the phosphorylation state remains at a high level in egg cells even prior to fertilization. Thus, the mechanism for the histone exchange and deposition onto chromatin is unknown. Structural studies using X-Ray Crystallography (XRC) have succeeded in characterizing the pentamerization domain which roughly encompasses the N-terminal half of the protein. Other studies using Negative Stain Electron Microscopy have characterized the protein complex at specific stages of development. Here, Cryo-Electron Microscopy (Cryo-EM) was used to reconstruct Npm at three stages of development: recombinant Nucleoplasmin (rNPM), oocyte Nucleoplasmin (oNPM), and egg Nucleoplasmin (eNPM). The roles of the conformation changes and corresponding functional changes educed in the C-terminal arms by means of Arginine methylation and Glutamylation will be examined using these reconstructions. These additional modifications are believed to modify Npm's histone affinity so that it is high enough to store them until they are needed, and then readily exchange them for sperm basic proteins upon fertilization so that nucleosomes can form in the zygote.

EDA Segment of Fibronectin Affects PET Signal in Mouse Model of Joint Injury

Yasaman Arabi
Sponsor: Dominik Haudenschild, Ph.D.
Orthopaedic Surgery

Osteoarthritis is prevalent in patients after an ACL tear. Our research involved EDA, a particular segment of fibronectin, which participates in inflammatory response of joint trauma. Researching the point that signals are sent in the body after a ligament tear helps prevent the development of osteoarthritis in ACL-injured patients. My research project involved 3D microCT and PET images of mice with the EDA segment removed and wild-type mice. PET images illustrated glucose uptake as a form of cellular activity within knee joints. Day 14 and 25 images of mice were then quantified and analyzed to determine whether cellular activity was due to injury or genetic background. In general, glucose uptake at 14 days was higher in injured mice knees than uninjured knees. With respect to genetic background, wild-type mice showed higher activity in the injured than uninjured knee. However, glucose uptake between the injured and uninjured knee of mutant mice did not increase. At 25 days, glucose uptake of the injured and uninjured mice had no significant difference. Moreover, mutant mice with fibronectin observed less inflammation-associated response than the wild-type upon joint injury. With this better understanding of inflammation during joint injury, our research goal is to prevent future osteoarthritis.

Remote-Sensing System for Environmental Monitoring

Robert Arlen
Sponsor: Susan Ustin, Ph.D.
Land, Air & Water Resources

The development of autonomous systems and remote sensing technology have significantly advanced in recent years. Unmanned Aircraft Systems (UAS) have shown promise in monitoring terrestrial and atmospheric processes. These mid-altitude platforms can gather relatively low-interference sets of measurements. This information, along with ground-based and satellite data, should improve the accuracy of current weather/climate models and other information systems. Our research project aims to test the feasibility of an airborne fleet of UAS to fly in unison under various flight formations, coupled with a complex software network and robust data architecture, to collect data and generate high-resolution three-dimensional landscape and atmosphere models that change over time, based on a designated mapping scale. The aircraft and software programs for this project will monitor changes in soil-moisture content and plant stress in certain plots of land over the course of a year. The UAS will also measure and model orographic changes in the atmosphere near Lake Berryessa. Although limited by particular sensors used in the study, the UAS are designed for plug-and-play compatibility with a variety of instruments. Future UAS-generated information should contribute to enhanced weather monitoring, city planning and crop management, among many other applications.

Aquarium Biogeography and Succession of Microbial Communities in Built Aquatic Environments

Sabreen Aulakh
Sponsor: Jonathan Eisen, Ph.D.
Evolution, Ecology & Biodiversity

There has been extensive research conducted to characterize the microbial communities of natural ecosystems and environments. However, much less is known about the communities of microbes associated with the "built environment"--our cars, schools, offices, water pipes, etc. Aquariums are habitats that bridge the natural and built environments and were the focus of this work. In this study, we aim to better understand the biogeography and succession of the microbial communities inhabiting a pair of newly established tanks in the UC Davis Biological Sciences Teaching Laboratory. We utilize 16S rRNA PCR surveys, a culture-independent, DNA-based sequencing method to answer two questions: 1) how does the microbial composition of newly established aquarium systems change over time? 2) how do the environmental conditions (temperature, salinity, pH, oxygen and nutrient concentrations) correlate with these changes? We collected ~500 samples and daily water chemistry data from two new coral ponds to map the succession of microbes over a period of two months.

Linked Tarantula Toxins as a Novel Way to Increase Ion Channel Selectivity

Daniel C. Austin
Sponsor: Jon T. Sack, Ph.D.
Physiology & Membrane Biology

Neuronal apoptosis (programmed cell death) after stroke is believed to result largely from pathways triggered by efflux of potassium through voltage-gated potassium (Kv) channels. However, it has been a difficult task to determine which Kv channel type is the culprit that leads to apoptosis. This is a difficult task because there are 40 subtypes of Kv channels in humans. A paucity of selective Kv channel inhibitors has made it difficult to determine each subtype's physiological function. A prime candidate for the apoptotic trigger is the Kv2 channel. A tarantula peptide toxin, guangxitoxin (GxTX), has a higher affinity for Kv2 channels over other Kv channel subtypes; this affinity difference is not high enough to conclusively determine if Kv2 channels are to blame. However, by linking together multiple GxTX molecules with polyethylene-glycol (PEG) chains we can create multimeric toxins that will increase the selectivity of GxTX. Using bioconjugate chemistry, we have created these multi-headed toxins that bind to Kv2 channels more slowly, but also dissociate from the channels much more slowly. It has also been shown that these dimeric toxins are more selective for Kv2 channels than the normal toxin.

Understanding Risk-Taking Behaviors in Mexican-Origin Adolescents Using the Balloon Analogue Risk Task (BART)

Brenda V. Avila
Sponsor: Amanda Guyer, Ph.D.
Human Development

The Balloon Analogue Risk Task (BART) is a task used to assess proclivity for risk taking and has been used in conjunction with other measures of real-world risk taking (Lejuez, 2003). Adolescence is a period in which individuals are more susceptible to engaging in risky behaviors such as using alcohol, tobacco, and other drugs (ATOD). ATOD use has been found to be predictive of negative consequences later in life like unemployment (Skiba, 2004). As Mexican-origin youth are one of the fastest growing groups in the U.S. it is vital to understand risk taking in this population to create appropriate intervention plans for those who initiate ATOD use early. In the present study, 50 Mexican-origin adolescents were grouped as either those reporting early ATOD use by age 14 (n=25) or those reporting no use by age 14 (n=25). Both groups will be compared on the amount of risk taking exhibited on the BART at ages 15-16. This study allows us to understand differences in risk taking proclivity in Mexican-Origin adolescents who use substances during early adolescence versus those who abstained. I expect adolescents who used ATODS in early adolescence will show higher propensity for risk taking relative to adolescents who abstained.

Characterizing Cognitive Outcome in a Novel Traumatic Brain Injury in Pediatric Rats

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

Approximately 1.7 million people sustain a traumatic brain injury (TBI) each year in the United States. Many of these injuries occur in the pediatric population and can often be attributed to a sports-related mechanism. As injury severity increases, so does the likelihood of chronic disorders in which impairments in learning and memory are most common. We recently developed an injury that models pediatric sports-related concussion. In the following study we characterized how injury of the young brain affects a series of behavioral tasks (Temporal, Topological, Metric, & Novel Object). We will then compare the behavioral outcomes with those recently reported in adult rats. Because TBI affects the developing brain and adult brain differently, it is important to develop reliable models of sports-related TBI for both pediatric and adult populations. We can then use these models to better understand how TBI alters the brain and to test potential treatment options to prevent impairment and restore function.

Theoretical Electromagnetic Shielding for Intersolar Rocket

Benjamin J. Bairrington
Sponsor: Nesrin Sarigul-Klijn, Ph.D.
Aerospace Science & Engineering

The goal of this project is to create a shield to protect a living crew from radiation exposure. As most radiation that an astronaut crew will be exposed to has a nonzero electric charge, it would seem advantageous to assemble a shielding structure utilizing this fact. The shield design being tested here attempts to meet the demand for effective shielding by lensing harmful radiation through magnetic quadropoles. This same technology is already currently in use in most particle accelerators to control charged particles heading for collisions. However, the application to spaceflight is rather novel, and has yet to have been tested in a rigorous manner. The testing of this shielding design will be completed by sending two rockets of equal mass into the low-atmosphere. One of which will have the magnetic shield, and the other will have an equal weight as a control. The shielding will have multiple photographic sheets at the back of each quadropole to discretely measure the exposure, and trajectory of each incoming particle.

Breast Cancer Screening Rates in Muslim Women in Sacramento

Sara Balla
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Internal Medicine

Breast cancer is defined as an uncontrollable growth of abnormal cells in the breast tissue and/or nearby lymph nodes. In women, breast cancer is the most frequently diagnosed cancer and the second leading cause of cancer deaths. Recommended screenings for women increase their chance of detecting breast cancer in the earlier stages, increasing their chance of survival. Few studies have been done on breast cancer screening rates in Muslim women, particularly in the United States. In studies that have been done, the focus tends to be on one subgroup of Muslim women, for example, Muslim Arab women. A common finding among these studies is low rates of breast cancer screening among Muslim women. In our study, we are interested in what influences breast cancer screening rates and preventive health behaviors in Muslim women in the Sacramento area. I hypothesize that screening rates are influenced by cultural and personal preferences more than by religious beliefs. To collect data, Muslim women will be recruited from Sacramento mosques and four focus groups will be conducted, followed by individual interviews. Overall, we aim to identify and gain a better understanding of the influences on breast cancer screening rates in Muslim women in Sacramento.

Characterization of the *Arabidopsis thaliana* Gene *PBL13*

Jesus Banderas
Sponsor: Gitta Coaker, Ph.D.
Plant Pathology

Plants area attacked by various pathogens that can cause huge losses in agriculture. In response, plants have evolved to recognize pathogen associated molecules that will trigger multiple signaling pathways that induce a defense response by a reprograming of gene expression. Within these pathways, kinases play an important role by attaching phosphate groups to proteins, thereby changing their structure and function. Because of its homology with known genes, *PBL13* has been identified as a gene encoding a receptor-like kinase involved in plant defense signaling pathways. To better understand the function of *PBL13*, the promoter region, which provides a starting point for gene expression, of *PBL13* will be fused to the marker gene β-glucuronidase (GUS), which codes for an enzyme that reacts with glucuronosides to produce a visible color in a process known as GUS staining. Next, *Agrobacterium* will be used to transform *Arabidopsis* plants with the aforementioned promoter-GUS fusion. After obtaining transgenic lines from these plants, GUS staining will be performed to reveal the location and timing of *PBL13* expression. By revealing the function of *PBL13*, this project will provide a better understanding of plant defense signaling.

Induced Reduction of Anti-Predator Behavior in Tadpoles in Presence of Non-Native Predatory Fish

Evan Bare
Sponsor: Sharon Lawler, Ph.D.
Entomology

Brook trout (*Salvelinus fontinalis*) stocking is a common practice in foothill and alpine lakes and ponds, even in areas with threatened or endangered species that they may prey upon. Cascade frogs (*Rana cascadae*) are considered a near threatened species in the Northern California Cascade Range, where they have gone extinct from nearly 50% of their historical range, and now rarely occur in lakes with stocked *S. fontinalis*. *R. cascadae* cohabitates with western toads (*Bufo boreas*), a species considered to have tadpoles distasteful to Brook trout. Our goal was to test if the presence of *B. boreas* tadpoles would cause a behavioral change in *R. cascadae* tadpoles when exposed to the chemical scent of *S. fontinalis*. We found that when exposed to *S. fontinalis* scent, *R. cascadae* show a significant increase in antipredatory behaviors (immobility and refuge use). When exposed to both *B. boreas* and *S. fontinalis* scent, the defense behaviors of *R. cascadae* were reduced by comparison. As such, this study indicates that in this system there is an interspecies effect related to the presence of a predatory fish. More tests need to be done to determine the direct cause, be it visual recognition, chemical scent, or physical presence.

The Middle East and Muslim Women in U.S. Media Representations

Gizem Basar
Sponsor: Suad Joseph, Ph.D.
Anthropology

My research analyzes the representations of the term Arab within the *New York Times* (*NYT*) in the years 1920 to 1929. This data indicates that the *NYT* frames Arab society as the "other" in comparison to Western society. While scholars consider the *NYT* to be an objective, liberal, and unbiased media outlet in the United States, my research raises awareness of the *NYT* frame. My work is grounded in Edward Said's *Covering Islam*, which explores the representation of Islam in contemporary Western media. Said's work argues that Islam is portrayed as oppressive, dangerous and backwards. My research was conducted via an archival search using ProQuest, an online database of newspaper articles. 3279 articles were examined and analyzed that were inclusive of the term "Arab" in the *NYT* from the years 1920-1929. This project is part of a larger project analyzing 150 years of the *NYT* conducted in the lab of Professor Suad Joseph.

Unethically Sustainable? Feeling the Forest From the Trees With Ethically Informed Systemics

Andrew K. Baskin
Sponsor: Thomas P. Tomich, Ph.D.
Sustainable Agriculture & Food Systems

Constrained largely by exclusive reliance upon reductionist scientific approaches, we face multiple local and global crises - economic, ecological, ethical, etc. A need exists to better understand natural and designed complex systems, the relationships between them, and their interacting parts to advance the health and welfare of living systems. Thus, a systems approach is appropriate. It is the right tool for the job to integrate and synthesize scientific knowledge across disciplines. While this approach is invaluable, it potentially produces unethical 'solutions' that can exacerbate existing problems. Incorporating an ancient realm of philosophical inquiry - ethics - with the younger science of systemics, I hypothesize that this integration can unleash vigorous discovery of new insights, effectively bridging the identified gap between sustainability studies (a *problem-solving application* of systemics) and ethics. After initial exploration of relevant history, theory, pedagogy, and leading directions of research/application, I employ critical realism focusing upon pioneering academic programs (ASI/SAFS) as a case study for constructivist pedagogy and action-research. By rooting sustainability studies to the nexus of systems thinking and ethics, this research should have significant implications locally (UC Davis) and globally for innovative praxis, pedagogy, action-research, and ongoing work in sustainability studies.

Shifa Community Clinic's Healthy Breast Program: Promoting Breast Health and Overcoming Barriers in South Asian and Middle Eastern Women

Ramneet Basra
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Internal Medicine

According to the American Cancer Society, one in eight women in the United States will develop breast cancer and 232,670 new cases of invasive breast cancer are estimated to be diagnosed in women in 2014. Shifa Community Clinic's Healthy Breast Program, supported by the Susan G. Komen Foundation, aims to increase breast cancer awareness among underserved 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 over 300 South Asian and Middle Eastern women. Subjects disclosed socio-economic demographic status, personal knowledge about breast cancer, and attitudes regarding breast cancer screening. The average age of the respondents ranged from 40 to 50 years old. Data showed that 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 never received a mammogram, about 40% faced language barriers while communicating with health professionals, preventing them from obtaining mammograms. With these barriers identified, educational material and outreach approaches can be developed to target South Asian and Middle Eastern female communities.

Interrogation of Crosstalk Mechanism Between Endothelial Colony Forming Cells and Mesenchymal Stromal Cells When Co-Cultured in Fibrin Gels

Samir Batarni
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Biomedical Engineering

A primary limitation of bone tissue engineering is reduced perfusion to an injury site. Implantation of stem cells that simultaneously drives bone formation and vascularization is a promising strategy. Endothelial colony forming cells (ECFCs) and mesenchymal stromal cells (MSCs) are under investigation as previous studies have revealed that co-cultured MSCs and endothelial cells show greater angiogenic and osteogenic potential than when cultured alone. These studies implicate a crosstalk communication system via soluble signaling molecules secreted by both cell types. I attempted to elucidate the mechanism of crosstalk in the proliferation and differentiation of ECFCs and MSCs when co-cultured in fibrin gels. I hypothesized that one of the paracrine signaling factors, secreted by either ECFCs or MSCs, dominates this pathway. I blocked paracrine signaling, individually testing three soluble antagonists, in mono- and co-cultures of MSCs and ECFCs entrapped in fibrin gels. I used colorimetric assays to quantify alkaline phosphatase activity (ALP: early marker for osteogenesis), calcium content (late marker for osteogenesis), and DNA content. Calcium content significantly decreased when bone morphogenetic protein type 2 (BMP-2) was blocked in co-culture vs. control (****$p<0.0001$). These results indicate that BMP-2 may be the primary signaling factor in the crosstalk mechanism.

Exploring the Molecules Involved in Host Recognition in Parasitic Plants

Dane Bauerlein
Sponsor: John I. Yoder, Ph.D.
Plant Sciences

The facultative hemiparasitic plant *Triphysaria* invades the roots of neighboring host plants. The *Triphysaria* genus contains five species, the roots of each release different chemicals into the environment, a chemical profile known as an exudate. Host plants such as *Medicago* have chemicals in their exudates that cause *Triphysaria* to form haustoria, the parasitic root structures that allow for parasite attachment and invasion. While *Triphysaria* roots form haustoria in response to chemicals from a wide range of host plants, they typically do not form haustoria in response to exudates from its own species. Interestingly, partial haustoria formation may occur when two different *Triphysaria* species are grown together, suggesting that partial recognition may be due to different chemical profiles in the exudates of the various *Triphysaria* species. I am fractionating and bioassaying exudates of various *Triphysaria* species to identify chemicals that induce haustoria formation in natural environments. We hypothesize that the active molecules will be various polyphenols that induce the growth of haustoria with varying levels of effectiveness. This research will elucidate a novel mechanism of self-recognition in plants.

RNF212 Is Involved in Meiotic Checkpoints

Connor J. Beebout
Sponsor: Neil Hunter, Ph.D.
Microbiology

The signaling mechanisms of mammalian meiotic checkpoints have to date remained largely uncharacterized. In *Caenorhabditis elegans*, ZHP-3 has been shown to be involved in apoptotic signaling during meiosis. In order to elucidate the signaling mechanisms of mammalian meiosis, we examined the role of RNF212, a ZHP-3 homolog, in male and female meiotic cells. We found that in females RNF212 deletion rescues oocytes from meiotic checkpoints. This result led us to examine the immunolabeling patterns of meiotic proteins in spermatocytes in order to elucidate the role of RNF212 in male meiosis. In males we found that RNF212 is involved in coordinating meiotic stage progression, chromosome synapsis, and DNA damage repair. Because of the involvement of RNF212 in regulating female and male meiosis, we examined the role of RNF212 in meiotic silencing of unsynapsed chromatin (MSUC), one proposed mechanism of checkpoint enforcement in spermatocytes. We found that RNF212 regulates MSUC sensor and effector proteins HORMAD1, ATR, and γH2AX. This data suggests that RNF212 is involved in meiotic checkpoints likely via MSUC. These results will prove critical in further understanding the checkpoint signaling mechanisms which are related to infertility, miscarriage, and birth defects.

Effective Methods to Reduce Voter Ignorance

David A. Belcher
Sponsor: Ethan Scheiner, Ph.D.
Political Science

Perhaps the biggest threat to the success of democracy in America is voter ignorance. I have designed an experiment to test whether an electoral system that rewards knowledgeable voters with more votes would incentivize voters to increase their knowledge of issues. I have created an election with candidates A and B. Subjects in both my control and treatment groups are given general information about the candidates. Subjects in the treatment group are told they can get more votes depending on their knowledge of the candidates. Both groups are then given the option to read more about the candidates. Before the groups vote, they are quizzed about their knowledge of the candidates, and depending on their quiz scores, subjects in the treatment group are given extra votes. Initial findings have indicated that subjects in the treatment group opt to learn more about the candidates more often and score higher than in the control group. If this electoral system can effectively reduce voter ignorance, then elections could better serve as a gauge of public opinion, thus allowing the government to better reflect constituent desires when making policy.

Examining the Effects of C-Jun N-Terminal Kinase (JNK) Signaling on the Lifespan of *Anopheles stephensi* and *Anopheles gambiae* Mosquitoes

Marie C. Belen
Sponsor: Shirley Luckhart, Ph.D.
Medical Microbiology & Immunology

There are currently 3.3 billion people at risk of malaria infection world-wide. Malaria is caused by *Plasmodium* parasites that are transmitted to humans by *Anopheles* mosquitoes. One factor that affects the transmission of malaria is mosquito lifespan, since mosquitoes that live longer are much more likely to become infected with malaria and to transmit the parasite to humans. Currently, little is know about the signaling pathways that regulate aging in mosquitoes. C-Jun N-terminal kinase (JNK) is a cell signaling protein that regulates lifespan in other insects and mammals. In order to determine the effects of JNK signaling on mosquito lifespan, we assessed how well *Anopheles stephensi* (the Asian vector of malaria) and *Anopheles gambiae* (the African vector of malaria) mosquitoes survived in the presence or absence of a JNK inhibitor. Based on published reports in other organisms, we hypothesized that inhibition of JNK signaling would increase the lifespan of mosquitoes. Expanding our understanding of the signaling pathways that regulate mosquito lifespan will be a critical component of the design of future mosquito control strategies.

Surface Effects on Racehorse Proximal Hind Limb Kinematics

Catherine A. Belock
Sponsor: Susan Stover, D.V.M., Ph.D.
Anatomy, Physiology & Cell Biology

Synthetic racetrack surfaces are proposed to be the cause of upper (proximal) hind limb soreness that results in poor athletic performance and retirement of racehorses. Surface type has been shown to affect lower hind limb motion, consistent with respective injury patterns. Surface effects on equine upper limb biomechanics that could affect risk for injury are unknown. In order to examine the effect of surface on upper hind limb motion, high-speed video was taken of racehorses galloping on dirt and synthetic surfaces. Custom software was used to track upper hind limb bone and joint motions during stance. Repeated measures ANOVA was used to determine differences in upper limb motions between surfaces. Although tarsal peak flexion occurred 4% earlier and angular velocity was 20% greater during the beginning of stance on the synthetic surface compared to the dirt ($p<0.05$), these findings are unlikely to contribute to upper limb soreness, since all other kinematic variables remained consistent. However, combining these results with those of a previous study on lower hind limb joints, it can be inferred that horses compensate for surface differences primarily in the fetlock joint (lower limb) and that upper joint ranges of motion maintain consistency on the two surfaces.

Creation of Chimeric Genes to Test the Clock Function of Sunflower Putative *CCA1* Homologs

Zachary A. Bendiks
Sponsor: Stacey L. Harmer, Ph.D.
Plant Biology

Most organisms possess biological clocks that direct the processing of light, heat, and other inputs into specific outputs such as growth, metabolic regulation, and development. Studies with *Arabidopsis thaliana* have implicated *Circadian Clock Associated 1 (CCA1)* as a clock gene. *CCA1* mutants display shortened timekeeping cycles and altered flowering times. However, no clock-related genes have been identified in *Helianthus annuus* (sunflower), an important agricultural crop. I hypothesize that (1) sunflower possesses *CCA1* homologs and (2) these will restore wild type clock function in *A. thaliana* plants mutant for *CCA1*. I performed multiple sequence alignments of *CCA1* and two putative sunflower *CCA1* homologs, then constructed a phylogenetic tree. Results of the analysis indicate that *CCA1* and the sunflower *CCA1* putative homologs descended from a common ancestral gene, supporting hypothesis 1. I then created two chimeric genes, each containing a *CCA1* promoter and a coding region from a putative sunflower *CCA1* homolog. These will be transformed into *A. thaliana CCA1* mutants and their clock function will be assessed to determine if the wild type phenotype has been restored (hypothesis 2). This project will help elucidate the complex molecular nature of sunflower clock functioning.

Phase Behavior of Aqueous Agarose/Sodium Dodecyl Sulfate Systems

Gil Benezer
Sponsor: Stephanie Dungan, Ph.D.
Chemical Engineering

Agarose and sodium dodecyl sulfate (SDS) are essential to modern biochemical processes and are used extensively in the pharmaceutical and consumer products industries. Agarose is routinely used as a thermoreversible gel as well as to alter the rheology of a formulation. Sodium dodecyl sulfate is one of the most thoroughly studied surfactants, in particular its micellization behavior above a critical micelle concentration (CMC) of 8 mM (0.2 wt %). Despite their importance, the interaction of SDS micelles and agarose at concentrations well above the CMC has received little attention. An investigation into the phase behavior of aqueous agarose/SDS mixtures was carried out, in which mixtures of aqueous agarose and SDS were prepared and visually inspected for phase separation. The separation phenomena occurred in samples with SDS concentrations between 8-9 wt % and agarose concentrations of 1-2 wt %. The majority of samples phase separated into a suspension composed of 5-10 µm spheres within a clear solution that would gel upon cooling. If left as a solution for extended periods of time, the sample would form a white crystalline precipitate, and the solution would not gel upon cooling.

State-to-State Imaging Photodissociation Study of CO_2 Molecules: Correlations Between CO(v) and O(^{1}D), O(^{1}S) Photofragments

Yanice Benitez
Sponsor: Cheuk-Yiu Ng, Ph.D.
Chemistry

CO_2 is known as a strong contributor to the greenhouse effect, and its concentration in the atmosphere increases annually. Photodissociation of CO_2 is considered an important photochemical sink of CO_2 molecules which could ultimately limit the increase of CO_2 concentration in the atmosphere. The absorption cross section of CO_2 molecules increases dramatically in the vacuum ultraviolet (VUV) region compared to the ultraviolet (UV) region. Thus, the VUV photodissociation study of CO_2 molecules is of great importance in understanding the photochemical decomposition processes of CO_2 molecules. By employing two independent tunable VUV lasers and the velocity-map-imaging-photoion (VMI-PI) method, we have explored the CO_2 photodissociation dynamics for the formation of the $CO(X^1\Sigma^+)+O(^1S)$ and $CO(X^1\Sigma^+)+O(^1D)$ channels in the VUV energy range of 94,000-96,000 cm^{-1}. The total kinetic energy release spectra of these channels reveal significant differences in the CO vibrational state distributions from different CO_2 predissociative absorption bands. The angular distributions of these channels were also determined, which have allowed us to estimate the photodissociation lifetimes leading to the formation of $CO(X^1\Sigma^+)+O(^1S)$ and $CO(X^1\Sigma^+)+O(^1D)$. Furthermore, our experimental CO_2 photodissociation result can be served as a benchmark for theoretical calculations of the CO_2 potential energy surfaces involved.

Blurred Vision: Redefining Ethics and Meaning in Times of Cultural Crisis

Kaleena Bergfors
Sponsor: Mark Elmore, Ph.D.
Religious Studies

On 17 March, 2009 the creators and cast of *Battlestar Galactica* were invited to speak at the United Nations Department of Public Information to raise awareness and public profile of humanitarian concern. In times of cultural devastation, humanity is faced with tough moral choices in their fight for survival, and this series grapples with those morally grey areas, challenging our concepts of justice, faith, and humanity – and as Admiral Adama says "it is not enough to survive, one has to be worthy of surviving." In conducting a close textual analysis of the series, this paper explores ethics and morality present in a multitude of ways, drawing from philosophical theory as well as history, resulting in a more well-rounded analysis of the human condition. This television series causes viewers to reflect on not only the show's implicit values but our own society's; these questions of humanity and survival are vital for us to evaluate so that we may improve society just as the creators of the series set out to do when they spoke at the UN. *Battlestar Galactica* is no futuristic fantasy; it is a biting critique of the self-destructive drives at the heart of modern, contemporary culture.

Laser Harp

Anuj Bhardwaj
Sponsor: Andre Knoesen, Ph.D.
Electrical Engineering

Current trends show that the US is lagging behind in STEM education. Change needs to be made to remedy the situation, and research shows that the most effective way to increase interest in STEM fields is through hands-on engagement with science and technology. Music is a creative medium that can appeal to all audiences. This project aims to stimulate interest in students of all age groups to pursue degrees in the fields of Electrical and Computer Engineering. Our project infuses the musical qualities of a harp with laser and sensor technology. In our rendition of a laser harp, the user plays notes not by plucking a string, but rather by interrupting the path of laser beams. When the user interrupts a laser beam, the microcontroller detects this action and plays a corresponding note. Users can then play various tunes by simply placing their hand in the path of the laser beam. Additionally, a teaching mode exists in which the harp will guide a user through playing a pre-programmed song by indicating what notes should be played. The Laser Harp gives people of all ages a fun way to engage with technology and learn more about the field of engineering.

Image Analysis of Interacting Galaxies in the Deep Lens Survey

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

We analyze images of objects taken in the Deep Lens Survey (DLS) to identify interacting galaxies. Interacting galaxies are those whose gravitational fields interfere with one another's-they are also known as colliding or merging galaxies--and they tend to be asymmetric. We devise a statistic to estimate rotational asymmetry. We rotate each galaxy by 180 degrees and subtract the rotated image from the original image. The significance of the residuals are then assessed. We describe steps to decrease false positives--such as accounting for contamination by close neighbors, image bleed, noise or dead pixels. This yields a catalog of interacting galaxies. We correlate the interacting galaxy catalog against redshift, to determine a relation between the frequency of interacting galaxies and redshifts. At higher redshifts, we are looking back in time, at a younger version of the universe, when objects were closer together. Because the universe is expanding, we expect to see a higher frequency of interacting galaxies at higher redshifts. We further breakdown the catalog results and identify relationships between galactic interactions and color, shape, size, star formation and gas richness.

Two-Pion HBT Analysis on Central Au+Al Fixed Target Collisions at STAR

Kyle J. Bilton
Sponsor: Manuel Calderón de la Barca Sánchez, Ph.D.
Physics

One of the primary goals of the Relativistic Heavy Ion Collider (RHIC) is to find a first-order phase transition between ordinary nuclear matter and the quark-gluon plasma (the state hypothesized to exist after the first few microseconds after the big bang). A thorough search for this transition requires a sweep over a wide range of collider energies. While RHIC is capable of dialing in to many different collider energies, more energies are accessible by using a fixed target setup, where a stationary nucleus is struck by a moving one. Collisions between gold nuclei and the aluminum beam pipe of RHIC have been registered by the Solenoidal Tracker at RHIC (STAR) detector, providing us with fixed target data. Particles produced in these background collisions have been identified and used in various analyses. Here, we present Hanbury-Brown Twiss (HBT) correlations between negatively charged pions were produced. HBT analyses offer a way to determine the space-time dimensions of a particle's source at the time the particle was produced. Preliminary results suggest that information regarding the particle emission region can be extracted in a fixed target configuration at STAR, even though the detector was designed for collider events.

The Force Sensitive Protein Complex of Epithelial Cell-Cell Adhesions

Alexandra Blee
Sponsor: Soichiro Yamada, Ph.D.
Biomedical Engineering

As multicellular organisms, we rely on the continual maintenance of many different cell-cell adhesions to sustain cohesive tissues and organs that can withstand physical abuses. The loss of normal cell-cell adhesion has adverse effects on the body. For example, in primary tumors, this loss promotes cancer metastasis. Elucidating the mechanisms of cell adhesion regulation will not only further the understanding of tissue homeostasis, but may also improve cancer metastasis treatments. One hypothesis is that cells modify adhesion strength in response to external stimuli, like tension between neighboring cells. To study potential force-sensing mechanisms, I will analyze how epithelial cells respond to external forces by plating the cells on a clear flexible polydimethylsiloxane chamber and applying external forces to the cells using a custom stretch device. To identify force-sensitive protein interactions, I will analyze force-induced changes in protein recruitment at the sites of cell-cell adhesion using a promiscuous biotin ligase tagged to a cell-cell junction protein. Under stretched conditions, the force-induced complexes at cell-cell junctions will be biotin labeled by the biotin ligase, then purified for further analysis. Our approach could improve the current understanding of force-dependent cell adhesion regulation that may play an important role during cancer metastasis.

Identification and Visualization of *Giardia* Ventral Disc Proteins

Lorita Boghospor
Sponsor: Scott C. Dawson, Ph.D.
Microbiology

Giardia is a parasitic protist that has 2 nuclei and 8 flagella essential for swimming. It possesses a ventral disc, which is used for attachment to the host intestine. The ventral disc is an organelle that is characterized by a spiral microtubule array including dorsal microribbons and cross bridges. We aim to understand the host attachment mechanism and to determine the protein components comprising the disc. We used a proteomics approach to generate a list of candidate disc proteins and assigned them to known genes in the *Giardia* genome. The goal is to tag candidate proteins with GFP, introduce the tagged proteins into *Giardia*, and to confirm that the proteins localize to the disc. For each candidate gene, we designed polymerase chain reaction primers to amplify the entire coding sequence plus 200 bp upstream of the start codon to include the native promoter. PCR products were cloned into a Gateway entry vector, propagated in *E. coli*, extracted, and recombined with a Gateway destination vector such that the GFP gene was fused to the C-terminus of each candidate gene. After propagation in *E. coli*, the final vectors were introduced into *Giardia* via electroporation. Their expression was examined under a fluorescence microscope.

Angular Correlation Functions of High Energy Hadrons in PbPb, pPb, and pp Simulations

Gabriel S. Bonilla
Sponsor: Manuel Calderón de la Barca Sánchez, Ph.D.
Physics

The quark-gluon plasma has a role in understanding the strong force, which is described by the theory of quantum chromodynamics. 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 examine the results of colliding heavy nuclei together at high energies to recreate the quark gluon plasma. One such observation is jet quenching, which is believed to occur when the jets of particles produced in the collision interact with the plasma and lose energy. In this project, we use the HYDJET (Hydrodynamics plus Jets) and URQMD (Ultrarelativistic Quantum Molecular Dynamics) simulation programs to observe how HYDJET treats jet quenching in comparison to URQMD, which ignores these effects. In particular, we will look at how the angular correlations of the jets of particles created in such an event vary across the choice of collision system (proton-proton, proton-lead, lead-lead). We will also look at the behavior of these angular correlations to help us understand the mechanisms of energy loss.

Zooarchaeology and Historical Archaeology: A Case Study of the Leland Stanford Mansion

Kathleen S. Brandl
Sponsor: Teresa E. Steele, Ph.D.
Anthropology

Investigating the socioeconomic status of occupants in 19th century historical sites has long been a goal of archaeological investigations; more recently, analyses of the animal bones preserved in these sites (zooarchaeology) have been used to compliment conclusions drawn from other lines of evidence. Following in this tradition, I will use faunal remains to examine changes in socioeconomic status of the inhabitants of the Leland Stanford Mansion in Sacramento, California. The Stanford Mansion was the epitome of luxury when it served as the Governor's mansion in the late 1800s. However, after the house was graciously donated by Jane Stanford to the Catholic Diocese of Sacramento, it became an orphanage and subsequently a home for dependent high school girls. I hypothesize that the conversion of the Stanford Mansion from the Governor's mansion to an orphanage and girls home will be evident in the animal bones, which will reflect meat cuts, excavated at the site. I expect to see a decrease in the quality of butchered meat from older to younger archaeological layers, reflecting the transition of social strata that occurred at the mansion.

Identification of the Responsible Gene for Seed Death in Maize

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

Essential genes of an organism are usually identified through the phenotype of lethal mutation. Here is an unidentified embryo lethal mutation of maize, found in a Mu-transposon insertion line, resulting in seed death. To identify the responsible gene for this phenotype, I initially was able to narrow down our selection of possible effected genes from nineteen Mu-inserted loci of this line. I have selected the genes that have low Ka/Ks (non-synonymous genes to synonymous genes) ratio, that is the more conserved genes and are the most likely to cause lethality with an inserted mutation. To find the exact location of inserted mutation associated with the phenotype of seed death, I am using polymerase chain reaction (PCR) methods, across several genes within the maize genome. I am currently working on this project and the results pending. The identification of the gene will be important for understanding functions of genes in maize.

In-Depth Participant Adherence Analysis (IDPA) Within the Ran-Din Nutrition Study

Lauren Brink
Sponsor: Christine Stewart, Ph.D.
Nutrition Science

Provision of small quantity-Lipid-based nutrient supplements (LNS) to pregnant and lactating women (PLW) in populations at risk of under-nutrition has the potential to improve birth outcomes. By analyzing facilitators and barriers to LNS consumption we hope to understand how adherence may be increased. In order to explore what may influence adherence to LNS, attitudes towards and beliefs about LNS were assessed via qualitative interviews. In-depth interviews were conducted with 4 sub-groups of n=2 each: PLW identified as low adherers, PLW identified as high adherers, family members of PLW provided LNS, and the community health workers (CHWs) who provided LNS to the PLW. Constant Comparison Analysis served as the framework for coding common themes in NVivo software. Common themes that emerged included improved nutrition, improved health of women and children, taste of LNS, and advice from family, friends, and CHWs. CHWs identified women's initial fear of having a large baby if they consumed LNS as a factor contributing to low adherence. Family and friends are important sources of support and advice for women regarding LNS. Positive support from this group seems to be important in this context and may help to improve future adherence.

Quantification of Fragile X Mental Retardation Protein (FMRP) in a Doxycycline-Inducible Mouse Model of the Fragile X Premutation

Laura C. Brochard
Sponsor: Robert Berman, Ph.D.
Neurological Surgery

Fragile X premutation (FPM) carriers have a mutation in the *FMR1* gene (i.e., CGG-repeat expansion of between 55 and 200 trinucleotides) and are at risk for developing the neurodegenerative disorder Fragile X-associated tremor/ataxia syndrome (FXTAS). In humans, this genetic mutation results in elevated levels of *FMR1* mRNA, but decreased levels of the actual FRMP protein. I will be using a Western-Blot analysis to determine the brain levels of FMRP protein in a doxycycline-inducible mouse model of the FPM. In this method we isolate tissue from specific brain regions (i.e., hippocampus, cortex) and then separate the proteins by gel electrophoresis. The amount of FRMP protein is quantified by immunoblot, and compared between normal control mice and those in which the premutation is activated by doxycycline treatment. Our mouse model displays many features seen in premutation carriers and in FXTAS, and this study will determine whether expression of a CGG repeat expansion in our mice also alters brain FMRP levels. The results will help us understand why FMRP levels are reduced in carriers of the FPM and in patients with FXTAS.

Effect of Weight Gained During Pregnancy on mtDNA Copy Number and Deletions in Placenta and PBMC From Mothers With Previous Child With Autism

Casey J. Bronec
Sponsor: Cecilia Giulivi, Ph.D.
Molecular Biosciences

Over 2 million individuals in the U.S. and tens of millions worldwide are diagnosed with Autism spectrum disorders (ASD), a neurobiological disorder characterized by impaired social interaction, verbal and nonverbal communication, and repetitive or severely restricted activities and interests. We have reported that the incidence of mtDNA deletions in PBMC from children with autism was higher than that of typically developing ones, suggesting either an increased oxidative stress or a lower repair capacity in autism. In this study, we evaluated whether the weight gain during pregnancy of mothers enrolled in the Markers of Autism Risk in Babies-Learning Early Signs (MARBLES) study have an impact on mtDNA copy number and deletions in placenta and maternal PBMC (at third trimester and delivery). To this end, mothers who gained a normal weight gain based on their pre-pregnancy BMI was 11-35 lb. whereas those who gained 5 lb. or more than the recommended range were classified as having an high weight gain. Our results indicated that high weight might cause more mtDNA deletions in placenta, which may have an adverse effect on the developing fetus, possibly increasing the risk for autism.

Effects of Diet-Induced Obesity on the Expression Patterns of Omentin-1 in Growing Mice

Sarah J. Bronstein
Sponsor: Bo Lonnerdal, Ph.D.
Nutrition Science

Adipokines have been implicated as active participants in the relationship between obesity and the development of metabolic disease (e.g., type II diabetes). Adipokines are cell-to-cell-signaling proteins expressed by fat tissue that orchestrate inflammatory responses. Omentin-1 has been identified as a novel adipokine negatively correlated with increasing obesity and insulin resistance in humans; however, the cellular origins and effector functions of omentin-1 remain to be fully elucidated. To investigate the effect of diet-induced obesity on omentin-1 expression patterns, we fed C57BL/6N male mice a control (CTRL: 10% fat) or a high fat-sucrose (HFS: 45% fat) diet for 14 weeks. HFS-fed animals gained more weight (~20%) than CTRL-fed animals by week 14, and oral glucose and intraperitoneal insulin tolerance tests revealed these animals exhibited glucose intolerance and insulin resistance across all test points. Protein analysis indicated omentin-1 is constitutively expressed across various tissues. Fasting omentin-1 concentrations were higher in the CTRL-fed animals compared to HFS-fed animals at week 4, but not later, suggesting a HFS diet in young mice may induce early alterations in inflammatory status. Omentin-1 is currently used as a biomarker in clinical settings for metabolic disease, but further research is necessary to ensure accurate diagnostic value.

Sulfur Chemistry Provides Insight Into Archaea Metabolism

Elizabeth A. Bucher
Sponsor: Andrew Fisher, Ph.D.
Chemistry

The reduction of sulfur is a vital process that affects organisms across all domains of life. In Archaea, these sulfur biochemical pathways are incomplete and not well understood compared to analogous pathways in bacteria. The following research focuses on the highly adaptive sulfur mechanisms of the thermophilic archaea, *Pyrococcus furiosus*, in order to understand differences in fundamental metabolic functions. Current efforts in method development and optimization will allow us to separate reaction byproducts of sulfur metabolism such as adenosine 5'-phosphosulfate (APS), 3'-phosphoadenosine 5'-phosphate (PAP), 3'-phosphoadenosine 5'-phosphosulfate (PAPS) and sulfurylated nucleotides. Techniques of interest include thin layer chromatography (TLC) and high pressure liquid chromatography (HPLC). Sulfur modifications to RNA in archaea help to stabilize RNA at high temperature living conditions. These adaptive mechanisms are sensitive to temperature and lead to more avenues of inquiry for sulfur metabolism. Whole cell extracts of *P. furiosus* are analyzed to look for sulfur modifications in total RNA extracts. Through this study, we hope to observe the details of the sulfur metabolism in *P. furiosus* to help us understand the unusual chemistry that make archaea thrive in a wide range of environments.

Behavioral Phenotyping of a Mouse Model for Fragile X Syndrome

Hanna Butler-Struben
Sponsor: Jill Silverman, Ph.D.
Psychiatry & Behavioral Sciences

Fragile X Syndrome (FXS) is a single gene mutation disorder in which the FMR1 gene is dysfunctional, resulting in a lack of production of Fragile X Mental Retardation Protein (FMRP), a critical component to synaptic development. FXS is the largest known genetic cause of mental retardation. Individuals suffering from FXS exhibit anxiety, learning and memory deficits, hyperactivity, and deficits in responsiveness to sensory stimuli. Previous literature has found that genetically modified mice on the common C57BL/6J genetic background with the same mutation of the *Fmr1* gene, exhibit some analogous behavioral deficits to those seen in clinical FXS. In our study, we wanted to extend these previous findings on a sighted version of the FVB genetic background to test their possible future use as a model for treatment development in FXS. A cohort of wild-type and *Fmr1* knockout mice were behaviorally assayed using open field locomotion, novel object recognition, prepulse inhibition, novel environmental observations, and light-dark transitions. We concluded that there are no significant differences between the wild-type and the *Fmr1 KO* mice. These results suggest that the *Fmr1 KO* on the FVB background may not be a useful model for future FXS research.

Consequences of College Drinking on the Academic and Social Lives of Non-Drinking Students

Shadd N. Cabalatungan
Sponsor: Bill McCarthy, Ph.D.
Sociology

Many college students experience negative effects of alcohol consumption. In this study, I investigate whether other students' alcohol consumption also negatively influences the academic and social lives of non-drinking college students. I examine the "second hand effects" of alcohol with scale measures of negative consequences of drinking. This scale includes the following: study or sleep disruption, verbal abuse, property damage, and sexual assault. I examine associations between this scale and three outcomes: grades, dissatisfaction with school, and anxiety about grades. Method: The variables measured in the study were drawn from a nationally representative sample of students, Wechsler's Harvard College Alcohol Study 2001. Multiple regression models were used to assess relationships between the negative consequences of drinking and outcome variables, independent of important controls (e.g., age, gender, and race). Results: Students who drink alcohol and those who abstain do not experience equally the negative consequences of their peers' alcohol consumption. Conclusion: The consequences of college drinking are not limited to individual college drinkers, but may extend to their non-drinking peers. Indeed, college students who abstain from alcohol appear to suffer more from their peers' drinking, compared to students who drink.

Association Between Maternal Prenatal Diabetes and BMI Amongst Mexican-Origin Children in Rural, Central California

Roxana Cabrera
Sponsor: Lucia L. Kaiser, Ph.D.
Nutrition Science

Rates of obesity and type 2 diabetes have been increasing in children. Studies report that children of diabetic mothers are more likely to become obese and develop diabetes themselves. The purpose of this study is to examine the relationship between mothers' self-reported prenatal diabetes status and their children's current age-adjusted BMI percentile in a Mexican-origin population. Subjects were participants in a five-year intervention study (Niños Sanos, Familia Sana) that aims to prevent childhood obesity in Mexican-origin children. Bilingual researchers interviewed mothers (n=34) about her history of diabetes during pregnancy. The children's anthropometry was collected at age 3-8 yrs. We compared 17 mothers with type 2 and/or GDM to 17 non-diabetic mothers. Of the 34 children, 29.4% (n=10) of the children were overweight and 26.5% (n=9) were obese. Of the 19 children who were obese or overweight, 10 had diabetic mothers. No significant differences were observed between diabetic and non-diabetic mothers. In a Mexican-origin, largely immigrant population, self-reported prenatal diabetes may not reveal an association with childhood obesity.

Absence of Thermal Expansion Mismatch Strengthening in Cryomilled Al-B_4C

Gage M. Caffery
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Materials Science & Engineering

Ultra-fine grain metal-matrix composites (MMC) were fabricated via "cryomilling" and subsequent hot consolidation to create high-strength, low-density materials. In particular, aluminum-boron carbide (Al-B_4C) was of interest due to its impressive compressive strengths in excess of 1000 MPa. The metal and ceramic particles within these composites have different coefficients of thermal expansion and these distinct expansion rates will lead to a strain gradient at the interface. This strain in turn can result in the "punching" of dislocations into the matrix, strengthening the material. This phenomenon is known as Coefficient of Thermal Expansion (CTE) mismatch strengthening. However, Vogt et al. has shown that these dislocations appear to be constrained within an interfacial layer of nanocrystalline (d<100nm) grains and will see an absence of this thermal mismatch strengthening. Thermal cycling will be performed in different quench environments and the materials will be evaluated by Rockwell hardness testing, compression testing and scanning electron microscopy.

Characterization of Corneal Endothelial Dystrophy in Boston Terriers

Allison Calderon
Sponsor: Sara Thomasy, D.V.M., Ph.D.
Surgical & Radiological Sciences

Corneal endothelial dystrophy (CED) is a devastating disease that causes discomfort and blindness in the eye. The most internal cell layer of the cornea, the endothelium, progressively degenerates causing corneal swelling. While a similar disease termed Fuchs Endothelial Corneal Dystrophy has been described in humans, CED has not been fully characterized in dogs. Since CED is seen more frequently in Boston Terriers compared to other breeds, we chose to use this breed to establish a comprehensive phenotype of the disease. Boston Terriers with CED and age-matched control dogs were included in this study. Corneal sensitivity and thickness were assessed using Cochet-Bonnet aesthesiometry and ultrasonic pachymetry, respectively. Spectral Domain-Optical Coherence Tomography (SD-OCT) was utilized to image cross sections of the cornea and assess the thickness and morphology of the corneal layers. *In vivo* confocal microscopy (IVCM) was used to obtain detailed images of the corneal cells. Endothelial cell density and central corneal thickness were significantly different between affected and control groups. The data conclusively shows that SD-OCT and IVCM are accurate, non-invasive methods for diagnosing and monitoring canine CED. Studies are currently being conducted to assess surgical and medical treatments to alleviate symptoms and slow progression of the disease.

PCB 95 Modulates Intracellular Calcium Levels in Rat Hippocampal Neurons via Sensitization of the Ryanodine Receptor

Tiani C. Calip
Sponsor: Pamela J. Lein, Ph.D.
Molecular Biosciences

Despite the ban on production of polychlorinated biphenyls (PCBs) in the 1970s, these chemicals persist in the environment and pose potential risks to human health. PCB 95, a non-dioxin-like congener, sensitizes ryanodine receptors (RyR), resulting in increased intracellular calcium (Ca2+) and activation of Ca2+-dependent signaling pathways that promote dendritic growth in rat hippocampal neurons. Interestingly, PCB 95 effects on dendritic growth of hippocampal neurons exhibit a non-monotonic concentration-effect relationship. However, the concentration dependency of PCB 95's effects on intracellular Ca2+ levels in these cells is not known. To address this gap in the database, we used primary cell cultures dissociated from perinatal rat hippocampi and live cell fluorescent imaging, to quantify the magnitude of the Ca2+ response in hippocampal cultures acutely exposed to varying concentrations of PCB 95 at day 7 in vitro. These data will enable us to determine potential molecular mechanisms underlying the differential effects of PCBs on dendritic growth at lower versus higher concentrations. Since neuronal morphogenesis and functional connectivity are mediated by Ca2+-dependent signaling, PCB-induced Ca2+ abnormalities could contribute to neurodevelopmental disorders.

Human Carbonic Anhydrase II: Optimization of Protein Production and Assay Protocol for Enzyme Kinetics

Amanda M. Calzada
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Chemistry

Optimization of protein production and assaying are critical points in the development of protocol for activity assessment and enzyme kinetics of protein engineering. This project investigates alternative routes and chemical species for these procedures of Human carbonic anhydrase II (hCAII) in determining ideal methods of attaining highest cell optical densities and identifying most appropriate buffers for lysis, purification and elution profiles. As an enzyme of the carbonic anhydrase variety, hCAII catalyzes the reversible hydration of carbon dioxide and is an ester hydrolase. It frequently functions well when paired with Tris, an amine and purification buffer, yet is known to be too reactive in the presence when imidazole, an aromatic heterocycle, is used as an elution buffer. Results, however, indicate that a crystalline reagent, PBS, better purifies hCAII and confirm the notion the enzyme cannot be coupled with imidazole, but rather, a sodium salt derivative of acetic acid, sodium acetate. Data demonstrates BugBuster protein extractor best perforates the E. Coli cell wall without denaturing hCAII. Additionally, results suggest cultivating a volume of cell culture overnight equal to that of the media in which it is resuspended yields significantly higher optical densities for expression.

San Lorenzo River Lagoon

Robert Campos
Sponsor: Jeff Loux, Ph.D.
Landscape Architecture

The San Lorenzo River outlet, located next to the Historical Santa Cruz Beach Boardwalk, is one of the most visited recreational sites on California's coast. The boardwalk, beach front, and river outlet create a very energetic space for visitors. The degradation of the riparian habitat can be seen on the banks of the river leading to the outlet and during the storm season, as heavy equipment is utilized to channel the rivers waters away from the Santa Cruz Boardwalk. An intervention that resolves management issues with the San Lorenzo River outlet will benefit the Boardwalk and ecological diversity in the area. I will design an ecological feature that would manage the meandering river during peak flows and storm surges. My research methodologies will include site visits / analysis, literature review, case study and water flow models. My findings will give me a direction to design, produce and finalize an intervention to meet my goals for the San Lorenzo River Outlet.

Pleading the Belly: Death, Pregnancy and Fiction in Early Modern England

Laurel Carney
Sponsor: Frances Dolan, Ph.D.
English

In Early Modern England, if a woman convicted of a capital offense could convince the court that she was pregnant, she would be awarded a stay-of-execution until she had given birth. This process was known as "pleading the belly." As a writer of historical fiction, I have examined the role that fiction and story-telling played in the act of pleading the belly and the subsequent trial, as well as in popular printed texts that depicted these women's crimes and executions. Because pregnancy was nearly impossible to prove during this time period, a woman's claim had to originate in the form of personal testimony. More often than not, however, her testimony doesn't survive, and much of what we want to know about the case is simply not on the historical record. Instead, 21st century researchers must rely on heavily skewed and fictionalized pamphlets written by third parties hoping to make a profit off of her story. My project uses both historical and literary sources, research and invention, to explore these areas of uncertainty and to bring the Early Modern law to life through the same medium that has been its heart since the very beginning: fiction.

Controlled Delight: Literary Techniques and Action in *Lolita*

Theo Carruthers
Sponsor: Evan Watkins, Ph.D.
English

What does Vladimir Nabokov's *Lolita* (1955) reveal about the power of literary techniques to make collected details "alive" and to then compel particular perspectives and actions? How does this compulsion inform the moral questions of the story? What does it show about the ultimate source of desire? *Lolita* tells the story of Humbert Humbert, a man in his thirties who molests a young girl he finds overwhelmingly attractive; it is ambiguous whether or not he can control himself as he wavers between seeing the Lolita he abuses and the half-imaginary Lolita he calls "more real." His sensitivity discovers literary interest everywhere, which, once discovered, is too forceful to be ignored and can even compel him biologically. Therefore, Humbert cannot be condemned as an aesthete who deliberately crafts an inappropriate object of desire. Nor is he an entirely helpless pawn. Instead, he is in an intermediate position, wrestling with the compelling force of his own sensitivity to aesthetic clichés and literary techniques.

U.S. Citizen Children and Their Undocumented Parents: A Study of the Effects of Mexican Parents' Deportations on Their American Children

Melissa Castillo
Sponsor: Yvette Flores, Ph.D.
Chicana/Chicano Studies

The number of U.S. citizen children living in mixed status families is rapidly growing. Today, more than three quarters of children born to immigrant parents are U.S. citizens and one third live in mixed-status families. With the United States taking a stronger stand on immigration, many of these children are separated from their parents and placed in foster care or with another family member. Deportations affect children of undocumented immigrants tremendously whether the child remains in the United States away from one or both parents or relocates to their parents' home country. Involuntarily separating a child from their parents, whether for a short or long period of time, can cause a wide array of psychological and emotional strains that have detrimental effects in a child's development, success and wellbeing. Similarly, separating a child from their home country and forcing them to relocate to another country can be just as detrimental. This thesis utilizes a case study methodology to explore the impact deportations have on children who are separated from their parents' and those who are forced to relocate to their parents home country by examining existing research and applying the findings to three separate families in California.

The Carbohydrate Kinase-Like Proteins in Plants: Can We Understand Their Function by Looking at Their Mutants?

Philip Christian Cavales
Sponsor: Judy Callis, Ph.D.
Molecular & Cellular Biology

Analysis of genomes of higher plants has revealed the presence of a family of proteins with significant identity to a bacterial phosphofructokinase called Pfk-2 or Pfk-B. In bacteria, there is one Pfk-B protein that functions in glycolysis in the utilization of sugars. In plants, the number of Pfk-B proteins is much greater; there are 22 family members. However, the biochemical activity of only seven is known. These seven proteins catalyze phosphorylation of various metabolites while others participate in repair of enzyme co-factors. The functions of the remaining 15 proteins are not known. To begin to understand their functions, we are isolating and characterizing loss of function mutants in 12 of the remaining uncharacterized genes in the model plant *Arabidopsis thaliana*. Several libraries of DNA insertion mutants are available. From these libraries, we identified at least one insertion mutant in seven of the unknown genes. We have isolated plants homozygous for the insertion mutation and mRNA accumulation is severely reduced in the homozygous mutant lines. All homozygous mutant plants look wild type under normal conditions. We are generating double mutants and testing growth of the mutants under stress conditions. These studies will reveal functions for this enigmatic gene family in plants.

Wild White-Faced Capuchin Monkeys (*Cebus capucinus*) Distinguish Predatory and Nonpredatory Snakes as Infants

Cailey T. Cavanaugh
Sponsor: Richard G. Coss, Ph.D.
Psychology

This study examined whether wild white-faced capuchin monkeys (*Cebus capucinus*), emit noisier alarm calls after viewing a model of their primary snake predator, the boa constrictor, than after viewing models of a rattlesnake and harmless scorpion-eater snake. The noisy acoustic properties of alarm calls likely reflect the caller's arousal level and might convey information to neighboring monkeys about nearby predatory threats. In Costa Rica, individual infants, juveniles and adults traveling in trees were each presented one model type on the ground. Analyses of the first alarm call revealed that only the less experienced infants exhibited reliably noisier alarm calls to the dangerous boa compared with the harmless scorpion eater. Adults also emitted noisier calls to the boa that approached statistical significance. This result suggests that infant capuchins have an innate predisposition to recognize their primary snake predator, with older, more experienced monkeys showing less variation in arousal levels. Since the scorpion-eater does not display any scale pattern, snake-species discrimination might be due to boa's distinctive scale pattern. Preliminary analyses of the social effects of alarm calling showed that noisier infant alarm calls engendered noisier alarm calls in the first calls emitted by neighboring monkeys of all ages.

Developmental Effects on Behavior due to Early Exposure to Intranasal Oxytocin in Prairie Voles

Lara J. Cemo
Sponsor: Karen L. Bales, Ph.D.
Psychology

Oxytocin (OT) is currently being tested in clinical trials as a treatment for disorders that have social deficits, like autism. However, the long-term effects of chronic exposure to intranasal oxytocin (IOT) are unknown. We are using prairie voles as the research model for studying the long-term effects of IOT on social bonding, because they are a socially monogamous species. Clinical trials on the effects of IOT on autism are in progress for the age range of 3-17 years old, but the behavioral effects of chronic IOT exposure has never been studied in animals at such a young age. In this study, daily IOT treatments of a medium dose comparable to that used in clinical trials, or saline, will be given to prairie vole pups from postnatal day 8 to 15 in order to gauge the developmental effects of early exposure to daily IOT treatments. Social behavior immediately following treatment and the long-term effects on social behavior and anxiety will be assessed when treatment has ended. The long-term effects on social behavior will be assessed with alloparental care and partner-preference tests, and the long-term effects on social anxiety will be assessed with an open-field test. This research is supported by HDO71998.

Assessment of Pain Management Core Competencies for Healthcare Education

Mandeep K. Chahal
Sponsor: Scott M. Fishman, M.D.
Anesthesiology & Pain Medicine

Competency-based education (CBE), which emphasizes concrete skills (competencies) as opposed to abstract learning, is increasingly being used to develop curricula for health professionals. However, few medical schools have implemented chronic pain CBE, leaving many healthcare providers underprepared to serve patients with pain. As a result, chronic pain remains one of the most poorly understood and mismanaged health conditions, even though it affects millions of people and costs hundreds of billions of dollars annually. Though a set of pain competencies have been developed through an interprofessional consensus summit, they are seen by most teaching hospitals as overbroad. By comparing the consensus pain competencies to the general competencies developed to encompass all health professions, I will help develop a streamlined set of chronic pain-specific competencies that can be readily added to medical curricula. When these competencies are integrated into the training of health professionals, the diagnosis and treatment of chronic pain will be improved for millions of patients every year.

Comparing Voting Systems Using Kemeny Rankings

Trevor C. Chan
Sponsor: Jesús De Loera, Ph.D.
Mathematics

Imagine we are voting to elect a new president. We can use two different voting methods which may or may not result in different winners. The first method we can use is majority rule, meaning individuals vote for a single candidate. The second method we can use is voting by ordering all the candidates by preference, called preference voting. We would like to determine when majority rule and preferential voting result in different outcomes. At first, our team created a function to determine this difference. To make our function capable of taking in more data, our group decided to incorporate Kemeny rankings, a method of choosing a winner that compares every two candidates. Kemeny rankings are NP-hard, but bounds are known to give approximate solutions. Using Kemeny rankings would allow us to see not only that one candidate is preferred over another, but how much one candidate is preferred over the other.

Photocatalytic Properties and Water-Splitting Activity of α-Fe_2O_3 Nanoparticles

Megha Chandrashekhar
Sponsor: Frank E. Osterloh, Ph.D.
Chemistry

A pressing issue in the modern world is finding a cheap and sustainable source of clean energy. Photocatalytic water splitting, through harnessing solar energy, can lead to a promising future in carbon-free fuels, that do not contribute to climate change. This research focuses on the Fe_2O_3 nanoparticles as the catalyst for water oxidation. To attain higher levels of O_2 production, the iron oxide was doped with metals such as V, Al, Mg, and Ni. Solutions of metal doped iron oxide, V:Fe_2O_3, Al:Fe_2O_3, Ni:Fe_2O_3, and Mg:Fe_2O_3 were prepared and irradiated with visible light (> 400 nm) from a high power Xe-Arc lamp. The amount of oxygen evolved and the rate of oxygen evolution per hour were analyzed via gas chromatography and compared amongst the different metal dopants. Of the four mentioned above, Al:Fe_2O_3 had the highest levels of O_2 production (12.77 μmoles/hour) but the rate dropped sharply after three hours. Mg:Fe_2O_3 gave a lower rate (5.64 μmoles/hour) of oxygen evolution but was stable over the four hour experiment. This shows that doped Fe_2O_3 increases the O_2 production versus undoped Fe_2O_3, and further research will help to improve results.

Tracking Mpr1 Up-Regulation in *Cryptoccocus neoformans* Using Mpr1-Luciferase Reporter Gene

Ashley M. Chang
Sponsor: Angela Gelli, Ph.D.
Pharmacology

Cryptococcus neoformans causes life-threatening fungal infections of the central nervous system in immune compromised patients. Research on *C. neoformans* and the blood-brain barrier (BBB) has revealed a transcellular route of crossing and a metalloprotease (Mpr1) expressed by *C. neoformans* that is required for crossing. A strain lacking the gene encoding Mpr1 failed to cross the BBB in an *in vitro* model of the human brain endothelium. Furthermore, expression of Mpr1 in non-pathogenic yeast, *Saccharomyces cerevisiae*, allowed crossing of the brain endothelium *in vitro* model. Thus, Mpr1 plays a vital role in crossing and likely requires few other factors. This presents the opportunity to develop an Mpr1-conjugated nanoparticle drug delivery system. A large amount of Mpr1 is needed to develop carriers. However, Mpr1 is not highly expressed in *C. neoformans*, therefore to explore the conditions under which the Mpr1 promoter is most active, we have developed the Mpr1-Lucifererase reporter gene. Luciferase can be secreted from fungal cells and produces significant fluorescence. We intend to use this reporter gene to examine the regulation of the Mpr1 transcript under host-like conditions in order to resolve how promoter activity can lead to up-regulation of the Mpr1 mRNA transcript and metalloprotease production.

Characterizing MUS81-EME1 Endonuclease Kinetics in Homologous Recombination

Jessica P. Chau
Sponsor: Wolf-Dietrich Heyer, Ph.D.
Microbiology

Homologous recombination (HR) is a DNA damage repair pathway. MUS81- EME1 is an enzyme that cleaves DNA intermediates that arise during homologous recombination. Previous studies have shown that in all the organisms tested, cells lacking MUS81- EME1 are sensitive to interstrand crosslinking (ICL) agents that can stall DNA replication. Since interstrand crosslinking agents are commonly used in anti-cancer therapy, MUS81- EME1 is a potential novel anti-cancer chemotherapeutic target that may sensitize tumor cells to interstrand crosslinking agents and can spare adverse effects to normal cells. My research goals are to purify and characterize the biochemistry of *Homo sapiens (Hs)* MUS81- EME1 so that it can be used in a high-throughput inhibitor screen. My specific aims are: 1) overexpress and purify recombinant MBP- MUS81- GST- EME1 and 2) characterize the Michaelis-Menten kinetics of recombinant MUS81- EME1 on various DNA substrates. These studies will lead to the establishment of MUS81-EME1 as a novel anti-cancer chemotherapeutic target.

Laser Harp

Zibran Chaus
Sponsor: Andre Knoesen, Ph.D.
Electrical Engineering

Current trends show that the US is lagging behind in STEM education. Change needs to be made to remedy the situation, and research shows that the most effective way to increase interest in STEM fields is through hands-on engagement with science and technology. Music is a creative medium that can appeal to all audiences. This project aims to stimulate interest in students of all age groups to pursue degrees in the fields of Electrical and Computer Engineering. Our project infuses the musical qualities of a harp with laser and sensor technology. In our rendition of a laser harp, the user plays notes not by plucking a string, but rather by interrupting the path of laser beams. When the user interrupts a laser beam, the microcontroller detects this action and plays a corresponding note. Users can then play various tunes by simply placing their hand in the path of the laser beam. Additionally, a teaching mode exists in which the harp will guide a user through playing a preprogrammed song by indicating what notes should be played. The Laser Harp gives people of all ages a fun way to engage with technology and learn more about the field of engineering.

Examining the Genome-Wide Mutation Spectra and the Role of Translesion Synthesis Polymerases in *Saccharomyces cerevisiae*

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

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 Polη, Polζ, Pol4, and Rev1. I hypothesized that TLS DNA polymerases contribute significantly to mutation accumulation within *S. cerevisiae*. Using standard yeast genetic approaches I created single mutants in each TLS gene. The single and subsequent double mutants were mated to create the quadruple mutant. The *rev1 rev3 rad30 pol4* quadruple 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 68% when all TLS polymerases were absent, supporting my hypothesis. Furthermore, CHEF gel analysis of the quadruple mutant demonstrated no major genome instability. Finally, the quadruple mutant was 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.

Physical Spectrum

Jose D. Chavez-Verduzco
Sponsor: William H. Pardee, M.F.A.
Art Studio

While nature may have a wide spectrum of lights and colors that we can see, oil pigments can never emit light, but only reflect it. This inevitably limits the ability of painters interested in creating perceptual experiences similar to those presented by nature. This does not mean that it is not possible to create paintings that glow; it simply means that one must work within a very specific range that perceptually gives across the idea of a "glow". So, in order to explore color and light I have been challenged to create interiors with controlled lighting and color within a range obtainable by oil pigments. It is with these interiors that I will explore how different colored lights affect and change the hue, value, and intensity of my subject matter.Then the layering of opaque and transparent pigments will all play a key role in determining whether a painting can "emit" light. As a result one will be able to understand how light and color work in conjunction on a two-dimensional surface and how that differs from how we experience the world normally.

The Bubble of the Bitcoin

Haofeng Vincent Chen
Sponsor: Bagher Modjtahedi, Ph.D.
Economics

Bitcoin, as known as the most popular digitally-distributed currency in the past five years, has attracted a substantial number of users. This digital currency has been circulating among the users in the past five years without any intervention by a central bank or any other government agency, thus demonstrating the viability of a new monetary system. Due to many advantages that Bitcoin has offered the users, its use became widespread in the United States resulting in a rapid and a bubble-like increase in its value. As a result, in 2013, the value of Bitcoin grew by more than 1,000%, yet only two months later, in February, 2014, the apparent bubble collapsed. This research is going to analyze the main reasons for the substantial increase in the value of Bitcoin in the past 5 years and the subsequent collapse in its value in such a short period of time. The research will also speculate about the future of Bitcoin.

Identifying the Function of a Microtubule Motor Protein AtPAKRP2 in Plant Cytokinesis

Jia J. Chen
Sponsor: Yuh-Ru Julie Lee, Ph.D.
Plant Biology

The completion of cell division is critical for healthy growth and development in plants and other organisms. One of the biggest differences in cell division between plant and animal cells is the development of the phragmoplast during plant cytokinesis. The phragmoplast forms and spans across the midzone which separates the two future daughter cells. Its structure is composed as a barrel-like antiparallel array of microtubules along which Golgi-derived vesicles are transported to the future division site. In *Arabidopsis thaliana* we have identified AtPAKRP2 and hypothesized that it plays a major role in cytokinesis. AtPAKRP2 gene knockout mutants were obtained via T-DNA insertional mutagenesis. To investigate the function of AtPAKRP2, we applied various cytokinesis inhibitory drugs to AtPAKRP2 mutants and observed their growth. Among the drugs tested, treatments with caffeine or oryzalin severely inhibited the growth of AtPAKRP2 mutants at doses that would not obviously affect the wild-type control. Microscopic images of mutant root tips after the drug treatments showed that the absence of AtPAKRP2 greatly contributed to cytokinetic defects in mitotic cells. Further research into these mutants will give us a detailed mechanism on the function of AtPAKRP2 and its role in plant cytokinesis.

2D Interactive Surface

Jiun Rong Chen
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Electrical Engineering

The 2D Interactive Surface utilizes infrared proximity sensing to obtain user input and responds with RGB light from LEDs and sounds. This device demonstrates the practicality and capability of infrared sensors and its compatibility with microprocessors. A compact 30in x 30in x 6in box will be constructed, with a light diffusing acrylic glass surface on the top to cover the internal electronics. The device will be constructed of multiple modules, which can be thought of as "pixels". Each 3in x 3in pixel will be capable of emitting RGB light in response to user input. When an object is detected near the surface, infrared light is reflected back into the receiver, converted to a frequency, and fed directly to a microcontroller. The pixel responds by displaying color light that varies in intensity relative to the distance of the object to the surface. Full intensity is reached when the object is closest the surface and gradually decreases as the object is moved away. The modular design of the pixels allows the surface to be scaled up or down for various applications.

Methods for Capturing the Volatile Chemical Odor Profile of Citrus Infection

Malinda Cheung
Sponsor: Cristina E. Davis, Ph.D.
Mechanical Engineering

Huanglongbing (HLB) is a fatal disease that affects citrus trees. The disease results in plants with blotchy mottled leaves, misshapen and bitter-tasting fruit, and quick decline and tree death. HLB threatens the citrus industry worldwide and has been reported in many parts of Asia and the U.S., and there is currently no cure or treatment available. Our research aims to develop a method for early detection of the disease by sensing the volatile organic compounds (VOCs) emitted by infected plants using gas chromatography / mass spectrometry (GC/MS) and gas chromatography / differential mobility spectrometry (GC/DMS). Both methods involve sampling the gasses emitted from multiple species of citrus plant infected with a vectored pathogen and then testing the plant VOCs with both sensor modalities. By comparing the infected plant VOC's with baseline data from a healthy uninfected plant, we can develop identification for plants infected with Huanglongbing. This research will provide valuable insight regarding the early-detection of a currently incurable plant disease.

Uptake Optimization Assay for D/N-ATF5 Peptide: Comparison of Synthetic and *E. coli* Expressed Recombinant Protein

Nyemachi L. Chikere
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Molecular Biosciences

Activating Transcription Factor 5 (ATF5) is an intracellular transcription factor that is highly expressed in neural progenitor and neural stem cells. Studies have shown that the aberrant overexpression of ATF5 can be a primary marker and is required for survival of Glioblastoma. Therefore, finding pharmaceuticals that target and inhibit ATF5 can lead to the development of treatments for Glioblastoma. We previously published a study that showed the administration of D/N ATF5 peptide after tumor formation can kill malignant cells while leaving normal brain cells surrounding the tumor undamaged in mice. In this study, we sought to determine the optimal conditions for the uptake of D/N ATF5 Synthetic Protein (SP) against the positive control D/N ATF5 Recombinant Protein (RP), in both the U87 cell line (human Glioblastoma cells) and C6 cell line (rodent glial cells) in cell culture. We conducted immunofluorescence at one; two, and four hours post administration of peptides. We concluded that the cellular uptake of the D/N- ATF5 variants in both the U87 and C6 cell lines are equivalent. Furthermore, of the two D/N- ATF5 variants, the Synthetic Protein (SP) appears to have an improved cellular uptake when compared to the RP peptide variant.

cMyc-Xa21: Another Resource for Studying Xa21-Mediated Immunity

Joan Chiou
Sponsor: Pamela C. Ronald, Ph.D.
Plant Pathology

To ensure food security for our world's growing population, researchers aim to improve the qualities and quantities of today's staple crops. One such crop is rice, a grain that feeds over half the planet's inhabitants. Extensive study is in progress surrounding the rice gene Xa21, which has been found to activate an innate immune response upon detection of the bacterial pathogen, *Xanthomonas oryzae* pv. *oryzae (Xoo)*. The Ronald lab generated multiple independently transformed Xa21promoter c-myc tagged Xa21 transgenic plants. In this project, we will characterize these plants. We confirmed the presence of the Xa21 transgene using PCR, followed by verification of the expression of RNA and protein through qPCR and Western blotting. To confirm that the cmyc-XA21protein is functional, the plants were inoculated with *Xoo* and disease progression was monitored. The c-myc tag allows for use of additional techniques to study XA21-mediated immunity such as affinity chromatography, protein complex isolation, pull-down assays, and other procedures which can be accomplished using anti-myc antibodies.

When Sentence Processing Is Just "Good Enough," Does Personality Play a Role?

Connie Choi
Sponsor: Debra Long, Ph.D.
Psychology

The "Good Enough" approach to language processing assumes that readers/listeners often analyze linguistic input in a superficial manner, failing to construct fully specified representations of sentences. Previous research has focused on documenting the circumstances under which Good Enough processing occurs. The current study, in contrast, focuses on individual variation in the use of Good Enough processing. One factor that may influence its use is working-memory capacity. Working memory is the system that is responsible for maintaining task goals, task-relevant information, and the intermediate results of cognitive operations. Readers who are high in capacity may be able to inhibit incorrect interpretations more easily than can readers who are low in capacity. A second factor is conscientiousness. Conscientiousness is a personality variable that refers to the tendency to show self-discipline, act dutifully, and aim for achievement. Readers who score high in conscientiousness may be more diligent about constructing fully specified representations of sentences than readers who are less conscientious. Multiple regression methods are used to examine performance on a sentence ambiguity task as a function of working-memory capacity and conscientiousness.

Identification of Shade Avoidance Genes From GWAS

Megan Choi
Sponsor: Julin N. Maloof, Ph.D.
Plant Biology

Light is required for photosynthesis and therefore is an integral part of plant growth and development. In order to survive, plants must be able to respond to changes in their environment, including changes in light conditions such as shade. Plants can respond to shade in a number of ways to try to increase their access to light, like increasing hypocotyl length. An earlier genome wide association study looked at natural variants to find genomic regions that were associated with variation in hypocotyl length. We took a closer look at a number of markers that were found to be associated with altered hypocotyl length in *Arabidopsis* under varied light conditions to see if any linked genes were involved in light response. We also examined petiole length, flowering time, elongation and germination time to see if the gene plays a role in other shade avoidance phenotypes. Our results implicate several candidate genes that are involved in shade response. Information from this study may be useful in agricultural practices, as a plant's response to shade can affect its growth and negatively influence crop yield.

American Crow (*Corvus brachyrhynchos*) Flight Behavior From Agricultural Foraging Fields to Urban Communal Roosts in Yolo County, California

Michael Chou
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Neurobiology, Physiology & Behavior

American Crows (*Corvus brachyrhynchos*) have large communal roosts at night during the non-breeding season. They disperse into small groups and travel many miles away from their communal roost site during the day and return to the same site at night. I hypothesize that groups of crows leaving their last foraging area will fly in the same direction towards their communal roosting site several miles away. To do this, I examined the agricultural fields near Davis, California where crows forage together on 20 different occasions. At 90 minutes before sunset I located foraging groups of crows three to five miles away from Davis. I recorded direction of flight and group size as they departed from their agricultural foraging sites and returned to their nighttime roosts in Davis. My data show that crows leaving foraging sites fly in the general direction of their communal roosting site, and that approximately three quarters (76%) of those groups head toward their roosting site as soon as they leave the foraging site. My results suggest that crows take advantage of the interface between urban and agricultural lands in Yolo County, California.

Natural Disasters and Child Health: Observations From Cyclone Sidr

Sulin Chowdhury
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Economics

This is the first paper to utilize household and health survey data from a country impacted by a natural disaster (Bangladesh) to measure the events impact on children's health in the affected country. The primary purpose of this paper is to observe whether children who were in-utero while their mother's were residing in a region that recently experienced a large natural disaster would have negative health effects later in life. The empirical identification strategy uses event data to observe variation in the events extent and timing and the exposure of different children birth cohorts to the natural disaster. This paper also incorporates GPS information on the location of survey villages within districts that were heavily impacted by the natural event to more accurately measure the events affect on children. Children who both resided in disaster-impacted regions and were born within nine-months after the event have negative height-for-age *z*-scores. Effects are robust to include region-specific time trends and alternative exposure measures, as well as addressing potential biases due to education and endogenous migration.

Sqs1 Is a New Meiotic Checkpoint Protein in *Saccharomyces cerevisiae*

Isabel Chu
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Molecular & Cellular Biology

Meiosis is a specialized form of cell division in which a diploid cell gives rise to four genetically distinct haploid gametes. A vital part of this process is the accurate segregation of homologous chromosomes. Defects in this process can result in aneuploidy, which can lead to birth defects and other health complications. Proper segregation requires pairing and recombination, which requires the formation and repair of double-strand DNA breaks. In *Saccharomyces cerevisiae*, budding yeast, the Pch2 protein plays an important role in signaling defects in these processes within the chromosome axis. Pch2 and Rad17 function in different branches of the recombination checkpoint pathway. Through a yeast-two hybrid screen, our lab found that the protein Sqs1 physically interacts with Pch2. Both the *pch2*Δ*rad17*Δ and the *sqs1*Δ*rad17*Δ double mutants give a more severe spore viability phenotype. These results indicate that Sqs1 and Rad17 participate in different checkpoint pathways. We further found that mutations in both Pch2 and Sqs1 can bypass the delayed meiotic progression in checkpoint-activated strains. We are currently testing whether or not Sqs1 affects chromosome axis remodeling in response to checkpoint activation. We will assay the binding of the Hop1-GFP fusion in living cells undergoing meiosis.

Understanding the Roles of RVE3 and RVE5 in the *Arabidopsis* Circadian Clock

Nhu N. Chu
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Plant Biology

Most organisms keep track of daily time by using external cues to regulate the inherent biological clock within each cell. This project investigates the mechanism of regulation by studying the genetic interactions amongst members of a family of Myb-like transcription factors in *Arabidopsis thaliana* known as the REVEILLEs (RVEs). In particular, the role(s) of RVE3 and RVE5 on clock period phenotype is being studied because they share significant sequence homology with transcription factors that, when mutated, result in a longer period. However, we found that *rve3* and *rve5* single and *rve3rve5* double mutants have a period similar to the near-24 hour rhythms seen in wild-type. As a result, we are studying other phenotypes such as hypocotyl length and flowering time to see if RVE3 and RVE5 regulate clock output genes and pathways. In addition, higher order mutants are being isolated to see if loss of RVE3 and/or RVE5 has an effect on the clock when combined with mutations in other RVEs that have been shown to affect clock period phenotype. These studies on individual clock components will contribute to our understanding of how plants adjust their behavior and physiology to adapt to different environments.

Investigating Genomic Differences Between Neurons and Astrocytes in the Brain

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

Current genetic dogma states the genome, the total DNA in a cell, is consistently the same between every cell in an organism. However, recent evidence found that certain repetitive DNA elements, such as LINE-1 retrotransposons, are significantly increased in human neuronal genomes when compared to other cell genomes in the body. Neuronal genomes could vary significantly because LINE-1 retrotransposons copy and re-insert themselves throughout the genome. More than half of the human genome is comprised of repetitive DNA elements. Preliminary data confirmed that the LINE-1 elements increased in mouse neurons but also suggested that satellite repeats, another type of repetitive DNA element, are increased as well. To investigate this variation in the neuronal genome, I compared the number of satellite repeats between two types of brain cells: neurons and astrocytes. Sequence data of mouse neuronal and astrocytal genomes were quantified for repetitive element content. Results from this experiment can help further our understanding of cell-specific genomic differences using a mouse model system. Since genome editing will likely become the frontier of medical treatment in 20 years, knowledge of cell-specific genomes will be crucial to the target specificity of this treatment.

Investigation of Risk Factors for T2DM Global Health Disparities

Evan Chua
Sponsor: Raymond L. Rodriguez, Ph.D.
Molecular & Cellular Biology

Diabetes mellitus type 2 (T2DM) or adult onset diabetes affects over 285 million people around the world and is expected to increase to 438 million by 2030. T2DM is a complex disease with strong genetic, behavioral and environmental components. Certain ethnic and racial groups carry gene variants that increase their morbidity and mortality for T2DM. This research project aimed to investigate the various methods by which chronic diseases like T2DM are categorized based on various factors on a global scale. The outcome of this project was a better understanding of the complexity of global health disparities and the factors that contribute to it. Genetics and behavior were found to be the two principal categories used to analyze the risk factor for T2DM. Analysis of both older and more recent research articles revealed that most global health disparities including T2DM are due to multiple factors and that one factor cannot fully explain the frequency, severity and morbidity of T2DM. Therefore, when analyzing global health disparities and their risk factors, it is important to consider both the genetic and behavioral aspects of an individual's life. In other words, one-size-fits-all interventions are unlike to work with global health disparities.

Interdependent Presence and Proximity Sensing Electronic Modules

Yunseok Chung
Sponsor: Andre Knoesen, Ph.D.
Electrical Engineering

The overarching goal of the EE Emerge group is to create devices that demonstrate the impact the field of electrical engineering can have real life. Our aim is to build an interactive exhibit that combines the simplicity of a flashing LED with the complexity of a processor. We created devices that respond to the presence and proximity of each other. The greatest challenge of implementing this idea was to find a way to communicate distance from each other using cheap, low power hardware. This was achieved by using microprocessors to blink infrared LEDs in sequences unique to each device. Each device can decode sequences coming from nearby devices to establish spatial awareness and create patterns using visible LEDs. Additionally, the intensity of incoming light patterns can be used to determine distance to other devices. By moving the modules around relative to each other, a user can create interesting and diverse visual patterns.

Modeling the Crayfish Nervous System Using an Electronic Circuit

Gabrielle C. Chwalik
Sponsor: Timothy J. Lewis, Ph.D.
Mathematics

Neurons and neural networks are often modeled by simple analog electrical circuits. Examining these electrical circuits can provide insight into the mechanisms that coordinate activity in neural systems. In this project, we constructed and analyzed an electrical circuit that models the neural circuit underlying limb coordination during swimming in the crayfish. We first explored the behavior of a single neuron using the electrical circuit proposed by Keener (1983). Then we extended the Keener circuit to include two cells coupled by reciprocally inhibitory connections. This two cell network models the pattern-generating unit which drives a single limb of the crayfish. We found that this two-cell circuit generates an anti-phase oscillation that is observed in the nervous system of crayfish. Finally we explored activity in chains of pattern-generating units to model the neural circuit coordinating the crayfish's limbs. We show that only certain network topologies yield the activity analogous to that observed in the limb coordination of the crayfish.

Developing Transgenic Crop Plants With Normal Root Development and Vigorous Growth via an *Agrobacterium rhizogenes* Mediated Transformation

Kevin M. Coe
Sponsor: Eduardo Blumwald, Ph.D.
Plant Sciences

The expression of *IPT* (isopentenyltransferase) in plants delays drought-induced senescence. Transgenic plants expressing *IPT* displayed enhanced tolerance to drought stress and minimal yield losses after drought episodes. Although *IPT* has proven useful in developing stress tolerant crop plants, occasionally the expression of the gene has led to reduced root growth. The reduced root growth is most probably because of the stress induced during calli transformation and plant regeneration. Our objective is to develop a less stressful transformation method that will reduce the expression of *IPT*. We aim to develop transgenic *IPT* plants showing normal root development and growth via an *Agrobacterium rhizogenes* mediated transformation method. *A. rhizogenes* were transformed with a plasmid carrying the *GFP* reporter gene driven by the CaMV35S promoter. *Arabidopsis thaliana* cuttings were infected using transformed *A. rhizogenes*. The protocol for developing an effective transformation method will be optimized utilizing the *GFP* reporter gene; once the protocol has been refined, we will transform *A. rhizogenes* with the *IPT* gene and other genes driven by the *Senescence Associated Receptor Kinase* promoter (*pSARK*). Drought trials will be used to assess the effectiveness of the transformation compared to transformations using *A. tumefaciens* as well as wild-type plants as controls.

Differential Scanning Calorimetry Study on Precipitation Behavior in Ultrafine Grained Aluminum Alloys/Composites

Ryan C. Cohn
Sponsor: Julie M. Schoenung, Ph.D.
Materials Science & Engineering

Grain refinement and precipitation reinforcement enhance the strength, stress corrosion resistance, and several other mechanical properties in metal matrix composites. Recent studies indicate that a reduction in grain size also changes the precipitate behavior in Al 7000 series alloys. To investigate the influence of length scale and addition of reinforcing particles on the thermodynamics involved in the precipitation behavior, differential scanning calorimetry (DSC) is used to investigate the nucleation mechanisms in nano-grained aluminum matrix composites. With DSC, heat flux through each sample is measured as it is heated with varying heating rates from room temperature to ~$0.95T_m$. Analysis of the peaks in the DSC curve reveals the precipitation temperature as well as the activation energies and enthalpies of thermally activated reactions within the composite. We started with binary Al-Fe powder. Interestingly, it was found that grain refinement decreased the precipitation temperature while increasing the activation energy. Ongoing research focuses on precipitation kinetics in a boron carbide reinforced ultrafine grained Al 7091 composite. Transmission electron microscopy and X-ray diffraction will also be used to help interpret the results.

Neurorescue Effects of Early Gestation Placenta-Derived Multipotent Stem Cells on Primary Cortical Neurons

Jason Compton
Sponsor: Aijun Wang, Ph.D.
Surgery

Introduction: Early-gestation multipotent placental stem cells (mpSCs) hold great promise for autologous *in utero* therapy for congenital neurological damage. It was hypothesized that mpSC conditioned media may be capable of rescuing MAP2 expression and decreasing apoptosis in primary neuron cultures treated with the neurotoxin oxidopamine. Methods: E16 mouse embryo cortical neurons were isolated. Experiments were performed on days in vitro 5-7. Neurons were exposed to 100µM oxidopamine for 6 hours. The neurons were subsequently treated for 24 hours with either basic neuron media, or neuron media supplemented with 100µg/mL of mpSC conditioned media from one of three different cell lines. Neuron survival under these treatments was then compared to that of untreated neurons. Immunocytochemistry for MAP2, active caspase-3, and GFAP was performed. Results: Immunocytochemical staining shows that neurons treated with 100µg/mL of mpSC conditioned media had increased MAP2 expression and decreased caspase-3 expression, indicating increased neuron survival. Conclusion: The results demonstrate that proteins secreted by mpSCs *in vitro* have neurorescue effects on cortical neurons damaged by oxidopamine, supporting the feasibility of using mpSCs to treat congenital neurological damage. Additional analysis is in progress to determine the effects of mpSC conditioned media on glial populations, dendritic and axonal length, and arborization.

The Art of Craft

Katherine N. Comstock
Sponsor: Susan T. Avila, M.F.A.
Design

Founded in 19th Century Great Britain, The Arts and Crafts movement was a call for artisans to fight the mechanization of the industrial revolution. This movement espoused the ideas of naturally made materials, organic themes, and abstract linear shapes. Recently, a resurgence of these principles seems to have been taking place in fashion. From individually produced and marketed clothing, to sustainable practices and materials used, there is a "slow fashion" movement in response to consumer culture. In contemporary society however, artisans are finding ways to use technology to reaffirm the craftsman as the designer and create more ways to express personal and creative vision in a non-industrial way. To highlight this progression I am making a collection of five garments that have visual structural qualities of the buildings of the era and that are made out of fabrics resembling building materials such as copper. I am emulating materials that are high quality in the architectural community and are stylistic of the Arts & Crafts movement. I am working to display the parallel between this historical movement and the potential for 21st Century craftsmen, focusing on merging craft and technology and proving that "hand-crafted" no longer means strictly made by hand.

Influence of Media Pre-Conditioning and Incubation Conditions on VEGF Expression During Hypoxia

Alycia Cook
Sponsor: Clare Yellowley-Genetos, Ph.D.
Anatomy, Physiology & Cell Biology

When bone fractures, the vasculature is disrupted leading to hypoxia at the site of damage. Expression of vascular endothelial growth factor (VEGF), a key gene in vessel development, increases after a fracture due to this decrease in oxygen availability. In order to study the regulation of genes by oxygen, it is important to control the oxygen environment. In this study, we compared the effects of media hypoxic pre-conditioning and hypoxic incubation methods on hypoxia-induced gene changes in rat and mouse osteoblast cell lines. Media was pre-incubated for 4hr in the HypoxyCool™ unit or overnight in an incubator with 1% oxygen. Cellular media was replaced and cells were incubated in a 1% incubator or in an InVivo2 Hypoxia workstation for 1-24hr. We obtained variable results, with mouse osteoblasts expressing higher levels of VEGF when incubated with HypoxCool™ pre-conditioned media and incubated in the workstation. Rat osteoblasts expressed higher levels of VEGF when incubated with 1% incubator pre-conditioned media. Although neither method proved conclusive, pre-conditioning media in an incubator does result in the desired effect of decreasing oxygen content from 15% to 1%. In addition, the use of the workstation prevents re-oxygenation during sample removal since the chamber is kept at 1%.

Testing Direct Interaction Between Mxd3 and the Proto-Oncogene N-Myc

Abraham Corrales
Sponsor: Elva Diaz, Ph.D.
Pharmacology & Toxicology

Uncontrolled growth of cerebellar granule neuron precursors (GNPs) leads to the development of medulloblastoma, the most common brain tumor in children. Mutations in the Sonic Hedgehog (Shh) signaling pathway lead to medulloblastoma in mice and humans. In a previous study, the Diaz lab identified Mxd3 as a critical regulator of GNP proliferation during normal development (Yun et al., 2007). Mxd3 is a basic-helix-loop-helix-leucine-zipper (bHLHZ) transcription factor that is part of the Myc/Max/Mxd transcriptional network in which Myc and Mxd form heterodimers with Max to exercise opposite cellular responses. Myc and Max heterodimers are associated with cell proliferation while Mxd and Max heterodimers are associated with differentiation and repression of cell cycle progression. Mxd3 is an atypical member as high levels of Mxd3 have been shown to be expressed in pretumor cells and cerebellar tumors derived from mouse models of medulloblastoma compared to normal cerebellar tissue (Yun et al., 2007). Furthermore, Mxd3 and N-Myc may positively regulate each other's expression levels (Yun et al., 2007). Intriguingly, prediction tools rank highly a putative interaction between Mxd3 and N-Myc (Barisone et al., 2008). Here we test the theoretical protein-protein interaction between Mxd3 and N-Myc with Fluorescence Resonance Energy Transfer (FRET) experiments.

Reconstitution of HIV-1 Env Into Nanolipoprotein Particles

Natasha L. Cowan
Sponsor: R. Holland Cheng, Ph.D.
Molecular & Cellular Biology

The structure of full-length HIV-1 Env has been shown to be affected by the presence of the lipid bilayer, making reconstitution of Env into nanolipoproteins (NLPs) desirable. NLPs are nanometer-size discs (nanodiscs) that feature a phospholipid bilayer corralled by apolipoproteins. NLP particles are three orders of magnitude smaller than liposomes, provide a better representation of the lipid bilayer than micelles, and allow unrestricted access to both faces of the membrane. These properties make them useful for solubilizing membrane-embedded proteins into discretely-sized particles while maintaining their native environment. Thus far, only proteins with multiple transmembrane domains such as bacteriorhodopsin have been incorporated into NLPs, and the reconstitution of Env into NLP particles has demonstrated that these nanodiscs have the potential to stabilize and solubilize cell-expressed proteins with large ectodomains. Membrane-embedded Env will allow us to perform comparative structural analysis of soluble Env constructs for better insights concerning which native epitopes are perturbed by cleavage of the transmembrane domain. The Env-incorporated NLPs will be embedded in vitreous ice and imaged via cryo-electron microscopy, which allows for higher resolution structures.

Climate Change Impacts on Wildlife: Diet Preferences of Woodrats During Drought Conditions

Arielle A. Crews
Sponsor: Mary B. McEachern, Ph.D.
John Muir Institute of the Environment

The feeding preferences of generalist herbivores can vary substantially, both geographically and over time. Such behavioral flexibility can be an important adaptation to patchy or edge habitats, as well as habitats undergoing rapid environmental change. Dusky-footed woodrats (*Neotoma fuscipes*) are ecologically important herbivores in California's patchy network of oak woodland and chaparral habitats. Not only do they provide a prey base to a number of predators, their dens buffer extreme environmental conditions and provide cover to a variety of species. Despite the woodrats ecological impact, we have a very limited understanding of what plants are important to woodrat survival, and how woodrats might respond to changes in local plant communities. We conducted cafeteria trials on a population of woodrats at the Quail Ridge Reserve to assess individual preferences for locally available plants compared to edge vegetation. Our results show that woodrats sample a number of plants, but tended to prefer scrub oak, a dominant plant species in the available habitat, as well as chamise, a somewhat surprising result given that this plant is predominantly present in the surrounding edge habitat. We conclude with a discussion of the management implications and outlook for woodrats at the Quail Ridge Reserve.

Measurement of Light Attenuation Length for Large Neutrino Detectors

Brenton J. Cromwell
Sponsor: Robert Svoboda, Ph.D.
Physics

The focus of my research is looking at the attenuation lengths of light through the types of water that would be found in Neutrino detectors. Neutrinos are very low mass, zero charge particles that move at highly relativistic speeds. Since they have such a small cross-section huge detectors are needed to find them. The particular type of detector we are interested is called Water-Cherenkov since it uses only water and detects the Cherenkov radiation produced when particles move at relativistic speeds through it. The light created from these reactions are then collected by Photo Multiplier Tubes (PMTs) on the perimeter of the detector. However as the light travels to the PMTs it looses power (attenuates). The rate of this attenuation is determined by the transparency of the water, which can be affected by the material that is used to build the detector. Using a small detector, built at Lawrence Livermore National Laboratory, I will be able to take different materials used in proposed detectors and accurately measure the transparency and attenuation length. The data from this project could be used to create more accurate models and to help bring awareness to potential problems when planning future detectors.

Regulation of (Non-Canonical Wnt Signaling/ Dvl) by the E3 Ligase Nrdp1 in Glioblastoma

Antonio Cuevas
Sponsor: Kermit L. Carraway, Ph.D.
Biochemistry & Molecular Medicine

Glioblastoma is the most common and most aggressive malignant primary brain tumor in humans. In the United States, more than 50,000 patients are currently living with this disease and approximately 10,000 new cases of glioblastoma are diagnosed each year with a median survival time of ~15 months. Because these tumors aggressively invade the surrounding normal brain tissue, effective treatments are limited and tumors often recur. Our laboratory explores the contributions of the non-canonical Wnt signaling pathway to glioblastoma invasiveness. The project presented here investigates the protein-protein interaction between Nrdp1, an E3 ubiquitin ligase, and the non-canonical Wnt pathway scaffolding protein Vangl2 to better understand how loss of regulation in normal signaling pathways contributes to glioblastoma. Our findings indicate that interaction between Nrdp1 and Vangl2 occurs via their coiled coil domains. Moreover, we find that this interaction is necessary for Nrdp1 to suppress the function of the non-canonical Wnt pathway protein Dvl2, a critical signaling hub that contributes to tumor cell motility and invasiveness. By identifying the underlying biological foundations of glioblastoma, our study lays the mechanistic foundations for the ultimate development of more effective treatment strategies for this devastating disease.

Quantifying Root System Development of Cover Crops to Assist in Nitrate Leaching Modeling

Amy L. Cunningham
Sponsor: Wendy Silk, Ph.D.
Soils & Biochemistry

In agricultural regions, utilizing the groundwater for drinking water and crop use can be risky because of usage of nitrogen-heavy fertilizers that seep through the soil profile and produce levels of nitrate toxic to humans. Since much leaching occurs during the rainy winter months, one technique currently used by farmers to retain soil nutrients during this season is to plant cover crops. This project characterized root system development of two common cover crops, Triticale and Bell Bean, to better understand their influence on nitrate leaching in the soil profile. Plants were grown in rhizotrons and root growth was tracked using time lapse photography. Computer assisted image analysis revealed the growth rates and branching frequency of the root systems over time. After around 3 weeks of growth at 23.5 degrees Celsius, the Bell Bean had a tap root extending down the 50 cm soil profile with dense branching in only the upper 30 cm. In contrast, Triticale had root growth that was more uniformly dense to depths of 50 cm. Knowledge of cover crop root system development can be used to guide best agricultural management practices for the use of cover crops in reduction of nitrate leaching.

Chaucer's Chessboard: Reading Spaces in *The Book of the Duchess*

Annika J. Cunningham
Sponsor: Seeta Chaganti, Ph.D.
English

For nearly a century, the chess metaphor in Geoffrey Chaucer's *The Book of the Duchess* has perplexed literary scholars. Some of these scholars question Chaucer's knowledge of chess and the narrator's obtuse response while others search for hidden meanings in Chaucer's chess terminology. Playing with the technicalities of chess, however, may be the wrong approach to *Duchess*'s metaphor. Instead, I suggest we view the chess metaphor from the perspective of a fifteenth-century reader, which requires taking a closer look at the aesthetics of medieval chess sets. This reading also necessitates examining the poem's earliest manuscripts – Bodley 346, Fairfax 16, and Tanner 346 – as visual and material objects. These fifteenth-century chess sets and manuscripts suggest that chess in *Duchess* encouraged medieval readers to read visually, a practice that not only discloses a tension between words and images but also lays groundwork for experiencing the text as a three-dimensional space. Ultimately, visuality in the chess metaphor reveals how *Duchess* experiments with enclosure and scale to construct spaces for early readers to negotiate visual and verbal signs.

The Nrdp1 E3 Ubiquitin Ligase is an Endoplasmic Reticulum Stress Response Protein

Daniel A. Curiel
Sponsor: Kermit L. Carraway, Ph.D.
Biochemistry & Molecular Medicine

Nrdp1 is an E3 ubiquitin ligase that regulates various biochemical pathways by marking key pathway components for degradation. In addition to its functions in programmed cell death, oxidative stress, and Parkinson's disease, it acts at the endoplasmic reticulum (ER) to ubiquitinate and degrade newly synthesized ErbB3 receptor tyrosine kinase. The loss of this quantity control mechanism in breast cancer promotes tumor progression and therapeutic resistance by allowing unchecked ErbB3 signaling. To carry out its ErbB3 suppressive function, Nrdp1 engages components of the ER-associated degradation (ERAD) pathway, a cellular pathway that mediates the degradation of misfolded ER-produced proteins. The ERAD pathway is also engaged under conditions of ER stress, where the ER suffers a loss of luminal Ca2+, produces significant quantities of misfolded proteins, or is responsible for very high levels of ER protein synthesis. In this study we demonstrate that ER stress-inducing drugs dramatically elevate cellular Nrdp1 transcript levels. Moreover, we identify the downstream ER stress signaling pathway largely responsible for Nrdp1 induction. Our observations conclusively demonstrate that Nrdp1 is an ER stress response protein, raising the possibility that it plays roles in ameliorating ER and cellular stresses associated with the production of secreted and membrane proteins.

Role of Proteasome-Dependent Degradation of Ephexin 5 in Activity-Induced Spine Formation

Sina Dadafarin
Sponsor: Karen Zito, Ph.D.
Neurobiology, Physiology & Behavior

Dendritic spine outgrowth has been associated with the formation of new synaptic connections, ultimately leading to changes in neural circuitry. Investigation of the underlying molecular mechanism involved in spine outgrowth is vital for a better understanding of circuit modifications occurring during experience-dependent synaptic plasticity in learning and memory. Studies from our lab have shown that neural activity leads to activation of the proteasome that is required for outgrowth of dendritic spines. One potential target of the proteasome we are currently studying is Ephexin5 (E5), a protein that acts as a molecular break for spine formation. We hypothesized that E5 is a downstream target of the proteasome involved in activity-induced spine formation. In order to test our hypothesis, I'm using organotypic hippocampal slices transfected with GFP-tagged E5. I then monitor changes in E5-GFP fluorescence as a readout of degradation. My results show that there is reduction of green fluorescence ($p<.05$) after inducing neural activity, indicating that E5 is indeed degraded in response to activity. Currently, I'm investigating if degradation of E5 is proteasome-dependent by using the proteasome inhibitor MG132. Results of these experiments will determine if Ephexin5 is part of the same biochemical pathway as the proteasome in activity-dependent spine formation.

Mechanism of Chromosome Rearrangement by Exchanges Between Short Repeated Sequences

Mahtab M. Danai
Sponsor: John R. Roth, Ph.D.
Microbiology

Gene duplications are the most common mutations, contributing to cancer, birth defects, and drug-resistant pathogens. Yet, little is known about the mechanisms by which they form. Duplication formation is usually studied in regions flanked by large sequence repeats, where they can form by recombination, but in nature, both duplications and deletions often occur between sequence repeats that are too short to support this mechanism. Since endpoints of these rearrangements are widely distributed in the chromosome, it is difficult to assess the rate of exchange between any particular pair of short sequences. I am developing a system for detecting duplications and deletions between specific short repeats at widely separated chromosomal sites. One copy of the repeat is placed near a promoterless unexpressed biosynthetic gene, *hisD*. A second copy is placed near a distant promoter. Selection for hisD expression demands recruitment of a new promoter by exchange between the sequences generating a duplication or deletion. These assays will allow me to compare duplication and deletion rates in normal cells and in mutant strains defective for various repair and recombination functions. With these experiments, I hope to gain insight into the mechanisms that underlie duplication and deletion formation.

Viability of a Fourier Approach to the Neutrino Mass Hierarchy Problem in WATCHMAN

Daine L. Danielson
Sponsor: Robert C. Svoboda, Ph.D.
Physics

The mass-ordering of the three neutrino mass states presents an open problem in particle physics. Two hypotheses exist: $m_1 < m_2 < m_3$ ('normal'), and $m_3 < m_1 < m_2$ ('inverted'). WATCHMAN is a gadolinium-doped water-Cherenkov reactor-antineutrino detector currently under development for nuclear nonproliforation purposes. Experimental sites under consideration lie 13 km and 20–25 km away, respectively, from the nearest nuclear reactor. For each hierarchy, we simulate the production of a reactor antineutrino flux; propogate that flux across each reactor-detector standoff, incorporating the effects of neutrino flavor oscillation; and simulate the detector physics of a WATCHMAN-type detector. We apply a Fourier transform from the oscillatory neutrino detector response, as a function of neutrino flight distance over neutrino energy, into a Fourier power spectrum as a function of $|\Delta m^2|$. The oscillation frequencies are proportional to the neutrino mass-squared differences $\Delta m^2_{ij} = m^2_i - m^2_j$, and thus determine the mass hierarchy. We attempt to resolve the spectral geometry characteristic of the mass hierarchy present in the simulated physics with sufficient precision to distinguish it from the alternate hierarchy. Thus, we assess the ability of WATCHMAN at various candidate reactor-detector standoffs to distinguish between the normal and inverted neutrino mass hierarchies.

Metamorphic Hormone Expression in Exaggerated *Drosophila prolongata* Forelegs

Chelo Jane Datinguinoo
Sponsor: Artyom Kopp, Ph.D.
Evolution, Ecology & Biodiversity

The mechanisms of growth and differentiation have long been explored in developmental biology. During insect metamorphosis, the hormones juvenile hormone (JH) and 20-hydroxyecdysone (20E) or ecdysone are responsible for regulating the differentiation of adult structures. The size of the adult body parts of the fruit fly *Drosophila melanogaster* is determined during the transition from the third larval instar to the pupa stage. In its relative *Drosophila prolongata*, males have larger forelegs with respect to body size than any other *Drosophila* species. I compared adult appendage scaling between *D. prolongata* and its sister species *D. rhopaloa*. These comparisons showed that the first and second legs have a similar scaling relationship across the three species, but the first legs are larger by a consistent degree which indicates shared regulation. This suggests that there are differences in imaginal leg disc, larval precursor cells of the adult leg, response to hormone signaling. Through qPCR, I can detect and quantify the differences of expression of the hormone receptor genes *Met* and *EcR*. I aim to add to the understanding of hormone interactions and their role as evolutionary mechanisms toward novel traits such as the elongated legs of *D. prolongata*.

Social Dynamics and Personality Attributes Modulate Subordination Signaling in Rhesus Macaque Societies

Kendall Davidek
Sponsor: Brenda McCowan, Ph.D.
Population Health & Reproduction

In rhesus macaques, silent-bared-teeth displays given in peaceful contexts (pSBT) are subordination signals which communicate the long term state of dominance relationships. The frequency and diversity of signals serve as a measure of how group members regard an individual, i.e. social power. Although higher-ranking individuals tend to receive more pSBTs than low-ranking conspecifics, some individuals receive more than expected given calculated ranks. We hypothesized that individual attributes, such as temperament, sex, and age, as well as social behavior, such as grooming and alliance relationships, may explain why some mid-ranked individuals receive more signals than expected whereas other high-ranked individuals receive fewer than expected. These hypotheses were tested using behavioral data from five groups of captive rhesus macaques, housed at the California National Primate Research Center. We fit multi-level generalized linear models to counts of pSBTs received to understand the social mechanisms behind this phenomenon. Preliminary results indicate smaller matriline size, grooming efforts to non-kin, and alliance support provided to dominant non-kin are among strong predicting factors. Evaluation of personality factors demonstrated that as matriline size increases, the effect of being a very confident individual decreases. Continued analysis will provide important insights into the detailed behavioral mechanisms governing macaque societies.

Talking Dirty: The Social Effect of Stand-up Comedy and Sexual Discourse

Manasa Davuluri
Sponsor: Scott Shershow, Ph.D.
English

Unlike many artistic mediums, stand-up comedy provides an individual artist with an opportunity to directly promote an agenda, and it may even be apt to liken the stand-up comic to a preacher. Comedy certainly can be cruel toward its subject, but it also has potential for promoting tolerance, with many recent stand-up comics openly and positively discussing sexuality and gay rights in their material. I use Henri Bergson's *Laughter* and Michel Foucault's *The History of Sexuality* to uncover the social effects of laughter as well as the different techniques used in constructing jokes and how they add to sexual discourse. While Bergson is useful in analyzing laughter and its social functions in dramatic comedy, he fails to provide a deeper understanding of stand-up comedy in society due to the comic's unique position as an individual on stage. I explore whether stand-up comedians have moral obligations to capitalize on their elevated platform and promote social tolerance. Ultimately, I aim to understand how stand-up comedy's increasingly open discussion of sexuality moves society toward what Foucalt deems "a different economy of bodies and pleasures" and to what extent it liberates us from restrictive categorizations.

Interdependent Presence and Proximity Sensing Electronic Modules

Samuel Dawson
Sponsor: Andre Knoesen, Ph.D.
Electrical Engineering

The overarching goal of the EE Emerge group is to create devices that demonstrate the impact the field of electrical engineering can have real life. Our aim is to build an interactive exhibit that combines the simplicity of a flashing LED with the complexity of a processor. We created devices that respond to the presence and proximity of each other. The greatest challenge of implementing this idea was to find a way to communicate distance from each other using cheap, low power hardware. This was achieved by using microprocessors to blink infrared LEDs in sequences unique to each device. Each device can decode sequences coming from nearby devices to establish spatial awareness and create patterns using visible LEDs. Additionally, the intensity of incoming light patterns can be used to determine distance to other devices. By moving the modules around relative to each other, a user can create interesting and diverse visual patterns.

The Mechanisms of Diabetic Cardiomyopathy

Radha Daya
Sponsor: Aldrin Gomes, Ph.D.
Neurobiology, Physiology & Behavior

Type 2 diabetes patients are diagnosed with abnormally high blood glucose levels. This is caused by a defect in pancreatic insulin production or insulin resistance. Diabetic cardiomyopathy has been identified as a co-morbidity of diabetes. Patients experience ventricular failure followed by heart failure solely due to diabetes. Diastolic dysfunction and cardiac muscle atrophy are the earliest manifestations of diabetic cardiomyopathy. The pathology of this complication is not understood and no methods have been developed for treatment or prevention. The ubiquitin proteasome system (UPS) is a protein degradation systems in the body, primarily responsible for muscle protein degradation. In diabetic mice, the UPS has been shown to be overly active in skeletal and cardiac muscles. Irregularities in UPS activity were observed in a type 2 diabetic mice model by proteasome assays, suggesting protein degradation is affected by diabetes. Results suggest that the UPS is more active at 4 weeks, at the onset of diabetes and less active at 15 weeks. Western blot analysis indicates that protein synthesis is unaffected by diabetes, suggesting that any irregularities in muscle mass are attributed by the UPS. Further study indicates that bortezomib, a proteasome inhibitor, could be used as a prevention treatment for diabetic cardiomyopathy.

Decolonizing Methodologies in Indigenous Hip Hop

Justen H. Deaton
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Native American Studies

Looking to answer questions aimed at how the music is used to decolonize, as well as publicize communities in contemporary music, this research takes an in-depth look at First Nations rap group War Party and their music, the effects of the African Diaspora on Indigenous communities and the use of hip hop as a decolonizing methodology. My research employs Linda Tuhiwai Smith's decolonizing methodologies to highlight the use of music as a method of decolonization and hip hop as a tool of remapping. Examining the African Diasporas influence, I will discuss African influence on the Indigenous through forms of artistic expression in music. Utilizing these comparisons, I aim to bring recognition to a culture misrepresented by the "Sound of Indian". Societies must face the realization that Indigenous communities exist in a modern sense. The nature of hip hop originating with the stories of trauma, poverty, marginalization, and class separation provide examples of how Native North American hip hop can be used as a decolonizing methodology. In short, I aim to bring the colonial struggles of the past to a contemporary thought and out of the shadows of the dominant, European Western school of thought.

Characterization of the Pathogenicity Island in *Helicobacter pylori* from Naturally Infected Rhesus Monkeys

Samuel L. Deck
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Medical Microbiology & Immunology

Helicobacter pylori is a bacterium that commonly infects the gastric mucosa and epithelial layer of the human stomach and is associated with an increased risk for the development of several gastric diseases, including peptic ulcers, gastric adenocarcinoma, and gastric lymphoma. *H. pylori* is a genetically diverse species, and the risk for developing these diseases is partially dependent upon the presence of a cytotoxin associated gene pathogenicity island (*cagPAI*). The *cagPAI* 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). Socially housed rhesus monkeys often are naturally infected with *H. pylori* similar to humans, but little is known about their *cagPAI*. Here we present data showing the prevalence of the *cagPAI* in *H. pylori* strains isolated from naturally infected rhesus macaques. Our results indicate that infection with *H. pylori* strains that carry the *cagPAI* was ubiquitous among rhesus monkeys, that these strains were able to induce IL-8, and that the DNA sequence is highly homologous to strains found in human infection. These results provide evidence for the usage of rhesus monkeys as a valid experimental model for *H. pylori* in humans.

The Relationship Between Bilingualism and Ethnic Identity Among Asians, Whites, and Asian-White Biracials

Misha Delfin
Sponsor: Nolan Zane, Ph.D.
Psychology

A recent meta-analysis of 237 studies demonstrated a positive relationship between stronger ethnic identification and better mental health outcomes (Grant, 2008). Researchers are now considering different factors that may affect ethnic identity and extant research suggests there is a positive link between speaking a heritage language other than English and the ethnic identity of monoracial minorities (Phinney, Romero, Nava, & Huang, 2001) and Whites (Jasinskaja-Lahti & Liebkind, 1998). However these findings have not been extended to biracials (Shin, 2010). This study explored the relationship between bilingualism and ethnic identity among 106 Asians, 95 Whites, and 95 Asian-White biracials. Results indicated that speaking/understanding a heritage language in addition to English was significantly correlated with ethnic identity among Whites. Bilingual Whites identified less as "Caucasian/White," and race/ethnicity was more important to the self-concept of bilingual Whites than their non-bilingual counterparts. Bilingualism was not significantly related to ethnic identity strength or importance among Asians and Asian-White biracials. Monolingual and bilingual Asians and Asian-White biracials were more ethnically identified than Whites and considered race/ethnicity to be moderately important to their self concept.

Changes in Composition of Human Oral Microbiota Post-HIV Infection

Ramses C. Delgadillo
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Medical Microbiology & Immunology

The gastrointestinal tract is home to a balanced ecosystem of microbes that are essential to health. Although the human GI tract contains many non-pathogenic microbes, we also carry potential pathogenic organisms that are maintained in low concentration to prevent them from being harmful to the host. HIV may alter the homeostasis of the gastrointestinal tract and many research groups have reported disruption of the intestinal epithelium in HIV infected subjects. We are analyzing changes in the composition of the microbes inhabiting the GI epithelium that occur during chronic HIV infection. The current study is focused on characterization of the oral microbiota by analyzing DNA sequences that encode bacterial 16S ribosomal RNA. Cheek and tongue swab samples are collected from HIV infected individuals and healthy controls, the DNA is extracted, and the 16S rRNA sequence is amplified by PCR for Illumina-based sequencing. We are utilizing open-sourced bioinformatics software to obtain taxonomic and phylogenetic information from the sequence data. The results obtained by this project may reveal valuable new information about opportunistic infections in HIV infected individuals.

Topic Avoidance and Relational Satisfaction

Danielle N. Derman
Sponsor: Nicholas A. Palomares, Ph.D.
Communication

What is not said in a relationship is just as significant as what is said. Topic avoidance – the act of evading topics in conversation – is common in social interaction. Whereas a range of research exists studying relational outcomes from the avoider's perspective, there is limited data regarding the listener's perception of a conversational partner's topic avoidance, and even less data from an experimental paradigm. The main research question examined in this work is: When someone avoids a topic with others for different reasons, how does this affect his or her satisfaction with the relationship? My experiment manipulated avoided topics and motivations to examine their effects on relational satisfaction and other relational outcomes. If avoidance occurs to protect the relationship, I expect higher satisfaction levels than if avoidance is due to personal or selfish reasons. In addition, the avoided topic could moderate this effect on satisfaction. Essentially, this study will contribute to research on topic avoidance by exploring the resulting effects of motives for avoidance and the exact topic being avoided on relational outcomes.

The Effect of Pet Exposure on Scanning of Animal Images in Four and Six Month Old Infants

Sharmatha Devarajan
Sponsor: Lisa M. Oakes, Ph.D.
Psychology

Infants' development is influenced in many ways by their daily experience. For example, previous research has shown that 4-month-old infants with pets (and who see a dog or cat everyday) look at images of dogs and cats differently than do infants without pets. Specifically, infants with pets find the head regions of cat or dog images more quickly and maintain attention to that region for longer. By 6 months, even infants without pets find and focus on the head region of cat images. In this on-going study, I am examining infants at 4 months and 6 months to determine if the differences between infants with and without pets in scanning of dog or cat images is present at both ages. Using eye-tracking, I can measure where the infants look and how long they look at images. We are presenting infants with images of cats and dogs, and as controls images of human faces and cars. We expect that infants with and without pets will scan animal images differently, but that these two groups of infants will not differ in how they scan non-animal images.

Investigation of GRPR-Expressing Spinal Neurons in Chronic Itch

Jahnavi Devireddy
Sponsor: E. Carstens, Ph.D.
Neurobiology, Physiology & Behavior

Chronic itch is often associated with sensitization of the itch pathway leading to continuous itch, alloknesis (touch-evoked itch) and hyperknesis (increased itch strength). A role for gastrin-releasing peptide receptor (GRPR) expressing dorsal horn neurons in the itch circuit was shown by studies in which neurotoxic destruction of these cells resulted in the loss of itch-related scratching behavior. The aim of the present study was to identify the role of GRPR -expressing spinal neurons in the mediation of chronic itch. A model for atopic dermatitis (AD) was developed in order to simulate the symptoms of chronic itch. Mice were treated with ovalbumin (OVA), a skin allergen. Behavior analysis was conducted focusing on scratching, alloknesis and hyperknesis to determine the validity of the OVA model. The OVA-sensitized mice then received an intrathecal injection of bombesin-saporin, a compound that selectively binds to GRPR and disrupts ribosomal activity, causing cell death of GRPR-expressing neurons. Ultimately, the OVA model was suitable to study chronic itch due to the increase in itching, hyperknesis and alloknesis with treatment. However, OVA-sensitized mice treated with bombesin-saporin exhibited a reduction in exclusively hyperknesis. These results indicate that GRPR-expressing spinal neurons are specifically required for the behavioral expression of hyperknesis.

The Welfare Effect of the EITC

Aileen Devlin
Sponsor: Giovanni Peri, Ph.D.
Economics

The Earned Income Tax Credit (EITC) is a refundable tax credit that subsidizes wages among the working poor, particularly those with children. Congress increased the generosity of the EITC in 1993 to support the policy goal of a system where lower-middle class Americans can keep themselves out of poverty by working. Previous literature has shown that this expansion increased the labor force participation of individuals who were eligible for the EITC. I investigate whether the 1993 EITC expansion had an effect on the use of welfare among single, low-educated mothers as well as increasing their labor force participation. I use a difference-in-difference model to compare the relative behavioral changes between those strongly affected by the expansion and those less affected. I find that groups more affected by the EITC decrease their welfare usage by as much as 5% relative to other groups. I also investigate the timing of the effects and find that though the bill expanding the EITC was passed in 1993 and the expansion began in 1994, the labor force and welfare effects did not appear until 1995 and 1996.

Effects of Frataxin Deficiency on Mouse Forepaw Grip Strength

Van M. Doan
Sponsor: Gino A. Cortopassi, Ph.D.
Molecular Biosciences

Friedreich's ataxia is a rare inherited disorder characterized by damage to the nervous system and decreased motor coordination. The first symptom usually seen is "gait ataxia," or difficulty walking. It can also lead to heart disease and ultimately, heart failure. Friedreich's ataxia is an autosomal recessive disorder, meaning it is only inherited if a child receives the mutant gene from both mother and father. The disorder is caused by inadequate expression of the protein frataxin due to a defective frataxin gene. To study the effect of frataxin deficiency and resultant neurodegeneration on motor coordination, the behavior of frataxin deficient mice was examined. The forepaw grip strength of mutant mice was compared to controls. The grip strength of frataxin deficient mice was expected to be less than that of unaffected mice. In the future, I hope to implement the same experiment on hindpaw grip strength to further understand the relationship between frataxin deficiency and motor coordination.

Understanding Russia's Relationship With Syria and Iran

Haydee Dominguez
Sponsor: Josephine Andrews, Ph.D.
Political Science

Russia and Iran have a long-standing cooperative relationship, which is difficult for countries such as the United States to understand. This also holds true for Russia and Syria. To better understand these relationships, we need to investigate the underlying reasons as to why they continue them. I am doing this by attempting to pinpoint specific factors that keep them in cooperation. To do this, I look at their history together, and read journals and newspapers that discuss their relationship. I focus on common topics that the authors touch on, and then specifically investigate those parts. I then will look at how these relationships affect Russia's voting in United Nations. So far, I have found strong ties in the weapons, nuclear, and Caspian Sea resources aspects between Russia and Iran. These have provided both a cause for unity and division over the years. A long history of involvement by Russia in Iran and strategic motives on both sides allow them to continue their relationship as it is to this day. Understanding these relationships will help us understand and try to cooperate better with these countries, especially as their influence and power continues to grow.

The Usage and Function of German Hashtags on Twitter and Their Effect on Langauge Change

Rachael E. Duke
Sponsor: Vaidehi Ramanathan, Ph.D.
Linguistics

German, like all languages, is evolving over time and it is the job of linguists to examine this change. One of the clearest ways to see that change is in social media. Twitter, with its worldwide reach, has had an impact on languages by modeling new linguistic forms that are then integrated into the language (Cunha et al 2011). The question is: how do hashtags, frequently used on Twitter, effect language change in German? Specifically, what are the functions of hashtags and why do German Twitter users employ them? This paper explores these questions by paying special attention to the functions, grammatical forms, and word order of German hashtags. Based on a small corpus of hashtags from German Twitter users, the author takes a close look at how different linguistic elements, like language contact, word order, or phonological changes, effect German hashtag use. Some early findings indicate that German Twitter users frequently utilize shorter hashtags, integrate English hashtags into their tweets, and form nonstandard word forms with hashtags. This paper concludes with a discussion of the motivations behind hashtag use and the broader effects of hashtags on German language change.

From Swab to Publication: Microbial Genome Sequencing Workflow

Madison I. Dunitz
Sponsor: Jonathan Eisen, Ph.D.
Evolution, Ecology & Biodiversity

The sequencing and *de novo* assembly of microbial genomes has already yielded enormous scientific insight revolutionizing a diverse collection of fields, from epidemiology to ecology. In the past two decades increasing advances in DNA sequencing technology have led to the creation of a wide variety of options for DNA library preparation, sequencing and assembly. Each option comes with its own advantages and disadvantages in terms of complexity, expense, computing power, time, and experience required. The objective of the present study was to design, test, troubleshoot, and publish a comprehensive workflow for taking a researcher from a swab to a microbial genome publication; enabling even a lab with limited resources and bioinformatics experience to perform it. The workflow was designed in an attempt to democratize the process of microbial sequencing and *de novo* assembly, in order to make them accessible to low funded labs or even classrooms on a massive scale.

Male Courtship Adjustments in Response to Female Signals

Rebecca L. Ehrlich
Sponsor: Gail L. Patricelli, Ph.D.
Evolution, Ecology & Biodiversity

For courtship signals to honestly reflect male quality, those traits and displays should be energetically costly to produce. Previous research suggests that sexual selection favors males that can tactically allocate their energy during courtship by responding to environmental cues, thereby expending the optimal amount of energy for a given situation. There is currently little known about the relationship between a male's ability to attend to female signals during courtship and the male's fitness. In this study, we analyzed the courtship behaviors of greater sage-grouse (*Centrocercus urophasianus*) by examining video and audio recordings of both natural and experimental interactions of 52 males across 3 leks during the 2012 breeding season. We experimentally manipulated female signaling by using a robotic sage-grouse that was either "interested" or "uninterested" in males' displays. We measured time and frequency characteristics of the male vocalizations to determine whether differences among males relate to success on the lek, as well as to see whether males increase the quality of their displays when courting a more interested partner. Our study highlights the importance of the context of courtship interactions when quantifying male displays.

A Comparative Study of Refugees' and Asylum Seekers' Access to Employment – Germany, Sweden, and the United Kingdom

Hannes M. Einsporn
Sponsor: Jeannette Money, Ph.D.
Political Science

Although many states favor voluntary repatriation of refugees over local integration, it has become clear that the protracted nature of the conflicts which have forced refugees to flee their home countries renders this often times impossible. In this context, employment becomes a key issue for integration. Refugees and asylum seekers, however, face multiple obstacles to access the labor market in their host countries. Thus, in my research, I discuss the problems faced by refugees and asylum seekers to access the labor market and to find employment that matches their skills and qualifications. Conceptualizing refugees' and asylum seekers' labor market outcomes as a two-way- street, which involves both state policies and the refugees and asylum seekers themselves, I examine three major refugee hosting countries and recipients of asylum applications; Germany, the United Kingdom, and Sweden. My research will be based on empirical evidence from the Eurostat Labor Force Survey, which provides data on the labor market performance of humanitarian migrants. While providing a thorough comparative analysis, the paper also seeks to come to policy recommendations, which will lead to more favorable labor market outcomes for refugees and asylum seekers in the future.

Linking Thought, Emotion, and Action in Future-Oriented Reasoning: A Developmental Perspective

Noel M. Elrod
Sponsor: Kristin Lagattuta, Ph.D.
Psychology

Lagattuta and Sayfan (2013) examined developmental changes in 4- to 10-year-olds' and adults' future-oriented thought, emotion, and behavior predictions for a focal character who encounters someone who had consistently harmed, consistently helped, or both harmed and helped in the past. They documented age-related improvements in children's ability to integrate past event information to predict characters' mental states in these different kinds of situations. In the current study, we reanalyzed the data to explore developmental changes in children's ability to connect people's thoughts, emotions, and decisions into *coherent mental triads* (e.g., if a person thinks something good will happen, she will feel happy and decide to approach; whereas if she anticipates something bad, she will feel worried, and avoid), as well as *coherent mental state dyads* (e.g., thought-emotion; thought-decision; emotion-decision). Results showed significant increases within childhood and between childhood and adulthood in the frequency that children generated coherent mental state triads and dyads, with children demonstrating the strongest knowledge about thought-emotion relations. Gender differences emerged across age, with males making more coherent dyads and triads than females. Findings will be discussed in relation to the development of theory of mind, including implications for clinical practices with children.

Tying Space and Time Together: How Spatial Shifts Affect Time Perception

Ben Emerzian
Sponsor: Eve A. Isham, Ph.D.
Psychology

Traditionally, space and time are considered related but not necessarily dependent entities. However, some behavioral studies and clinical observations in neglect patients are converging on the perspective that time perception may have a spatial component (e.g., Frassinetti et al., 2010). To further examine the relationship between time and space, we asked the participants to judge the duration of a visual image (systematically varied at 1600, 1800, 2000, 2200, 2400 ms) before and after a spatial adaptation session. The spatial adaptation procedure involved having the participants wear a pair of prismatic goggles that shifted their visual field to the left or the right of normal vision by either 10 or 30 degrees. Similar to Frassinetti et al.'s findings, we found that the 10-degree adaptation elicited an *underestimation* of time when shifted to the left. However, the 30-degree adaptation elicited an opposite effect resulting in an *overestimation* of time when shifted to the left. These preliminary findings provide further support for a spatial component of time perception. Moreover, we propose that these spatial mechanisms operate differently across visual retinal space.

Repurposing Industrial Materials: The Port of West Sacramento

Alexander C. Espinosa
Sponsor: Emily Schlickman, M.A.
Landscape Architecture

The Port of West Sacramento has discontinued use of portions of its site after facing economic hardship. The Port presents an opportunity to reveal the value of unused space in urban areas and chance to redefine the role of landscape architecture in industrial communities. In order to revitalize the site, we focussed on retaining and reusing materials and vegetation, to catalyze the development of ecological habitats. Our analysis of aerial photography, GIS data, environmental impact reports, and site investigations have revealed the value of the port's former dilapidated features. These components could be recycled, providing a sense of place that connects visitors with the region's cultural heritage. The port will not only improve biodiversity in its adjacent landscape, but create recreational, economical, and historical opportunities. We are proposing a morphological grid consisting of repurposed concrete road barriers and salvaged metals. The Port of West Sacramento will serve as a model of reclaimed industrial landscape potential.

Minimizing Protein Loss During HDL Delipidation

Daniel G. Esquivel
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Food Science & Technology

HDL is a lipoprotein that plays an important role in the transport of cholesterol to various parts of the body, such as the liver. To better understand this important particle, it is prudent to identify its protein complex. This complex can be studied through 'shotgun' proteomics, however, sample preparation techniques for mass spectrometry analysis of HDL has been a challenge. Of particular importance is lipid delipidation following lipoprotein dialysis. Techniques such as Wessel Flugge and Folch have shown to decrease protein absorbance when measured in a spectrometer at 280 nm wavelengths, indicating that proteins are lost during delipidation. Thus, accurate mass spectrometry analysis cannot be performed. My project will focus on identifying a technique to remove lipids while minimizing protein loss. I will also determine if lipid delipidation is necessary at all. I hypothesize that an alternate method for removing lipids from HDL will be ideal for a mass spectrometry analysis.

Variability in Brood Parasite Egg Shape in Relation to Host Egg Shape

Jacob A. Ewald
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Entomology

Brood parasites are birds that minimize their parental efforts by laying their eggs in the nests of one or more host species. Several studies have shown that to a certain degree, brood parasite eggs emulate the color and speckling patterns of host eggs in order to avoid detection by host parents. Do brood parasites match host populations in egg shape in addition to egg color? To test this, we created a standardized photo method to photograph specimens of brood-parasitic *Molothrus ater* (Brown-headed Cowbird) eggs held in several museum collections. We then extracted the outlines of each photographed egg using imageJ software and analyzed the shape of each egg using four parameters: egg width, center of mass, tip shape, and pointiness. Where possible, we also photographed the eggs of the host clutches collected with the *M. ater* specimens. Results will compare the host/parasite shape relationships as potential evidence for shape matching.

Dressing Up: The Production and Performance of Gender Through Drag

Rebecca G. Ewert
Sponsor: Laura Grindstaff, Ph.D.
Sociology

Ever since Simone de Beauvoir wrote "One is not born a woman, one becomes one," gender scholars have been calling for empirically-based studies that demonstrate the ways gender is produced as a process while also functioning as an identity and as a structure for organizing social life. However, gender does not exist in isolation and therefore cannot be extracted and examined on its own. Gender, as a concept and a category, is mutually constituted on the body and in abstraction with categories of race, class, sexuality, and ability. Although the daily gender performances by each person are examples of engaging with gender, drag has the explicit purpose of performance, making it a highly visible site for the production of gender and the other components of identity that inform this production. By use of ethnographic observations of a weekly drag show in Sacramento, this study analyzes the way in which identities intersect to produce a performance of femininity that is specific to drag queens. In addition, this study explores questions of power, authenticity, and community through drag performances in order to reach a deeper understanding of the construction of femininity and gender more broadly.

Application of qPCR as a Quantitative Method in Gentamicin Protection Assay

Hamza Fakhri
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Population Health & Reproduction

The Gentamicin protection assay is a widely used method in the study of infectious diseases. This assay allows for the quantification of intracellular bacteria under carefully controlled conditions to elucidate the effects of varying assay conditions on bacterial infectivity. Traditionally, intracellular bacteria are released via gentle lysis of host cells and enumerated using serial dilution and a plating technique. While this assay is capable of quantifying intracellular bacteria, it cannot account for bacteria adhered to host cells. Additionally, variability in results will undoubtedly arise from different techniques on individual basis. This study aims to minimize user variability during quantification and account for extracellular associated bacteria through use of standard curves and quantitative PCR (qPCR) in place of serial dilution and plating. qPCR is used to amplify a predetermined bacterial gene, and the number of bacteria per sample is calculated from the sample cycle time (Ct) through use of standard curve equations. Cultured intestinal epithelial cells were infected with invasive pathogens, *Salmonella enterica* sv. Typhimurium, *E.coli*, and *Listeria monocytogenes.* Thus far, our findings indicate that this method is a reliable alternative that not only provides accurate results but also significantly reduces the amount of time required to implement the assay.

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

Sahar Fakhri
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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 $^1/_2$ 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.

Normal Aging is Associated With Sensory Impairments in Non-Human Primates

Sheila Fakurnejad
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Neurobiology, Physiology & Behavior

There is an established relationship between normal aging and the decline of sensory related processing. Recent evidence suggests that rhesus macaques experience age-related changes in auditory processing similar to humans. It is unclear if these changes extend to other sensory systems. The present study was conducted to elucidate symptoms relating to the deterioration of sensory abilities of aging bonnet macaques, and to determine if these correlations are comparable to responses recorded from other non-human primates, such as rhesus monkeys. Visual and auditory evoked potentials were recorded from twelve bonnet macaques, varying from ages 10 to 32. The acuity of the visual and auditory systems of the bonnets was evaluated by way of visual evoked responses (VEPs), auditory brainstem responses (ABRs), and mid-latency responses (MLRs). In the auditory system, ABR thresholds and MLRs were weaker in older bonnets, in addition to an observed reduction in frequency sensitivity. These correlations suggest that several aspects of sensory processing are compromised with age in a variety of primates, and that the observed sensory degradation may have consequences on higher-level cognitive functions.

Seroprevalence of *Bartonella* spp. in Captive Wild Canids in Brazil

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Population Health & Reproduction

Wild canids are potential hosts for numerous species of *Bartonella*, yet little research has been done to quantify their infection rates in South America. We sought to investigate *Bartonella* seroprevalence in captive wild canids from 19 zoos in São Paulo and Mato Grosso states, Brazil. Blood samples were collected from 100 wild canids belonging to four different native species. Indirect immunofluorescent antibody testing was performed to detect the presence of *B. henselae*, *B. vinsonii* subsp. *berkhoffii*, *B. clarridgeiae*, and *B. rochalimae*. Overall, *Bartonella* antibodies were detected in 11 of the canids, including five (12.8%) of 39 crab-eating foxes, three (11.1%) of 27 bush dogs, two (8.7%) of 23 maned wolves and one (12.5%) of eight hoary foxes, with titers ranging from 1:64 to 1:512. Knowing that many species of canids make excellent reservoir hosts for *Bartonella*, and that there is zoonotic potential for all *Bartonella* species tested for, it will be important to conduct further research in non-captive wild canids to gain an accurate understanding of *Bartonella* infection in free-ranging wild canids in South America.

Role of Extra Domain A(EDA) Segment of the Extracellular Matrix on the Pathogenesis of Osteoarthritis and Other Chronic Inflammatory Diseases of Aging

Gregory K. Fong
Sponsor: John Peters, M.D.
Internal Medicine

For many years, arthritis and bone-related diseases have been a consistent health problem for older aged individuals. The Extracellular Matrix (ECM) is a complex structure surrounding cells that plays an important part in cell signaling, cell development, wound healing and many other functions. A major component of the ECM is fibronectin (FN), a protein with many different forms or isoforms. Mutations in fibronectin have been linked to human disorders, but much remains unknown about the role of fibronectin and the ECM. Our study examines the relationship between inflammatory response and EDA, a specific segment of FN. In order to assess the role of EDA, we formed two groups of mice: one that underwent experimental trauma without the EDA segment and the other that was composed of wild-type mice and acted as the control. We measured the inflammatory response at knee joints using PET and CT scans that detected the uptake of radioactive glucose, which increased with inflammatory response. Our goal was to determine if different strains of mice have different inflammatory responses and whether they have different bone structures.

Overexpression of the Crossover Regulator *Rnf212* in Mammalian Meiosis

Jared Fong
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Microbiology

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. Failure to crossover results in improper chromosome segregation and aneuploidy, causing diseases such as Down's Syndrome in zygotes. In mice, RNF212 has been shown to help stabilize crossover events in a dosage-dependent manner (Reynolds et al. 2013). Moreover, variants of *Rnf212* are implicated in differences in crossover rates between humans (Kong et al. 2008). This study seeks to elucidate the influence of RNF212 expression level using a variety of transgenic mouse lines constructed using either a Bacterial Artificial Chromosome (BAC) that contains the entire *Rnf212* gene or complementary DNA (cDNA) expressing the major RNF212 isoform. Crossing-over and progression of meiosis will be monitored in these lines using cytological approaches. The results should provide further insight into the roles of RNF212 in meiosis.

The Effects of High Pass and Polynomial Detrending Filtering on ERP Data

Eric T. Foo
Sponsor: Steven J. Luck, Ph.D.
Psychology

With the onset of oscillating voltage in a conductor, AC oscillations, sweat, and LCD display, noise and artifacts have always been an issue for Event Related Potential (ERP) studies. While in the past, scientists have utilized a .1 Hz High Pass filtering technique to remove low frequencies, the use of this parameter has only been proven through much practice, rather than supported with quantitative evidence. Additionally, the use of these filters can distort data, creating artificial peaks and oscillations. Through the use of simulated EEG data and the insertion of controlled markers, we hope to validate .1 Hz High pass filtering as the optimal parameter or support an alternative value through quantitative evidence. Additionally, with the support of quantitative data, we hope to validate the use of an alternate filtering technique, polynomial detrending. Through this filtering method, it is our goal to demonstrate the reduction in artificial peaks and oscillations, in addition to showcasing a more accurate filtering method.

Controlled Release of Drugs From Core-Shell Nanoparticles

Evan M. Forman
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Chemical Engineering

Mesoporous silica nanoparticles have shown interest in drug delivery systems due to their biocompatible and non-toxic properties. Along with their magnetic properties allowing for targeted drug delivery, iron oxide nanoparticles have the advantage of being superparamagnetic and easy to synthesize. Therefore, superparamagnetic iron oxide (Fe_3O_4) nanoparticles (SPION) were coated with MCM-41 mesoporous silica to make core shell magnetic porous nanoparticles before being loaded with methylene blue. These silica core-shell nanoparticles were encapsulated with a 1,2-dioleoyl-sn-glycero-3-phosphocholine (DOPC) lipid bilayer to represent an in vivo scenario. The release rate of methylene blue was examined by adding different concentrations of pluronic L61 and L64, triblock copolymers composed of poly(ethylene oxide)-poly(propylene oxide)-poly(ethylene oxide) (PEO-PPO-PEO). The purpose of this experiment was to observe the interactions between pluronics and the lipid bilayer. Results show a linear relation between the concentrations of the pluronic and the release of methylene blue from the core-shell nanoparticles. Further research involves the use of Neutral Red, another dye, to observe the drug electrostatic charge effects within this system. We hope that these findings will further progress the use of multifunctional nanomaterial in the medical field.

RRS Skin Carotenoids as a Biomarker for Fruit and Vegetable Intake Among Children

Emma Frandsen
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Nutrition Science

U.S. Latino children's intake of fruits and vegetables (FV) falls short of current recommendations, and little research focuses on health and dietary assessments for this population. The Niños Sanos, Familia Sana ("Healthy Children, Healthy Family") study is a multifaceted intervention aimed at reducing obesity rates and increasing FV consumption among Latino children in low-income communities. The purpose of this study was to compare the skin carotenoid levels against average FV intake as reported in both a food frequency questionnaire (FFQ) and three 24-hour dietary recalls (24HDR), and to determine how skin carotenoids compare to dietary measures of total fruit and vegetable (FV) intake among children. Participants were 63 Latino children (ages 3-8 yrs) whose skin carotenoids were measured by resonance Raman spectroscopy (using a Biophotonic Scanner). Dietary intake of FV was assessed using both a FFQ and three 24HDR given to children's' parents within a 2 month period. Preliminary results were determined by correlation analysis and do not indicate a relationship between reported FFQ FV consumption and carotenoid score in this population.

Changes in Gene Regulatory Sequences Are Responsible for the Evolution of Sex-Specific Characters

Daniel A. Friedman
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Evolution, Ecology & Biodiversity

The sex comb is a row of specialized bristles found on the first leg of male flies from the *Drosophila melanogaster* and *obscura* species groups. Previous work showed that interactions between *Sex combs reduced (Scr)*, a HOX gene, and *doublesex (dsx)*, a sexual regulator, produce the sex comb phenotype. The sex comb has experienced multiple losses, expansions, and reductions in its evolutionary history. Seeking to better understand the mechanisms of rapid morphological divergence, we analyzed the evolution of non-coding regions contributing to the developmental expression pattern of *Scr.* We identified two non-coding regions in the *D. melanogaster Scr* locus that strongly recapitulated the native Scr expression patterns when used to drive reporter transgenes. Homologous regions from other species were isolated and used to drive reporter transgenes in *D. melanogaster*, where they recapitulated native *Scr* expression of the donor species. These results indicate that changes in non-coding regions of *Scr* have given rise to novel expression patterns, which may contribute to the evolution of the sex comb. Future work will focus on establishing a causal, mechanistic basis for the relationship between *Scr* spatio-temporal expression domains, non-coding sequence changes, and the evolution of the sex comb phenotype.

Various Mathematical Models for Solving the TA-Classes Assignment Problem

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

Every quarter the Mathematics Department at the University of California, Davis must go through the process of assigning graduate students to one (or possibly two) of the mathematics courses provided at the time. This process has been carried out by first emailing all graduate students (teaching assistants) to find out what classes they would prefer to teach and then one of the department's administrators matches the graduate students to the available classes via heuristics. The method takes upwards of 8 hours to complete and generally fails to reach a solution in which both the department and the graduate students find acceptable. With the goal being viable and efficient software to both expedite the process and generate acceptable matchings, three different models are considered for this problem, one that utilizes the Hungarian Algorithm, one that uses a combination of graph theory and the Gale-Shapley algorithm, and one that utilizes an integer program implementation.

Identification of Loci Controlling Cortex Layer in *Solanum lycopersicum* and *Solanum pennellii*

Jasmine K. Garcha
Sponsor: Siobhan Brady, Ph.D.
Plant Biology

The tomato root system performs basic functions including anchorage of the plant, absorption of water, and storage of photosynthetic products. Significant diversity exists in root morphology between tomato species. This project investigates the diversity in root cortex layer patterning of the domesticated *Solanum lycopersicum* (M82) and the wild *Solanum pennellii*. The central question to address is how many genetic loci control cortex patterning. Analysis of an introgression line population from these two species show this trait is regulated by multiple interacting loci. From the F1 population of the cross between M82 and *S. pennellii*, it was determined that the dominant trait was a 3 layer cortex while the recessive trait was a 2 layer cortex. A pool of 200 F2 individuals was screened for cortex layer number. It was expected that 2 interacting loci produce a 1/16 ratio of recessive individuals. Results show that two interacting loci control cortex patterning. Bulk segregant analysis combined with next generation sequencing will be performed to map intervals along the tomato chromosome that may control cortex layer number. Future work will explore how cortex patterning may contribute to the drought resistance found in *S. pennelli* but not in M82.

Identification of Novel Molecular Mechanisms in Oligosaccharide Uptake by *Roseburia intestinalis*

Armando Garcia-Llanos
Sponsor: Alan B. Bennett, Ph.D.
Plant Biology

Evolutionary pressure has made it possible for human gut bacteria to develop mechanisms that allow for utilization of complex carbohydrates, predominantly plant cell glycans. However, there is not enough insight into the biochemical systems involved in oligosaccharide uptake. The purpose of this research is to elucidate the molecular mechanisms associated with the metabolism of complex carbohydrates by the bacteria, *Roseburia intestinalis*. The first phase of the project involves identification of specific genes that encode solute-binding proteins (SBP) and ATP-binding cassette transporters (ABC transporters) by the use of bioinformatic tools. These soluble binding proteins and ABC transporters are known to be involved in the recognition and translocation of oligosaccharides across the membrane. The identified solute-binding proteins and ATP binding cassette (ABC) transporters will be characterized both structurally and biochemically. The selected oligosaccharide transport proteins will be produced by recombination into E. coli and analyzed using Surface Plasmon Resonance (SPR) and Isothermal Titration Calorimetry Analysis (ITC). These experiments will help determine the preference, affinity, and kinetics of oligosaccharide capture by bacterial transport systems. The last portion of this project involves monitoring and quantifying relevant carbohydrate consumption by *R. intestinalis* using High-Performance Anion Exchange Chromatography with Pulsed Amperometric Detection (HPAEC-PAD).

Evidence of Abnormal Negative Prediction Error Encoding in Schizophrenia: Correlating Negative Symptomology With Cognitive Control

Jordan J. Garner
Sponsor: Cameron S. Carter, M.D.
Psychiatry & Behavioral Sciences

Schizophrenia is a debilitating mental disorder diagnosed by the presence of positive and negative symptoms. Although positive symptoms (hallucinations, delusions) attract the public's attention due to their bizarre nature, negative symptoms and cognitive deficits tend to have the most profound effects on functioning. While deficits in executive functions are well-understood in the disorder, the degree to which these deficits impact processing of rewards and relate to symptomatology is less well understood. Consequently, this study examines the relationship between negative symptoms (particularly avolition and anhedonia) and cognitive control performance during a task with reward outcomes. Twenty-five patients with schizophrenia and Twenty-five healthy controls underwent an incentivized delayed match to sample task during fMRI. Our initial behavioral data analysis based on reaction times and accuracy revealed that patients showed similar gains on rewarding versus neutral trials when compared to controls. However, after error trials and after trial where expectations of rewards were violated, patients showed a significantly different pattern of performance. Analyses of fMRI and negative symptom data are underway and will be presented. These results will potentially improve our understanding of how dynamic cognitive control adjustments relate to both reward pursuit and negatives symptoms in schizophrenia.

2D Interactive Surface

Joshua C. Garrison
Sponsor: Andre Knoesen, Ph.D.
Electrical Engineering

The 2D Interactive Surface utilizes infrared proximity sensing to obtain user input and responds with RGB light from LEDs and sounds. This device demonstrates the practicality and capability of infrared sensors and its compatibility with microprocessors. A compact 30in x 30in x 6in box will be constructed, with a light diffusing acrylic glass surface on the top to cover the internal electronics. The device will be constructed of multiple modules, which can be thought of as "pixels". Each 3in x 3in pixel will be capable of emitting RGB light in response to user input. When an object is detected near the surface, infrared light is reflected back into the receiver, converted to a frequency, and fed directly to a microcontroller. The pixel responds by displaying color light that varies in intensity relative to the distance of the object to the surface. Full intensity is reached when the object is closest the surface and gradually decreases as the object is moved away. The modular design of the pixels allows the surface to be scaled up or down for various applications.

Does Perinatal Exposure to DDTs and Development of Glucose Intolerance Promote Skeletal Muscle Deficiency?

Ciara Gaston Main
Sponsor: Michele La Merrill, Ph.D.
Environmental Toxicology

Pesticide DDT and its metabolite, DDE (together, DDTs) have been an environmental health concern for decades. Recent epidemiological data link DDT exposures with devastating diseases such as obesity, hypertension, and of components of Type 2 Diabetes. Our work surrounds perinatal exposure of DDTs and adult phenotyping. C57BL/6J mice were exposed to DDTs from embryonic day 11 to postnatal day 5, given high fat diet (HFD) at 4 months as a metabolic challenge. Three months after exposure, dams exposed to DDE during pregnancy were glucose intolerant, while their female offspring displayed elevated fasting insulin. One month after being put on HFD (5 months after exposure), we assessed muscle deficiency, by testing forelimb grip strength (GS) using Chatillon Machinery Grip Strength Machine (Largo, FL). GS was tested in 3 day sets, 15 trials/day. On days 2 and 3, overall grip strength, max-strength, and first and last third of each set were analyzed. Dams showed a difference in strength between days two and three, however F1 offspring had no significant change between treatment groups. Although, we did not find conclusive evidence that DDTs impair skeletal muscle function, further research is needed to examine potential indirect effects that DDTs may have on skeletal muscle.

Lists, Quizzes, Nostalgia, and Journalism? BuzzFeed: "The Millennial Generation's Newspaper"

Joshua S. Gelfat
Sponsor: Julie Sze, Ph.D.
American Studies

I am researching BuzzFeed's practices of fostering citizen journalism to better understand the ways in which members of Generation Y (Millennials) consume news media, and popular culture. I hope to understand the ways in which the democratization of journalism through social media is influenced by, and created through millennial culture. BuzzFeed is my object of interest as its rapid rise in popularity has created polarizing opinions on journalism and perplexing additions and commentary to popular culture. This research will help provide an understanding of the socio-cultural success of BuzzFeed, and highlight the significance and utility of social media journalism to this generation. I will be compiling this research into a written project under the American Studies Department by means of the following methods: close readings of BuzzFeed's visual history, scholarly journals and books about social media and citizen journalism, and through a survey I formulated to better understand BuzzFeed users.

Shellfish Allergy: An in Depth Analysis of the Protein Tropomyosin

Nevena G. Georgieva
Sponsor: Patrick Leung, Ph.D.
Immunology

Food related allergies are one of the most common afflictions in America. Over the last few decades these allergies have been on the rise in industrialized nations. Shellfish allergy is one of the most common food allergies and is the focus of this study; it is often triggered by the invertebrate muscle protein tropomyosin. In this study, we take advantage of previously cloned cDNA and their derivatives of lobster and crab tropomyosin to determine which sections of the protein are allergenic. Expression cDNA clones spanning the entire protein are transformed into *Escherichia coli* (*E. coli)* to produce recombinant proteins. These recombinant proteins are purified by affinity chromatography and analyzed by immunoblotting for Immunoglobulin E (IgE) reactivity with sera from patients with shellfish allergy. Sera from subjects without shellfish allergy are analyzed as controls. The results of this study show which section of the tropomyosin protein contains the antigens responsible for shellfish allergy.

Empathy as a Mediator of Associations Between Mother-Child Attachment and Moral Development in Early Childhood

Komi T. German
Sponsor: Paul D. Hastings, Ph.D.
Psychology

The present study is a mediation analysis proposing that early childhood morality is founded in attachment security, constructed from growth in cognitive and affective understanding of others, based in other-oriented concern, and exhibited through selfless behavior. Empathy provides the cognitive and affective perspective taking abilities that are necessary for children to experience other-oriented feelings of guilt in conflict situations. Furthermore, it can be predicted that altruistic behavior, which is performed to promote someone else's wellbeing even at the cost to the self, will be associated with other-oriented feelings of guilt. A child's capacity to feel and act upon other-oriented concern may rely upon having experienced and benefited from responsive care provided by an attachment figure. To examine how empathy in more securely attached children may be associated with feelings of guilt and altruistic behavior, in a longitudinal study of 60 children, attachment security was observed at 3 ½ years, empathy was measured in an interview procedure at 4 years, and both guilt about rejecting other children's bids to play and altruistic donating of earned prize tokens were assessed at 6 years. The importance of conceptualizing links between attachment, empathy, guilt, and altruism are discussed.

Sustainability of Additive Manufacturing (3D printing)

Farhad Ghadmali
Sponsor: Barbara S. Linke, Ph.D.
Mechanical Engineering

Additive manufacturing is one of the fastest growing fields of manufacturing. As stated in the Oak Ridge National Lab additive manufacturing brochure *Realizing the Promise of Next-Generation Manufacturing*, "Additive manufacturing creates components directly from a computer model, adding material only where needed, which means unlimited design flexibility decreased energy consumption, and reduced time to market". The main unanswered question regarding this technology is whether commercial adaptation of 3D Printing technology could reliably produce products free of defects with an energy consumption rate and on a scale that would be financially sustainable. Defective products produce waste capital and material and energy. My research project is focused on determining if 3D printing is a technology that could act as substitute for existing manufacturing processes. Also, I will collect information about how sustainable this technology is and how sustainable it could be. Sustainability encloses the dimensions of environmental, economic and social sustainability, but I focus my research on energy costs and material efficiency for now. In addition to the sustainability of 3D printing itself, I look at the finishing of 3D printed parts including surface characterization.

Computational Study of Counterion Effects on NMR Chemical Shifts of Strychnine

Kate A. Gibson
Sponsor: Dean J. Tantillo, Ph.D.
Chemistry

Strychnine, a known poison, has applications to both chemical forensics and the medical field. In chemical forensics, it can be difficult to separate a compound from counterions, or salts, in its molecular environment. As such, the ability to understand a sample more efficiently, without having to conduct tedious separation techniques, would be invaluable. Nuclear Magnetic Resonance (NMR) Spectroscopy is one of the most widely used analytical instruments in chemistry, and it is known that the molecular environment of a sample can effect NMR data. Although experimental data has previously been collected on this compound, chemists still have questions regarding why strychnine, and similar structures, act the way they do in the presence of salts. This study utilizes computation and applied quantum mechanics to calculate theoretical NMR data, which is compared with experimental data, to reveal how strychnine behaves in the presence of various salts. Calculations to determine the effects of chloride, nitrate, and sulfate salts are currently ongoing. By determining the interactions between strychnine and its chemical environment, this study will yield valuable information for all organic chemists regarding its binding site(s) and how it likes to react. This knowledge may then be further applied to similar compounds.

Optimization of PKD Biosensors

Lisa Gilardoni
Sponsor: Julie Bossuyt, Ph.D.
Pharmacology

Fluorescent biosensors have become an indispensable tool to visualize spatial and temporal dynamics of signaling molecules *in vivo*. For protein kinase activity, these sensors include Fluorescent Resonant Energy Transfer (FRET)-based Kinase Activity Reporters, such as AKAR for PKA, and DKAR for PKD (our kinase of interest). These sensors consist of a fluorophore FRET pair flanking a kinase-specific substrate sequence, a flexible linker, and a phosphopeptide-binding domain and have the advantage that they can be targeted to specific cellular compartments. Here we describe our strategy for creating an improved PKD sensor, given the small dynamic range of DKAR (5-10% vs. ~50% for AKAR3). To improve the DKAR FRET efficiency we varied the fluorophores, linker length, and phosphopeptide binding domain. In a second approach we created KinDI (Kinase D Intuiting), where the full-length kinase was sandwiched between a donor and acceptor fluorophore and conformational changes upon activation result in FRET alterations. To avoid interfering with the scaffolding function of the PKD C-terminus we also created KinDI versions where the acceptor fluorophore was inserted in the PKD sequence. This new generation of PKD sensors was then tested for their ability to report on spatial and temporal dynamics of PKD.

Predictors of MRSA Infections Among Adults With Purulent Infections

Megan A. Gilbert
Sponsor: Jeffrey Green, M.D.
Emergency Medicine

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a common pathogen in cutaneous infections. The objective of this study was to evaluate predictors of MRSA infections among adults with purulent infections. This prospective, single center convenience cohort study was conducted from 7/2012-12/2013 and included adults with purulent cutaneous infections requiring incision and drainage and wound culture; prisoners and non-English speakers were excluded. Demographics, comorbidities and previously defined risk factors for resistant pathogens were collected and analyzed with descriptive statistics and a multivariate logistic regression model for the end-point of MRSA positive wound culture. 80 patients (43 +/- 14.8 years) were enrolled; 31% were MRSA+. On multivariate analysis, decreasing age was associated with increased risk of MRSA (p=0.009, OR=0.945 per year). Health care facility exposure (OR=0.27, p=0.03) was associated with decreased risk of MRSA infection, while participation in organized sports (OR 0.24, p= 0.185), non-private residence (OR 1.4, p=0.68) and recent antibiotic use (OR 0.54, p=0.43) were not associated with increased MRSA risk. No MRSA+ patients were diabetic, but 24% of MRSA- patients were diabetic. Traditional predictors of resistant pathogens did not predict MRSA risk in this cohort. Further research on potential predictors of purulent MRSA infection is indicated.

Neurotheology: This Is Your Brain on God

Marianne G. Glaser
Sponsor: Naomi Janowitz, Ph.D.
Religious Studies

Religious ideas are continually constructed and reconstructed in dynamic fluctuation with contemporary sensibilities and prevailing attitudes. Religious traditions claim to have access to fundamental truths, when it may just be a generation's attempt to find truth in their sociopolitical reality. Religious views infiltrate daily life and permeate thought processes. Ancient shamanism evidences biological underpinnings for religious ideas, and following this stream of thought, the current generation has chosen the authority of science to sort authenticity from falsehood and established truth. Even though modern brain imaging technology claims to have discovered correlations between objective neurochemistry and subjective religious experience, is this ample evidence to prove or disprove anything for certain in a highly complex system of neural networks? Philosophical frameworks explore the physical and metaphysical functions of the pineal gland while scientific discourse examines the immense conceptual and methodological challenges brain localization research encounters. Neurotheology aims to re-imagine and redefine religious experience through an organic basis: the human brain.

Eavesdropping Parasites: Do Blue Orchard Bee Nest Volatiles Attract Parasites?

Sonja Glasser
Sponsor: Louie H. Yang, Ph.D.
Entomology

Over the last several decades, commercial honeybee populations (*Apis mellifera*) have sharply declined, prompting increased research interest in native pollinator species. The native blue orchard bee (*Osmia lignaria*) is a promising candidate for supplementing pollination within fruit and nut orchards in Central California. However, our knowledge of its interactions with parasites remains limited. Specifically, few studies have examined whether parasites are attracted to host nest volatiles. To investigate parasite attraction to bee nest volatiles, I will place *O. lignaria* nesting tubes in a conventionally farmed orchard in Waterford, CA as well as in a nearby ravine with a natural population of *O. lignaria* in February 2014. At both locations I will randomly apply a commercially available *O. lignaria* cocoon extract to half of the nesting tubes, while the other tubes will receive a control treatment of ethyl alcohol. In a second experiment, I will apply cocoon extract to baited sticky traps to isolate the effect of the nest volatiles. Through these experiments, I hope to better understand the potential eavesdropping nature of parasites by chemical signals from nest volatiles.

Academic Performance in College Students Based on Language Group

Yevgeniy G. Gnedash
Sponsor: Katherine W. Gibbs, Ph.D.
Psychology

Previous research has shown that bilingual children have an advantage over monolingual children in some tasks requiring executive control, such as flanker tasks and card sorting tasks, dubbed as the "bilingual advantage" by some researchers. Many students in junior colleges and universities are tested using multiple choice exams with occasional short essay questions. These tests tap into many cognitive abilities including executive control in the form of response inhibition. In this study of 158 junior college students we compared academic performance between monolingual and bilingual groups using a questionnaire to identify their language status and then comparing that to their GPA. The subject pool was obtained through the consent of four instructors in psychology, economics, sociology and human services. We found that bilingual students had statistically significant difference in academic performance. This difference in performance may be attributed to the differences in executive control between the two groups. In addition, we then looked at the 4-year college population and compared the results to the junior college level.

COOH-Terminal COLQ Mutants Causing Human Deficiency of Endplate Acetylcholinesterase Impair the Interaction of ColQ With Proteins of the Basal Lamina

Danielle A. Gochez
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Neurology

At the neuromuscular junction (NMJ) of skeletal muscle, the enzyme acetylcholinesterase (AChE) is anchored onto the basal lamina by the collagen Q (ColQ) subunit. The anchoring of AChE to the synaptic basal lamina by ColQ is crucial for terminating synaptic transmission at the mammalian NMJ. When the neurotransmitter acetylcholine (ACh) released from motor nerve terminals into the synapse cleft binds to the acetylcholine receptor (AChR) it generates a transient depolarization of the endplate, which triggers a propagated action potential in the muscle fiber. Simultaneously, AChE degrades ACh molecules to prevent re-excitation of the NMJ. Patients suffering from congenital endplate AChE deficiency have impaired ColQ, because of mutations in the ColQ gene (*COLQ*). Mutations located at the carboxy-terminal end directly affect the interaction of ColQ with the muscle-specific receptor kinase (MuSK), necessary to properly anchor AChE to the NMJ. Typically, patients with endplate AChE deficiency are unable to anchor AChE causing overexposure of ACh to AChR, endplate depolarization at physiologic rates of nerve activation, endplate myopathy, and muscle weakness. Our lab has identified and studied five novel carboxy-terminal *COLQ* mutations that reduce the interaction of ColQ to MuSK and other proteins in the basal lamina, causing varying degrees of endplate AChE deficiency.

Population Genetics of the California Gray Fox (*Urocyon cinereoargenteus*)

Natalie Goddard
Sponsor: Mark Statham, Ph.D.
Population Health & Reproduction

Although the California gray fox (*Urocyon cinereoargenteus*) is not threatened or endangered, human population growth is an increasing threat to this species due to death by cars, clearing of woodland, and habitat fragmentation. Gray foxes are important to ecosystem health because of their role as a predator and a prey species. Extirpation of gray foxes from certain areas could lead to trophic cascades and the alteration of ecosystem structure. There have been very few genetic studies on gray foxes, but it is important to know the population structure of this species in order to assess its genetic health and understand the effects of human activities. In this study I developed four multilocus microsatellite assays for gray foxes comprised of 24 loci and one sex marker. I then screened gray foxes with this assay and performed population genetic analyses. The results will determine if there is evidence of substructure and if so how this compares to subdivision in other mammal species across the state. Based on these results, this study can help to inform management decisions and aid future conservation efforts.

Radiation Hardness Testing Using Arduinos

Benjamin Godfrey
Sponsor: Michael Mulhearn, Ph.D.
Physics

Development of programmable logic devices has paved the way for the creation of cheap, powerful application specific integrated circuits (ASICs). At the Large Hadron Collider (LHC) ASICs are on the front-lines, quickly deciding if particle collision data are worth analyzing further or not. Exposed to very high levels of radiation, it is important to understand how these ASICs will respond in such difficult environments to ensure reliable, efficient functioning of critical electronic components. Traditionally, radiation testing is done by chip manufacturers at great cost to the consumer. An alternative method is proposed using Arduinos; inexpensive, powerful, microcontrollers that allow for personalized radiation testing at minimal design cost. A proof of concept design is implemented to look at single event latch ups (SELs) and single event upsets (SEUs) in radiation-hardened simple random access memory (SRAM) chips. This proof of concept design is then tested at the Crocker Nuclear Laboratory. Ultimately, this design method could be extended beyond simple SRAM chips to the testing of ASICs designed for use in the high radiation environment at the LHC.

Water and Sugared Beverages Purchasing Patterns Among Low Income Communities in the Central Valley of California

Hilary Godinez
Sponsor: Richard Green, Ph.D.
Agricultural & Resource Economics

Given the growing concerns for childhood obesity and the recent drought in California, water consumption and the intake of sugared beverages is of increasing importance to improve health. The present paper uses data from a multi-disciplinary five-year intervention study aimed at preventing childhood obesity among Mexican-origin children in the Central Valley. Continuous 6-month consumption data from receipt collection is used to analyze water, sugared beverages and drink purchases completed by low income families in the study. Socioeconomic and demographic data are also used to describe water and sugared beverages purchasing patterns followed by families that are limited by income, health concerns, and the varied quality of water prevalent in the region. As part of the intervention, families receive classes on nutrition and a voucher for food and vegetable purchase. These interventions are expected to influence the proportion of water and beverages expenditure per month as they advance in the study. Water quality and income limitations are also expected to affect drinks and water purchases.

The Power of Infant Statistical Learning and Correlated Cues on Visual Learning

Elizabeth J. Goldman
Sponsor: Katharine Graf Estes, Ph.D.
Psychology

Previous research suggests infants are statistical learners, meaning that they make use of patterns in the environment to learn. I am investigating whether infants use correlated cues, cues that occur in conjunction with one another, to learn a visual pattern. During the learning phase of the experiment, sixteen-month-olds are exposed to a continuous sequence of colored shapes superimposed with faces. Each specific shape is superimposed with a distinct face. The shapes and faces act as correlated cues, which serve as a tool for the infant to learn the pattern. During testing, infants see the shapes without the superimposed faces. By removing the superimposed faces we are taking away one of the cues infants use to recognize the pattern. On half the trials infants see sequences consistent with the shape pattern they viewed during learning. The other half of the trials contain sequences the infant has never seen before. Despite seeing only one of the two original cues will infants be able to distinguish between the familiar and the novel sequences of stimuli? Because infants pay a great deal of attention to faces, I predict taking away the face cue will make recognizing the shape pattern difficult for infants.

Identification of YpkA Interacting Proteins Using a Yeast-Two Hybrid Assay

Martin Gonzalez
Sponsor: Lorena Navarro, Ph.D.
Microbiology

Like many Gram-negative bacteria, pathogenic *Yersinia* species, encode a type III secretion system (T3SS) and a range of effectors. The T3SS is used to deliver bacterial effector proteins into the host cytosol where they can manipulate the host's signaling pathways during infection. The *Yersinia* protein kinase A (YpkA) effector protein is a multidomain protein that contains an N-terminal serine/threonine kinase domain which is responsible for the phosphorylation of ser47 on host Gαq. Through the phosphorylation of ser47, Gαq is prevented from binding GTP which effectively inhibits all pathways dependent on this signaling molecule. This mechanism of inhibition allows the pathogen to hijack the host cell and resist phagocytosis by macrophage cells. To broaden our understanding of YpkA's molecular interactions, during infection in the host cell, we are performing a yeast two-hybrid assay to identify additional YpkA-interacting proteins. Identification of YpkA-interacting proteins will elucidate possible cellular processes that are targeted by the YpkA effector protein and expand our understanding of *Yersinia* pathogenesis.

Women Markets During the Rif War

Jorge G. González
Sponsor: Susan G. Miller, Ph.D.
History

This research focuses on the socio-political importance of the markets that women regulated in the Rif Mountains of Morocco from 1921 to 1926 and their importance as a factor in the participation of women in the Rif War. The Republic of the Rif was found by an alliance of Berber tribes in Northern Morocco who sought to abolish Spanish colonialism after WWI under the leadership of a local chief, `Abd al-Karim al-Khattabi. The Berber leadership effectively mobilized every citizen of the republic including women. The segregated markets that females controlled became places where women organized through social, political, and military means to contribute to the fighting. Through a detailed revision of historiography and analysis of primary sources, I argue that female social structures that developed in the markets led to the participation of women in military operations as soldiers and spies, thus exposing the socio-political influence of women on the war effort.

Like Goes With Like, Katy Did It! Correlation Between Substrate Selection and Body Color of Neotropical Katydids (Orthoptera: Tettigoniidae)

Aaron M. Goodman
Sponsor: Peter C. Wainwright, Ph.D.
Evolution, Ecology & Biodiversity

Crypsis is the ability of an organism to avoid predation, by adapting its morphology to match the color and texture of its surroundings. Neotropical katydids (Orthoptera: Tettigoniidae) are models for the evolution of crypsis because of their leaf-mimicking capabilities. Leaf mimicry is likely to be most effective against visual predators during daytime, but it is unclear whether katydids can modulate cryptic behaviors depending on their detection risk. I studied whether roosting katydids select the same color as their body during the day, and if this pattern is different in the night. I sampled the Monteverde Cloud Forest by capturing 77 katydids of four different subfamilies (Pseudophyllinae (n=21), Phaneropterinae (n=37), Copiphorinae (n=3), Tettigoniinae (n=14)), in the night and releasing them during the day, noting their behavior and final roosting substrate. I concluded that during the day, green katydids select live green leaves, while brown katydids select dead brown foliage on the forest floor. Both colors selected the adaxial surface of live leaves during the night. My results suggest that katydids can modulate their behavior in response to their perceived risk of predation by nocturnal and diurnal predators.

Growing San Francisco: Urban Agriculture Transforms South of Market

Diana L. Grandi
Sponsor: Stephen Wheeler, Ph.D.
Landscape Architecture

This project involves the research, design, and feasibility of urban agriculture projects of varying scales throughout the South of Market neighborhood (SoMa) in San Francisco. The research involves literature reviews, case studies, and site analyses. The findings will guide the design of five different sites within the boundaries of the SoMa neighborhood. The scales of the sites range from small to large and are intended to cater to the needs, resources, time, and space of the diverse residents of the neighborhood. These scales and their corresponding sites were decided on in order to display how all community members can be urban gardeners and how underused space can be transformed into productive landscapes. The sites to be designed follow in ascending order: container garden, yard garden, rooftop garden, community garden, and urban farm. Following the design of the five sites, calculations will demonstrate how much food the design is capable of producing and will determine the percent of total food needed to sustain the SoMa neighborhood. It is hypothesized that if these types of designs were implemented throughout San Francisco, the city will be more secure in their food supply and less dependent on food importation.

Kelp Subsidies on Intertidal Filter Feeder *P. cinctipes*

Austin Greene
Sponsor: Rick Grosberg, Ph.D.
Evolution, Ecology & Biodiversity

Petrolisthes cinctipes, the flat porcelain crab, spends its life tucked under rocks filter feeding. Little is known about the feeding preferences of these small crabs, nor what resources contribute to their survival in winter months. In particular, does *P. cinctipes* benefit from nutrient pulses via the breakdown of kelp? This study aims to gather data across field sites of varying kelp density via field water sample collections, and then relate observed suspended particulate to potential impact on porcelain crabs. Selected field sites spanned 30 miles of coastline North of Bodega, Bay and included Coleman Beach, Shell Beach, Twin Coves, and Gerstle Cove. Substrates range from rocky cobble (known habitat of *P. cinctipes*), large boulders, and sandy flats. While sampling is underway, preliminary data suggest that levels of suspended algal detritus do vary across sites. Experimental results will provide clues into how intertidal foodwebs are maintained across seasons, a gap in our current understanding of shoreline ecology.

FRET Measurements of the Sodium Potassium Pump Interactions

Stav Grossfeld
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Pharmacology & Toxicology

The sodium potassium pump (NKA) establishes the electrochemical gradient that drives many cellular processes. The minimal functional unit of NKA consists of a catalytic α and regulatory β subunit with a tissue specific FXYD protein (αβFXYD). Multiple isoforms of α and β subunits exist and are differentially expressed. Several biochemical studies also suggest that NKA could exist as dimers both homo-and hetero-dimers (α1βFXYD-α1βFXYD and α1βFXYD-α2βFXYD) but whether these form in living cells remains highly controversial. It is also unclear what functional importance, if any, these oligomers have. Here we use a fluorescence resonance energy transfer (FRET)-based approach to start to address these questions. We created both CFP and YFP fusion proteins of NKA α1 and α2 isoforms, which were then expressed in HEK293 cells. We used a progressive acceptor photobleaching approach to investigate the NKA NKA interaction. We find that α1-α1, α1-α2, and α2-α2 exhibit robust FRET suggesting that both homo- and hetero-oligomers are formed in vivo. Donor fluorescence depended linearly on acceptor fluorescence indicating a 1 to 1 stoichiometry, i.e. dimers. Interestingly, ouabain, an NKA inhibitor, abolished the detected FRET. We then also used a site-directed mutagenesis approach to determine the structural determinants of the NKA-NKA interaction.

The Application of RGD Peptides in Enhancing Oral Vaccine

Qiran Gu
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Molecular & Cellular Biology

$\alpha_5\beta_1$ integrin is found predominantly at the apical surface of the Microfold cells (M-cells) in the intestinal epithelial. Because the M-cells serve as a critical mechanism in the transcytosis of pathogens across the intestinal barrier to the antigen presenting cells, the delivery system with high adhesion to M-cells is hypothesized to enhance the potency of the immune induction by the delivery of immunogen. With the Arg-Gly-Asp (RGD) motif as the primary recognition sequence for $\alpha_5\beta_1$ integrin, we aim to modify the HEV-VLP based delivery system by inserting RGD-containing short peptide to the VLP surface. Two RGD peptides have been proposed, namely RGD-1 CFTPRGDMPGPYC and RGD-2 CDCGPRGDGLGDDGCFC. The specificity of the RGD peptides is thus improved by introducing amino acids that flank the RGD, so that the peptides will target particular cell types that overexpress the target integrin receptors. The peptide sequences are inserted into the ORF2 of HEV virus by mutagenesis, and the HEV-VLPs carrying the RGD peptides are expressed via the baculovirus expression system. We expect that the obtained RGD-chimeric VLP will aid the delivery of HIV DNA vaccine in order to elicit antigen-specific immunity at mucosal surface, in a way of defense at the primary entry and reproduction sites.

A Solutal Fingering Instability During Capillary Imbibition in Porous Media

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Chemical Engineering

We report the existence of a solute driven fingering instability that occurs during capillary imbibition into cellulosic porous media. Contacting a piece of paper with an aqueous solution containing hydrophobic solutes causes the liquid to move forward into the paper. For sufficiently low solute concentrations and sufficiently high ambient humidities, the imbibition front moves forward smoothly as expected. For higher concentrations and lower humidities, however, the imbibition front develops spatially periodic oscillations that grow with time, i.e., a fingering instability occurs. Surprisingly, under these conditions the solute concentration becomes larger at the imbibition front compared to the bulk, contrary to the behavior expected based on chromatographic separation. We present a stability analysis predicated on solutal changes in the interfacial tension driven by water imbibition into a precursor film ahead of the macroscopically observable air/water interface, and we derive a critical Peclet number above which the interface is unstable.

β-Adrenergic Signaling Inhibits G_q-Dependent PKD Activation by Preventing PKD Translocation

Derrick Ha
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Pharmacology

Protein Kinase D (PKD) is a key nodal point in cardiac hypertrophic signaling, leading to pathological cardiac remodeling. Despite this important role, the regulation of PKD in cardiomyocytes remains poorly understood. To date, conflicting results have been obtained regarding the effect of β-adrenergic (β–AR) signaling on PKD. Some groups report that β–AR signaling has no effect on PKD activation, while others find PKD inhibition or even PKD activation. Here, we used a fluorescence-based approach to determine if compartmentalized PKD signaling can reconcile these disparate findings. GFP-tagged PKD and Fluorescence Resonance Energy Transfer (FRET) based biosensors (DKAR) were used to measure spatial and temporal dynamics of PKD signaling. We found that β–AR signaling triggers local nuclear PKD activity, without preceding sarcolemmal translocation. We also found that β–AR stimulation inhibits G_qR-mediated PKD activation by preventing its intracellular translocation. The latter effects were mediated by PKA-dependent phosphorylation of PKD S427. We conclude that PKD S427 fine-tunes the PKD responsiveness to G_qR-agonists, serving as a key integration point for β–AR and G_q-coupled stimuli.

Characterization of Chlamydia Type III Secretion System Effector CT621

Kevin Ha
Sponsor: Lorena Navarro, Ph.D.
Microbiology

Chlamydia are gram-negative intracellular pathogens that cause genital, ocular, and respiratory diseases in humans. Utilizing a type III secretion system, Chlamydia inject effector proteins, with many containing domains of unknown function, into their hosts. In order to characterize CT621, one such effector from *C. trachomatis*, we used a yeast two-hybrid assay to identify protein interactions, allowing us to identify affected cellular pathways. We found interactions between CT621 and proteins encoded by the genes for ADP-ribosylation factor 3 (ARF3), aquarius intron-binding spliceosome factor (AQR), spermatogenesis associated 17 (SPATA-17), bromodomain and WD repeat domain containing 1 (BRWD1), PDS5, regulator of cohesion maintenance, homolog A (*S. cerevisiae*) (PDS5A), and protein phosphatase 2, regulatory subunit B' gamma (PPP2R5C). Of these proteins, ARF3 controls vesicular and cytoskeletal activity and is a likely target of Chlamydia, which survives by creating an intracellular inclusion body. Confirmation of in-vivo interactions between CT621 and the identified proteins within HeLa cells will allow us to elucidate the role of CT621 in Chlamydial pathogenesis.

NADH Regulation of CTP Synthetase

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

The enzyme Cytidine Triphosphate Synthetase (CTPS) produces the essential nucleotide CTP and is found in most living things. The importance of CTP as a precursor to RNA, DNA, phospholipids and sugars, and its endpoint position in the pyrimidine pathway, make CTPS a critical control point in nucleotide metabolism and an attractive target for anticancer and antiviral drugs. Previous work identified several regulatory inputs, but their mechanisms are not yet fully understood. Like many enzymes, CTPS activity is modified by small molecules: for example the product CTP is a feedback inhibitor, whereas GTP can activate or inhibit depending on concentration. Here we describe the inhibition of CTPS by the redox mediator NADH, which is a cellular metabolite. Of the four molecules that CTPS requires to make CTP, NADH modulates CTPS interaction only with GTP and CTP, acting synergistically with both. These data suggest that NADH, CTP and GTP may exert their activities through similar mechanisms. This is the first evidence that CTPS may monitor the activities of other pathways beyond nucleotide metabolism.

Tracking the 2013 Guantanamo Bay Detainee Hunger Strike

Nicolai A. Haddal
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Linguistics

The Guantanamo Testimonials Project, the main project of the Center for the Study of Human Rights in the Americas, gathers testimonies about prisoner abuse at the Cuban base and organizes them in meaningful ways in order to preserve and make them widely available online. The ongoing detainee hunger strike is in response to detainees being held indefinitely without trial, as well as worsening conditions in the facility. I've compiled a report on the strike by corresponding with public relations personnel at the base and compiling a statistical database showing the numbers of hunger strikers and those force fed against their will–a violation of medical ethics. This report highlights the inconsistencies between the reports of detainees and the government, as well as the difficulty of obtaining objective information on a politicized subject. The strategies used to obtain information on the hunger strike, analyze the information in its political context, and verbally and visually present the information online are of high value for researchers in human rights. The report has been met with enthusiasm by detainee defense lawyers and advocates. Two weeks after the report's publication, statistics on the strike were no longer available to the public.

Molecular Tools for Hummingbird Conservation: Determining Sex by DNA

Kelly A. Hagadorn
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Population Health & Reproduction

Sex identification of hummingbirds is difficult to do in the field and is vital in determining the demographic structure of populations and in assessing male vs. female population genetic diversity and structure. In order to accurately sex hummingbirds, a molecular approach using the polymerase chain reaction (PCR) needs to be developed so that gender determination errors that occur during field identification can be reduced. Up to seventeen different PCR primers have been found to accurately sex various bird species were tested. Primers that determine sex in birds will generate two bands of appropriate size are for females (representing genes found on the W and Z chromosome) and one band of appropriate size for males (representing genes present on Z chromosomes). The primer sets were tested on the four main species of California hummingbirds (*Calypte anna, Archilochus alexandri, Selasphorus sasin, Selasphorus rufus*). As a first step, three males and three females from each of the four species were tested to determine the primers that work best to determine sex. Next steps will include testing of higher sample sizes to assure reliability of the DNA test.

Expression of Potassium Voltage Gated Ion Channels in Adult Born Neurons

Garrett Hall
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Psychiatry & Behavioral Sciences

The hippocampus is unique in its ability to undergo neurogenesis throughout life. Dentate gyrus granule cells (DGgc) born in the subgranular zone of the adult hippocampus are integrated into existing circuitry forming mature mossy fiber synapses onto proximal dendrites of CA3 pyramidal cells within 8 weeks. Using a novel transgenic mouse model to track newborn mossy fiber contacts we found they initially share postsynaptic targets with preexisting mossy boutons but eventually take over the entire postsynaptic structure. Competitive refinement of synaptic targeting depends on neuronal activity during developmental critical periods, but whether such mechanisms occur in adult neurogenesis is not known. Neuronal excitability is dependent on voltage gated potassium channels. In mammalian CNS, the shab subfamily (Kv2.1, Kv2.2) of delayed rectifier currents are the predominant regulators of intrinsic excitability. To investigate the role of Kv2 channels in adult neurogenesis we examined localization of Kv2.1 and Kv2.2 in genetically birth-dated newborn DGgc. We find that newborn neurons initially lack Kv2.1 expression, but by 4 weeks express mature levels of the channel. In contrast, Kv2.2 is expressed early, in immature newborn DGgc. Temporal progression of Kv2 expression in newborn neurons may have implications for successful integration into mature circuits.

Identifying Cell Death Related Transcripts in Irradiated *Arabidopsis* Tissue

Ryan A. Hamstengel
Sponsor: Anne B. Britt, Ph.D.
Plant Biology

Is death necessary? The study of eukaryotic cell death allows for the visualization of the biological process that leads to the organism's demise. Transcripts induced by irradiation mediate cell death in the stele region of *Arabidopsis*, which is composed of xylem and phloem tissue. One can determine whether the transcripts translated into proteins act as inducers for cell death by isolating these transcripts from the stele tissue. The tissue that dies after radiation, however, are the stem cells that all the stele cells differentiate from. To help isolate the tissue, the stele stem cells are tagged with a nuclear tagging fusion protein (NTF) expressed from a promoter that is only active in those cells, such as the promotors from the genes "Short Root" (SHR) and "Wooden Leg" (WOL). The creation of the pSHR::NTF and pWOL::NTF complexes and their integration into *Arabidopsis* helps determine the biochemistry of the stele cells when they induce the cessation of all their vital biological phenomena and serves as an opportunity to hypothesize why *Arabidopsis* has evolved the ability to kill off these specific cells.

Studying the Decay of B Meson to J/psi+K

Sevan K. Harootonian
Sponsor: Manuel Calderón de la Barca Sánchez, Ph.D.
Physics

We present a study, based on computer simulations of proton proton collisions, of the decays of B meson particles in the J/psi+K channel. The J/psi is a flavor-neutral meson, which is made of up a charm quark and a charm aniquark. The K meson, also known as a kaon, is a particle, which carries a strange quark or antiquark combined with up or down quark or antiquark. The B meson carries a heavy quark, called bottom quark, which can be used to study quark energy-loss in heavy-ion collisions. However, this decay has not been observed in heavy-ion collisions due to its small probability and large backgrounds, which is created from multiple proton and neutron collisions. We must indirectly detect this decay through electrons and muons, which then means we must reconstruct the event with the limited data collected. We study the kinematic variables from a simulation which can help us prepare for the eventual measurement of this particle in a heavy-ion collision.

Alehouses and the Public Sphere in Britain 1707-1830

Allegra C. Harrison
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History

The public sphere, as a marker of early modern consciousness, has been examined, discussed and reinterpreted by scores of academics. In 1962, sociologist Jurgen Habermas developed an influential theory of public sphere formation based on the example of English coffeehouses. However, a discussion of the public sphere centering only on coffeehouses ignores more traditional public spaces, such as alehouses and taverns. Public houses ("pubs"), as their name implies, were the focal gathering point for much of Britain's population. By examining only coffeehouses and not pubs, Habermasian theory and critiques ignore a large and politically significant demographic. My research explores the ways in which traditional British drinking spaces constituted a Habermasian public sphere. Though modern historiography and contemporary stereotypes create a sharp delineation between coffeehouses and alehouses, my research suggests that these different drinking spaces existed on a much more fluid social continuum. Alehouses, commonly characterized as laborers' recreational retreats, served as stages for political debate as frequently as coffeehouses, known for rational discussion, doubled as gambling and prostitution dens.

Hardware Redesign for Mobile GC/DMS Detection of Huanglongbing Disease in Citrus

Virginia K. Hartz
Sponsor: Cristina E. Davis, Ph.D.
Mechanical Engineering

The bacterial infection Huanglongbing (HLB) is responsible for the collapse of citrus industries worldwide. This incurable disease inhibits viable fruit production as symptoms manifest too late for early detection and tree removal. We can utilize mobile sensing hardware systems to monitor volatile organic compounds (VOCs) off-gassed from both control uninfected and HLB positive citrus trees. By developing a baseline chemical analysis it is possible to predict which trees have been infected in order to initiate early preventative care. In order to improve existing hardware sensor and collection systems, it is necessary to redesign the devices to reflect ease-of-use as well as to take advantage of rapidly advancing technology in the fields of chemical sensing and material strength and integrity. These changes will be implemented through the installation of upgraded components along with a fundamental redesign of the heat and air flow systems. The goal of these alterations will be to decrease the overall size of the device and increase its sensing capabilities. Ultimately, these modified devices will be more portable, perform better and be easier to use than earlier versions.

Mapping Experiential Recreation Typologies in the Delta

Katie Herman
Sponsor: Brett Milligan, M.A.
Landscape Architecture

The McCormack-Williamson Tract (MWT), situated within the larger Sacramento-San Joaquin River Delta system, is a topic of debate as complex issues such as habitat restoration, flood control protection, and a reliable water supply converge. Peak flows frequently exceed the current levee system capacity causing seasonal flooding and huge social and economic losses. Located in an area of hydrologic and ecological importance along the Mokelumne River, the MWT is of particular interest as it is one of the few restoration efforts currently in progress. A literature review and an in-depth site analysis and inventory using GIS data layers will build on the existing restoration framework and reveal pertinent site features and their impact on the surrounding area. Incorporating flood control and current restoration efforts, this analysis will inform the design of a master plan for the MWT. The planning proposal will include a list of programmatic elements and interpretive facilities that will be defined by specified criteria established during the analysis stage. These elements will be developed into a series of recreational experiential typologies that coincide with the new master plan. Together, they will become a framework for identifying opportunity areas for developing specific types of recreational programs and experiential facilities.

Queering ChicanaDyke Smiles

Sarah Maritza Hernández
Sponsor: Susy J. Zepeda, Ph.D.
Women & Gender Studies

In reading bell hooks and Gloria Anzaldúa, I started to deconstruct my ideas around *la familia* and I developed a deep curiosity in how my experience as a Queer Chicanita had failed to learn how to love and learned how to perform through domestic violence. I focus on how *smiling* Queer Chicanas can be both a false form of protection as well as a comical form of resistance to the domestic violence. This interdisciplinary creative project will be conducted through photo-ethnographic narrative writing, qualitative Feminist interviews with five Queer Chicana Survivors who have participated in the production "VAGINA:OurStories," as well as Queer zine-making and silk screen-printing. Through writing narrative, I will reflect on how *smiling* is a destructive form of survival with gendered, classed, racialized, and sexualized implications. In interviewing these artists, I hope to unmask how performance is healing through resistance. In creating political art, I will distribute these knowledges far beyond academia to reach the voices of domestic violence survivors that have suffered the silence of *smiling*. This work aspires to increase awareness of the violence-inspired Chicana *smile* as well as to deconstruct the notion that *la familia Chicano* is home.

Understanding the Influence of the Beta 2 Adrenergic Receptor on Wound Healing

Caitlin R. Hertzler
Sponsor: Roslyn R. Isseroff, M.D.
Dermatology

Wound healing is an intricate biological process where damaged tissue is repaired. One of the key components in wound healing is migration of keratinocytes, the cells that make up the epidermis (the top layer of the skin). In previous research, it has been suggested that the amount of epinephrine present in the wound affects how quickly keratinocytes migrate. Epinephrine binds to adrenergic receptors, which are found in abundance on human keratinocytes. Epinephrine, a naturally occurring hormone in the human body, is produced at higher concentrations when a person is stressed. Therefore, stress affects wound healing when stress-related epinephrine binds to B2AR receptors at different concentrations. Interestingly, preliminary data shows us that not every individual's keratinocytes react the same way when exposed to epinephrine: in some individuals, the keratinocyte migration is sped up and in others it is slowed down. We are hoping to understand whether the differences in migration speed correlate to polymorphisms (small mutations) in the B2AR gene. If the B2AR polymorphisms can be correlated to changes in cell migration speeds with epinephrine treatment, we can use this data to better understand how stress-induced epinephrine affects wound healing and devise individualized treatments to improve healing.

Venation Density and Genetics in *Populus trichocarpa*

Ramona Hihn
Sponsor: Maciej Zwieniecki, Ph.D.
Plant Sciences

Leaf vein density affects the transport of water and nutrients, as well as contributes to the physical support of leaves; however, it is uncertain if this trait is related to genetics, or if it is primarily - or perhaps solely - controlled by environmental factors. Previous literature has focused on the effect external forces have on vein density and has found that multiple environmental attributes can influence this trait, but little research has been undertaken to determine the role of genetics. To examine the relationship between genetics and venation density, a collection of 84 clones of *Populus trichocarpa* were obtained from a common garden growing at the University of California at Davis campus. The initial clones were acquired from diverse locations across the Pacific Northwest before being planted in this location. Mature leaves were collected from the top of 15 meter tall trees, and vein to vein distance was measured on cleared and safranin stained leaves. A total of 576 leaves were collected, stained, and measured. Preliminary results indicate that the distance between veins is potentially correlated to the original geographic locations of the clones, and thus that a direct relationship between vein density and genetics may exist.

Diversity in the Allele Frequency of Major Histocompatibility Complex Class 2B Genes in Leach's Storm-Petrels, *Oceanodroma leucorhoa*

Joshua C. Hincks
Sponsor: Gabrielle A. Nevitt, Ph.D.
Neurobiology, Physiology & Behavior

Leach's storm petrels (*Oceanodroma leucorhoa*) are one of the most numerous seabirds on Earth, and are considered sentinels of ocean health. They have a keen sense of smell that they use for individual recognition. I examined the genetic diversity in a population that nest on Bon Portage Island, Nova Scotia, Canada. I used the Major Histocompatability Complex (MHC) Class IIB genes as molecular markers. MHC genes are highly polymorphic, associated with immune function, and are involved in individual recognition in other species. DNA was extracted from 350 blood samples collected from chicks and adults in 2013. Two MHC loci (DAB 1 and DAB 2) were amplified using site-specific primers and Polymerase Chain Reaction (PCR), then sequenced and genotyped. I compared the genotypes and allele frequencies between age classes and sexes, and observed higher genetic diversity in chicks compared to adults at both loci. Since MHC is a proxy for local adaptation and selection, my data suggests that some genotypes either a) do not survive to adulthood or b) grow up to disperse to other islands to breed. My data also contributes to a long-term data set that will reveal how these sentinels of ocean health are reacting to climate change.

Not All Splice Variants are Created Equal: A Novel Ranking System for Gene Isoforms

Tiffany A. Ho
Sponsor: Ian F. Korf, Ph.D.
Molecular & Cellular Biology

The information encoded in DNA is crucial for advancements in fields such as medicine and agriculture. Genes are portions of DNA that encode for a certain biological function. Due to experimental errors and the different ways that parts of genes are joined (gene splicing), genes could have isoforms, which are different versions of the same genes. The gene isoforms vary in the DNA sequence that they contain, which may lead to different gene functions. This proves to be a problem to scientists who wish to use genes with isoforms for their research; they do not know which isoform is the most correct. In order to solve this problem, I am developing a ranking system that ranks the gene isoforms based on how often they are supported by experimental data. My preliminary ranking system shows that there is an obvious ranking of best to worst isoforms for some genes, while for other genes, there is no clear ranking. In order to further refine my ranking system, more work is necessary to determine the quality of the genes, identify test sets of genes, and train my ranking system to improve its accuracy.

cMyc-Xa21: Another Resource for Studying XA21-Mediated Immunity

Yuen T. Ho
Sponsor: Pamela C. Ronald, Ph.D.
Plant Pathology

Rice is a fundamental food source worldwide. As world population increases, it is important to find new ways to enhance rice yields. Because of this, the scientific community constantly researches ways to improve rice immunity to pests and diseases. Rice pathogen *Xanthamonas oryzae* pv. *oryzae* (Xoo) causes bacterial blight of rice and leads to significant yield losses in affected rice fields throughout Asia. The rice gene Xa21 confers high resistance to Xoo, however, much of the XA21 mechanism is unknown. To improve our understanding of the XA21-mediated immunity, the Ronald lab has created transgenic cMyc-Xa21 rice plants. In this project, we will first genotype the plants by polymerase chain reaction to confirm the insertion of the transgene. Then, we will determine the level of XA21 RNA and protein expression through qPCR and Western blotting. Lastly, we will inoculate the transgenic rice plants to make sure the transgene is functional. The cMyc-Xa21 transgenic rice plants will be a new resource for the lab and can be used for further experiments to improve our understanding of XA21-mediated immunity. This project will also provide undergraduates the opportunity to experience the process of scientific research.

Yeasts Naturally Associated With *Drosophila melanogaster* Exhibit Different Intestinal Survival Rates Than *Saccharomyces cerevisiae*

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

Often, "commensalism" is assigned to relationships that are not yet understood. However, microbial communities whose functions may not be entirely obvious at first glance are gaining recognition. Due to extensive knowledge of its biology, *Drosophila melanogaster* serves as a useful model for studying host-microbe interactions. Yeasts are a known component in the *D. melanogaster* microbiome, but have generally been overlooked despite suggestions of a more complex relationship. *Saccharomyces cerevisiae* is often used for convenience when studying *Drosophila*-yeast relationships. *S. cerevisiae*, however, is rarely found with *Drosophila* in nature. Therefore, assessments of *Drosophila*-yeast relationships may require using yeasts found naturally with *Drosophila*. Eleven different species of yeast that were isolated from natural *Drosophila* populations were used to define the *Drosophila*-yeast relationship. *D. melanogaster* adults were fed a species of yeast, then fly digestive tracts were removed after specific time periods and surviving yeast were quantified. Current data show that different yeast species persist for different amounts of time. To explain these differences, yeast growth rates are being determined by spectroscopy and feeding preference is being tested using choice-based assays. These differential *Drosophila*-yeast interactions suggest that yeasts are worth further investigation to understand their role in *Drosophila* physiology, ecology, and evolution.

The Seagrass Microbiome

Hannah E. Holland-Moritz
Sponsor: Jonathan Eisen, Ph.D.
Evolution, Ecology & Biodiversity

Microbial organisms can be found in nearly all environments on Earth and have been shown to play critical roles in the health of organisms and ecosystems alike. However studies of these organisms have often been limited to culture-dependent methods which inadequately capture the diversity of these important communities. The microbial communities living in and on seagrass (collectively known as a "microbiome") are one example of an understudied system. As a foundation species, seagrasses themselves play an important role in coastal marine environment health by providing a refuge habitat for small marine fauna in addition to their other contributions of primary production and water filtration. In this study we seek to characterize and compare the microbiomes of two different species of seagrass, *Zostera marina* and *Phyllospadix scouleri* using culture-independent 16s ribosomal RNA survey methods. This study will not only help us understand the variation of the seagrass microbiome within one plant, it will also provide insight into methodologies for future, broader-reaching studies of seagrass microbiomes and their effects on seagrass health.

Tracing the Origin of Laotian Cynomolgus Macaques Through Nuclear DNA Analysis

Konner J. Holzwart
Sponsor: David G. Smith, Ph.D.
Anthropology

Biomedical research relies heavily on the use of non-human primates to understand the etiology and most effective diagnosis and treatment of virulent diseases affecting humans from around the world. Cynomolgus macaques (*Macaca fascicularis fascicularis*) are one of the two most important species of non-human primate used for biomedical research. *M.f.fascicularis* can be subdivided into three genetically distinct populations, insular, mainland and Philippine *M.f.fascicularis*, each population exhibiting different levels of susceptibility to many diseases due to their genetic differences. Although there is much data for the origins of insular, Philippine, and mainland populations of *M.f.fascicularis* in Cambodia and Vietnam, the origins of cynomolgus macaques in Laos, where their home-range overlaps that of rhesus macaques (*M. mulatta*) and substantial inter-species admixture has probably occurred, remains unknown. I will genotype forty-four samples of Laotian cynomolgus macaques and conduct a principle component analysis to characterize their genetic differences from cynomolgus macaques from Cambodia and Vietnam. I hypothesize that all mainland cynomolgus macaques comprise a genetically homogeneous population. This analysis will give further understanding of the suitability of Laotian cynomolgus macaques as a mainland cynomolgus macaque model for the study of human disease.

Scent of Tea: A Study of Chinese Tea Culture Through Poetry

Anna-Tanya E. Honey
Sponsor: Michelle Yeh, Ph.D.
East Asian Studies

I analyzed the connection between tea and poetry in China. My project consists of two parts. The first explores the ways in which tea culture in traditional China gave rise to very interesting works of literature, specifically poetry from the Tang dynasty onward. The second part of my project examines the lasting impact of tea on Taiwan poetry and culture today. The aims of the project were to gain a deeper understanding about how tea's power has had such a strong influence on Chinese language, literature, and culture from ancient times to the present. Tea is connected closely with all three major religious and philosophical traditions of China: Taoism, Buddhism, and Confucianism. I will study how tea influences each of those beliefs because it made a great contribution to the development of Chinese scholastic culture. I focused on how tea has contributed to Chinese literature and how it has shaped Chinese society. Why do people drink tea? Why do tea and literature, especially poetry, go hand in hand? What aspects of tea are most often incorporated into poetry? These are some of the questions that I addressed through readings by famous Chinese authors as Bai Juyi, Lu Yu.

Group Symbols, Size, Threat and Their Affect on Group Identity

Maxwell Hong
Sponsor: Alison Ledgerwood, Ph.D.
Psychology

People regularly encounter symbols of group identity such as flags or logos, which may profoundly impact group perception. In the present research, we will use two studies to test our hypothesis that symbols increase group identity in the face of obstacles. In Study 1, participants will imagine being part of a novel group that is a minority, majority, or half of the population. Critically, half of the participants will see a symbol for their group-a flag-and half will not. We will measure group identity and perceived group inclusiveness/uniqueness. We hypothesize that symbols will increase group identification and uniqueness and reduce group inclusiveness for all group sizes, but that this pattern will be strongest for minority groups. Study 2 will use the same design with one change: In lieu of the size distinction, participants will confront intergroup threat by reading about their group's economic struggles. We predict that the threatened group will identify less with their group (relative to the non-threatened group) but that symbols may simultaneously increase identity to make up for this effect. If our predictions are confirmed, we may conclude that symbols can create a more cohesive group in light of conflict and varying group sizes.

Clinical Impact of Sample Interferences on Glucose Monitoring Systems

Megan H. Howes
Sponsor: Nam K. Tran, Ph.D.
Pathology & Laboratory Medicine

Glucose monitoring system (GMS) accuracy in hospital settings is crucial for the practice of laboratory medicine and management of critically ill patients. Burn patients are at risk for high glucose levels (hyperglycemia) due to the body's stress response. Intravenous insulin administration is used for tight glycemic control and requires highly accurate GMS measurements. However, many GMSs do not adequately adjust for interfering substances, such as drugs and hematocrit, in critically ill patients– impacting patient care. We conducted a clinical study to analyze the effect of B-hydroxybutyrate, lactose, ascorbic acid, L-glutathione, N-acetylcysteine, galactose, and hematocrit on GMSs from 3 different brands. Whole blood from healthy individuals was adjusted to 5 levels of glucose and 3 levels of each interference. GMS measurements were compared to a plasma reference. We performed two-way ANOVA and Tukey HSD tests through MATLAB. One GMS brand exhibited significantly higher glucose values ($P<0.01$) with increased levels of lactose, ascorbic acid, L-gluthione, N-acetylcysteine, and galactose. Increased hematocrit levels caused all three GMS brands to read significantly lower glucose values ($P<0.011$). The assessment of GMS accuracy in patient care settings where these interferences are most prevalent is necessary for safe and accurate insulin administration.

You Shall Not Pass: Bound States of a Quantum Particle on a Half-Infinite Lattice

Aaron Hsu
Sponsor: Bruno Nachtergaele, Ph.D.
Mathematics

The motion of a quantum particle, such as an electron, obeys the Schrödinger equation, as determined by its Hamiltonian (which corresponds to the total energy of the particle). Such a particle may either remain localized in a small region of space (a bound state) or diffuse through the entire system. In this project, we are particularly interested in a two-dimensional lattice system with a boundary, such as a lattice of points in half of the *xy*-plane; physically, this might correspond to a thin layer of atoms on a substrate or to the surface of a crystal. Recent research has revealed that a particle in such a system may either be confined to the boundary in a bound state or diffuse along the boundary. We extend this knowledge by analyzing several configurations that until now have not been studied. Using techniques of spectral analysis, linear algebra, and functional analysis, we investigate conditions differentiating the two cases and test a conjecture for a general criterion for the existence of a bound state. We anticipate that our results will find practical applications in the fields of condensed matter physics and materials science and in the design of quantum information devices.

2D Interactive Surface

Siyuan Peter Hu
Sponsor: Andre Knoesen, Ph.D.
Electrical Engineering

The 2D Interactive Surface utilizes infrared proximity sensing to obtain user input and responds with RGB light from LEDs and sounds. This device demonstrates the practicality and capability of infrared sensors and its compatibility with microprocessors. A compact 30in x 30in x 6in box will be constructed, with a light diffusing acrylic glass surface on the top to cover the internal electronics. The device will be constructed of multiple modules, which can be thought of as "pixels". Each 3in x 3in pixel will be capable of emitting RGB light in response to user input. When an object is detected near the surface, infrared light is reflected back into the receiver, converted to a frequency, and fed directly to a microcontroller. The pixel responds by displaying color light that varies in intensity relative to the distance of the object to the surface. Full intensity is reached when the object is closest the surface and gradually decreases as the object is moved away. The modular design of the pixels allows the surface to be scaled up or down for various applications.

Determining the Role of the Estrogen-Producing *Cyp19a1a* Aromatase in Zebrafish Sex Determination

Kevin Hu
Sponsor: Bruce W. Draper, Ph.D.
Molecular & Cellular Biology

Unlike mammals, zebrafish sex determination is not decided by a major chromosomal locus, and it is not known what genes are involved. Recent studies have shown that oocyte production is required for female primary sex determination, and the Draper lab has discovered that they are also required for maintenance of the adult female sexual phenotype. This suggests that oocytes produce a signal that is required for female development. While the nature of the signal is not known, we hypothesize that its main function is to increase the production of estrogen by cells of the somatic gonad. In somatic gonad cells, estrogen is produced by the cytochrome P450 aromatase, encoded by the *cyp19a1a* gene, using androgens as a precursor. However, the role of *cyp19a1a* in zebrafish female development has not been determined. We hypothesize that *cyp19a1a* is required for female sex determination. To directly test this hypothesis, we have knocked out the *cyp19a1a* gene in zebrafish using the TALEN genome editing technology. We have identified two deletion alleles that are predicted to be null. We are in the process of determining what effect loss of *cyp19a1a* has on sex determination.

Blockade of the Potassium Channel KCa3.1 as a Potential Target for the Treatment of Encephalopathy of Prematurity

Philip Huebner
Sponsor: Mirna Lechpammer, M.D.
Pathology and Laboratory Medicine

Injury to the human brain during gestation often leads to neurocognitive deficits such as hyperactivity or autism later in life. In a rat model of encephalopathy of prematurity, a distinctive form of brain injury that manifests as white matter damage, we investigated the potential of a potassium channel blocker TRAM-34 to normalize behavioral deficits. This molecular agent has been shown to block activation of immune cells, which, after an insult to the brain, initiate a complex inflammatory response that is associated with the observed pathology. First, we were able to show that behavioral deficits in our rat model are similar to those that can be found in humans. Second, we evaluated the potential therapeutic effects of TRAM-34 by comparing behavioral performance of treated to untreated animals. Preliminary results suggest that twice-daily injections of TRAM-34 leads to significant improvements in levels of anxiety, activity, sociability, but not spatial memory. We therefore conclude that blockade of the immune response following brain injury during development may lead to improved behavioral outcomes in an animal model of encephalopathy of prematurity.

Floating Wetlands in the Arboretum Waterway

Siobhan Hussey
Sponsor: Emily Schlickmann, M.A.
Landscape Architecture

Throughout the years of being a UC Davis student, the Arboretum has always been a destination and a getaway from the classes. For as beautiful as the landscape is, the water quality is an ongoing issue, and goes highly noticed. This project provides a solution to the ongoing eutrophication in the waterway. Floating wetland technologies aim to filter out the excessive amount of nutrients that reside in the water. The microbial roots uptake nutrients and the aquatic vegetation flourishes, serving as a natural filter. In addition, the design of a solar-powered water pump adjacent to the wetlands will aid in aeration, in order to circulate the water through the microbes of the floating wetland. Both the floating wetlands and aeration pump work together to improve the quality of the water. These wetlands, not only serve as natural treatment, but also provide habitat islands above and below the water table. With an artistic interpretation, this site-specific design will not only be aesthetically pleasing, but also serve an ecological, regenerative function.

Zinc Finger as Gene Therapy for Angelman Syndrome

Monica T. Hwu
Sponsor: David J. Segal, Ph.D.
Biochemistry & Molecular Medicine

Angelman Syndrome is an autism spectrum disorder involving a mutation of the maternal UBE3A gene. A potential therapy for Angelman Syndrome is to activate the silenced paternal UBE3A allele by using a Zinc Finger Artificial Transcription Factor. Initial studies involving this recombinant protein in mouse have been promising; however long-term studies indicated an immune response that dictated a termination of experiment after 7.5 weeks. We harvested brains, blood, spleen, and liver from the animals to study the long-term immune response of the protein. An indicator of an immune response, enlarged spleens were observed in all treated animals with the mock animals having spleens similar in size to controls. ELISA was conducted on the blood samples to determine the level of the immune response in the animals. This study will aid in the production of new recombinant proteins that will hopefully produce less of an immune response than our initial protein.

Investigating the Effects of Fractalkine on Experimental Autoimmune Encephalomyelitis

Diane Hwu
Sponsor: Athena M. Soulika, Ph.D.
Dermatology

Currently, no efficient treatments exist for severe forms of multiple sclerosis (MS), a debilitating neuroinflammatory disorder affecting more than 400,000 Americans. Fractalkine (CX3CL1, FKN), a constitutively-expressed chemokine that is up-regulated during inflammatory conditions, promotes the migration of T-cells and Natural Killer cells into the central nervous system (CNS) and is a regulator of microglial-mediated neurotoxicity. Fractalkine can form a ternary complex with its receptor, CX3CR1, and the integrins $\alpha v\beta 3$ and $\alpha 4\beta 1$. To examine Fractalkine's role in the disease course, we employed Experimental Autoimmune Encephalomyelitis (EAE), the mouse model of MS, to determine whether antagonism of the FKN mutant integrin-binding site, mutant receptor-binding site, or of the wild-type FKN would affect the EAE clinical course. While there was no statistically significant improvement in clinical scores of mice treated with the respective antagonists for the two mutated binding sites, mice treated with the wild-type FKN exhibited a milder clinical EAE course compared to vehicle-treated control mice. Immunohistological examination of CNS tissues isolated at peak and chronic phases of EAE showed delayed infiltration of the CNS of mice treated with the wild-type FKN. Thus, these results suggest that treatments targeting wild-type FKN may prove a viable target for MS therapy.

Determining Sexual Maturity via Testicular Seminiferous Tubule Diameter

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

Sperm production requires development including growth and division of Sertoli cells. Porcine Sertoli cells proliferate in two waves, one before birth and one before puberty. Hemicastration or Letrozole, an aromatase inhibitor, may hamper estrogen synthesis. Letrozole treatment prolongs proliferation of the first wave. Whether hemicastration prolongs this first interval and delays maturation is unknown. The interaction between reduced endogenous estrogen and hemicastration on maturity is also unclear. This project focuses on 6.5-week-old pigs across four litters. Each litter replicate tests an individual administered vehicle (canola oil), Letrozole, hemicastration with vehicle, or hemicastration with Letrozole. Testis tissue samples are stained with hematoxylin and eosin (H&E) for cell nuclei and cytoplasm, respectively. The tubule space percentage per sample represents sexual maturity (interstitial space indirectly proportional to maturity). Differences in maturity among treatments suggested by variation in tubule space are not found significant (0.05, $P<0.10$). The working maturity assessment is diameter of seminiferous tubules, with distance from the mediastinum considered a variable in tubule diameter. This data will contribute to understanding testicular development regulation and potentially the role of environmental estrogens on this development.

Nationalism Through the Ballet Folklórico de México: Marginalization and Appropriation of Indigenous Dances in México

Fabian Iglesias
Sponsor: Jessica Bissett Perea, Ph.D.
Native American Studies

I will argue that the Ballet Folklórico de México de Amalia Hernandez has served to further marginalize the Indigenous communities in México by helping cement ideas of nationalism that appropriate indigenous dances, regalia, and music, during México's Post-Revolutionary period of nationalism. *Folklórico* offers a way to explore the history of a mestizo country through the creation of dances, choreography and wardrobe, based on research of different regional characteristics. With the creation of Amalia Hernandez' Ballet Folklórico de México in 1952, there was a shift from national to foreign audiences. This was done in order to portray México as a racially homogenous country through *indigenismo* and *mestizaje*. Hernandez's dances were tailored to fit the homogenous needs of nationalism. Through her shows it becomes visible how *indigenismo* glorified an Indigenous past and enabled the appropriation of certain Indigenous dances while rendering others invisible, such as the Danza del Venado, and the portrayal of the Guelaguetza.

Shifa Community Clinic's Healthy Breast Program: Promoting Breast Health and Overcoming Barriers in South Asian and Middle Eastern Women

Nigina Jalilova
Sponsor: Darin Latimore, M.D.
Internal Medicine

According to the American Cancer Society, one in eight women in the United States will develop breast cancer and 232,670 new cases of invasive breast cancer are estimated to be diagnosed in women in 2014. Shifa Community Clinic's Healthy Breast Program, supported by the Susan G. Komen Foundation, aims to increase breast cancer awareness among underserved 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 over 300 South Asian and Middle Eastern women. Subjects disclosed socio-economic demographic status, personal knowledge about breast cancer, and attitudes regarding breast cancer screening. The average age of the respondents ranged from 40 to 50 years old. Data showed that 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 never received a mammogram, about 40% faced language barriers while communicating with health professionals, preventing them from obtaining mammograms. With these barriers identified, educational material and outreach approaches can be developed to target South Asian and Middle Eastern female communities.

Nutritional Status Assessment of Primary School Children in Punjab, India

Parul Jandir
Sponsor: Nilesh Gaikwad, Ph.D.
Environmental Toxicology

Child malnutrition in the Indian subcontinent is a pervasive problem. As a part of LAKSH Nutrition, a non-profit organization geared towards correcting such undernourishment, I conducted a cross-sectional nutritional status assessment to ascertain what nutritional deficiencies needed to be addressed urgently amongst first and second grade students attending primary school in a small village by the name of Nangal Shahidan in Punjab, India. Biochemical, anthropometric and clinical methods were employed to determine the nutritional condition of 50 children. When compared to WHO standards, height-for-age z-score values indicated that 54% of the children were stunted in growth, among which 41% were severely stunted. This suggested that 60% faced moderate chronic malnourishment and 22% faced severe chronic malnourishment. Weight-for-age z-score values exhibited that 44% experienced wasting, 45% of whom were suffering from severe wasting, implying that 20% were undergoing severe acute malnutrition. Blood hemoglobin analysis demonstrated that 98% of the children were anemic, 48% of whom were found to be moderately to severely anemic. Thus, this analysis aims to discuss relationships between multiple assessment variables to address observed nutritional inadequacies. As such, this project focuses on the occurrence of nutritional anemia and its relationship to the other variables considered in the study.

Hippocampal Atrophy in Relation to Traumatic Brain Injury

Twyla Jaymes
Sponsor: Arne Ekstrom, Ph.D.
Psychology

An estimated 5.3 million Americans are left needing long-term or lifelong assistance due to traumatic brain injuries (TBI). TBI's are known to result in impairments in memory and cognition, and considering the importance of the hippocampal circuit in memory-related functions, we hypothesize that the memory deficits of TBI patients are due to atrophy in the hippocampus and its subfields. To investigate this relationship, we will use FLSview to manually segment and extract the hippocampal volumes and compare them between the TBI and control populations. Patients 12 – 18 months post-injury and with an Extended Glasgow Outcome Scale (GOS-E) score ranging from lower moderate (5/MD-) to lower good recovery (7/GD-) were selected for this study. Patients (n=8) and controls (n=14) underwent high-resolution hippocampal imaging, whole-brain MPRAGE scans (1mm^3), and several neuropsychiatric exams. Manual segmentation of the hippocampus will be performed on the high-resolution scans of TBI patients and control participants. The amount of hippocampal atrophy will be calculated from the difference in hippocampal and hippocampal subfield volumes along with total brain volumes. The results of the volumetric analyses and the corresponding neuropsychiatric exams will be used to determine if there are any correlations between memory deficits and hippocampal subfield volumes.

Laser Harp

Ruchika Jingar
Sponsor: Andre Knoesen, Ph.D.
Electrical Engineering

Current trends show that the US is lagging behind in STEM education. Change needs to be made to remedy the situation, and research shows that the most effective way to increase interest in STEM fields is through handson engagement with science and technology. Music is a creative medium that can appeal to all audiences. This project aims to stimulate interest in students of all age groups to pursue degrees in the fields of Electrical and Computer Engineering. Our project infuses the musical qualities of a harp with laser and sensor technology. In our rendition of a laser harp, the user plays notes not by plucking a string, but rather by interrupting the path of laser beams. When the user interrupts a laser beam, the microcontroller detects this action and plays a corresponding note. Users can then play various tunes by simply placing their hand in the path of the laser beam. Additionally, a teaching mode exists in which the harp will guide a user through playing a preprogrammed song by indicating what notes should be played. The Laser Harp gives people of all ages a fun way to engage with technology and learn more about the field of engineering.

Phase Response Properties and Phase-Locking in Neural Systems With Delayed Negative Feedback

Carter L. Johnson
Sponsor: Timothy J. Lewis, Ph.D.
Mathematics

Oscillatory electrical activity is ubiquitous in the brain and other central nervous systems. For effective behavior and cognition, nervous systems must coordinate these oscillations and respond appropriately to external and internal inputs. To understand how neural systems achieve this coordination, it is important to characterize the phase shifts that occur in a neuron's periodic activity as a response to brief perturbations, which is quantified by the system's so-called phase response curve (PRC). The PRC can then be used to predict how neurons respond to general input and understand how neurons phase-lock their activity in a network. In this project, we consider an idealized model of an oscillatory neuron with delayed negative feedback – a common motif in neural systems. We use the Leaky Integrate-and-Fire model to describe the intrinsic properties of the neuron and an alpha-function synapse to capture the dynamics of the negative feedback. We show how the phase response properties of the system arise from cellular and synaptic properties and examine phase-locking in networks of these neurons.

Growth Spurt: Engaging Youth in the Design Process to Prevent Gang Violence

Emily Johnson
Sponsor: Patsy E. Owens, M.S.
Landscape Architecture

The purpose of this project is to promote public health and safety by exploring how the environmental design process can prevent gang violence, specifically by preventing youth gang membership. Questions asked: How does a child's environment affect his/her risk of join a gang or partaking in gang violence? How have environmental design projects effectively prevented gang violence? How can youth involvement in environmental design prevent youth gang membership? Goals: Understand and increase awareness of the link between youth involvement in environmental design and gang violence prevention. Understand sustainable methods of engaging youth in the community. Understand timely and effective methods of implementing youth design concepts. Hypothesis: There is a sustainable, structured approach to involving youth in environmental design which can prevent gang violence. Significance: If youth-inspired designs are implemented quickly and effectively, younger generations may view environmental design as a more accessible way of impacting the community than current generations do.

Cell Surface Ligands for Potassium Channels

Rayan N. Kaakati
Sponsor: Jon T. Sack, Ph.D.
Physiology & Membrane Biology

There is a great need for highly specific drugs that target cancer cells. Interestingly, many tumor cells over-express various voltage gated potassium (Kv) channels. Targeted inhibition of these Kv channels has been shown to decrease tumor cell proliferation. Here, we have generated a novel method for screening drugs that target Kv channels. We have generated beads covalently bonded to protein fragments of a Kv channel. This study investigates the interaction of a tarantula toxin peptide, guangxitoxin (GxTX), with protein fragments of a Kv channel. Determining the segments of the Kv channel that bind to GxTX could elucidate its binding mechanism. My experiments have shown that fluorescent GxTX peptide binds to an extracellular loop of a Kv channel voltage sensor while attached to a bead. Mutating voltage sensor residues, pre-incubation with non-fluorescent toxin or linearizing the loop prevents fluorescent GxTX binding. These experiments suggest that beads with different parts of Kv channels can be used to screen peptides that bind to cancer-linked channels.

Aqueous Derivitization of Short-Chain Fatty Acids Enables the Use of Reversed Phase LCMS for Detection and Quantification

Coral A. Kahane
Sponsor: Carlito Lebrilla, Ph.D.
Chemistry

Short-chain fatty acids (SCFA) are an important functional component in biological fluids. SCFAs are among the end products after the fermentation of carbohydrates by intestinal flora. SCFAs are used as energy sources in both the liver and the colon, they increase the uptake of sodium and water in the colon, and they modulate expression of cell-cycle regulating proteins. Current general quantitation methods rely on gas chromatography (GC), ion chromatography, and capillary electrophoresis. We have developed a method that employs reverse-phase chromatography using mass spectrometry (MS) to detect and quantitate SCFAs. Using LC allows us to monitor lactic acid, whereas the dominant GC method does not allow this. To induce compatibility with reversed phase separation while simultaneously adding a mass tag, a water soluble carbodiimide linking agent was used to conjugate phenylethylamine with SCFAs (acetic acid, formic acid, butyric acid, and lactic acid) forming a phenylethylamide. MS was used to quantify the SCFAs by comparison to isotopic standards. Repeat runs will be used to test the method, which will also be tested on a cell culture and in feces. The purpose of this study is to develop a general method for quantitating SCFAs that can be applied to biological fluids.

How Do MAPK Phosphatases Influence *Anopheles gambiae* Innate Immune Signaling?

Christine S. Kai
Sponsor: Shirley Luckhart, Ph.D.
Medical Microbiology & Immunology

Malaria is caused by infection with protozoa of the genus *Plasmodium*, transmitted by *Anopheles* mosquitoes. Despite ongoing control efforts, malaria is a major global health burden complicated by insecticide-resistant mosquitoes and drug-resistant parasites. One strategy to disrupt transmission is to genetically modify mosquitoes to increase its refractoriness to parasite infection. A major component of immunity is the mitogen-activated protein kinase (MAPK) pathway, which has been shown to regulate *Plasmodium* development in the mosquito. Studies in mammalian systems reveal that MAPK Phosphatases (MKPs) are critically important in regulating MAPKs. However, MKP functions remain unknown in mosquitoes. Based on our studies of MAPKs and MKPs on immunity, I hypothesize that MKPs regulate MAPKs and immunity to malaria parasite infection in *Anopheles* mosquitoes. To this end, I have overexpressed *A. gambiae* MKP genes *in vitro* and examined changes in MAPK activity and immune gene expression in response to various immune stimuli. Preliminary results reveal that overexpressed *MKP4* reduces c-Jun N-terminal Kinase (JNK) activity in response to human transforming growth factor-beta (TGF-beta), a blood factor previously shown to modulate parasite development in the mosquito. The findings of this study will provide insight into the mechanisms of mosquito immunity in the defense against *Plasmodium* parasites.

Parent Feeding Styles and Child BMI: A Cross-Ethnic Comparison

Patricia A. Kamlley
Sponsor: Lenna Ontai, Ph.D.
Human Development

Cross cultural differences in associations between parenting and child obesity is important, because African Americans and Latino Americans have higher rates of obesity (Ogden et al., 2010). Exploring the foundations of these differences will help inform more effective interventions for these high-risk groups. Previous studies suggest that parents affect children's weight status in ways that mirror parenting effects on other child outcomes. For instance, feeding styles, which mirror parenting styles, are correlated with child weight status (Henessey et al, 2010). Furthermore, feeding styles vary by ethnicity (Hughes et al., 2006; Ogden et al., 2010). Such differences may help to explain ethnic differences in obesity rates. I hypothesize that associations between authoritative parenting and child outcomes transcends to authoritative feeding style and child BMI. However, based on previous studies, I expect these associations to vary by ethnicity (Chao, 2001; Ho et al., 2008; Lim & Lim, 2005). The current study will use data from the UC Davis Healthy Kids Project (N=200 parent-child dyads) to replicate findings relating to feeding styles (My Child at Mealtime, Ontai et al., 2010) and child BMI (CDC height and weight norms) by ethnicity (parent-reported) and extend current research by examining ethnic differences in these associations.

Women in Politics: A Comparison Between the United States and Britain

Natasha Kang
Sponsor: James Adams, Ph.D.
Political Science

Ever since women were granted suffrage, they have made historic strides in representing their sex in politics in both the United States and Britain. However, this success is limited as seen by the under-representation of women in politics in proportion to men. It is possible that the number of elected women is related to characteristics of the parties, including party ideologies and how much effort the party makes to appeal to minorities. I intend to investigate these possible causes of the under-representation of women by examining official records on how many female MPs and Congresswomen have been elected in a 20 year period, as well as examining relevant elements of parties these elected women claim membership to, such as their ideological positions and campaign strategies. This research will help us understand the numerous hurdles female politicians confront in getting elected, and may provide an explanation as to why women are under-represented in politics.

Identifying the Function of *LEUNIG* in Tomato Leaf Development via RNA interference

Jason Kao
Sponsor: Neelima R. Sinha, Ph.D.
Plant Biology

Tomato is an excellent model species for leaf development since a number of tomato wild relatives show tremendous variation in leaf shape and their genome and trasncriptome are now available. We identified *LEUNIG (LUG)* as a candidate gene responsible for the interspecific variation in leaf shape between cultivated tomato (M82) and its wild relative *Solanum pennellii*. *LUG* is a transcription factor that functions in regulating leaf shape in *Arabidopsis thaliana*, but no study has revealed the function of *LUG* in tomato leaf development. To determine the function of *LUG*, I analyzed transgenic tomato plants containing an RNA interference construct designed to knock down the expression level of the gene in M82. I obtained 10 transgenic lines and checked for the insertion of *LUG* transgene using genotyping by PCR. To determine the gene expression level of *LUG* I extracted mRNA, synthesized cDNA and designed primers that specifically target the *LUG* transcripts, and performed quantitative PCR (qPCR). The results indicated that 2 out of 10 independent transgenic lines have lower expression of *LUG* compared with M82. Currently I am growing these 2 transgenic lines for phenotypic analysis and plan to measure the difference in leaf shape statistically.

Integrating Transcranial Direct Current Stimulation With Electroencephalography

Daniel Kapulkin
Sponsor: Steven J. Luck, Ph.D.
Psychology

Transcranial direct current stimulation (tDCS) is an emerging technique that has shown potential for rehabilitating patients with brain injuries, improving symptoms in clinical disorders such as depression, and enhancing cognition and emotion in healthy participants across a variety of tasks. However, little is known about the precise neural mechanisms that are responsible for the improvements that have been documented in the literature. Electroencephalography (EEG) and event-related potentials (ERPs) have been used for decades to uncover the neural mechanisms involved in specific experimental tasks and manipulations. Using novel methods, we are exploring the potential of combining tDCS with EEG and ERPs as a way of furthering our understanding of the neural effects of tDCS. Furthermore, we are using a new advancement in the field of tDCS known as high definition tDCS (HDtDCS), which allows for much finer control of neurostimulation effects in the brain. This technique has the potential to increase the magnitude of desired effects of neurostimulation, while simultaneously reducing the spread of stimulation to other brain regions. Preliminary results from experiments integrating tDCS and EEG will be presented, exploring the differences in electrical brain activity with HDtDCS.

Thermoelectric Properties of $YbSb_xTe_{1-x}$

Airi Kawamura
Sponsor: Susan M. Kauzlarich, Ph.D.
Chemistry

Thermoelectric materials can be used to reacquire energy from waste heat thereby increasing efficiency of devices. This is accomplished by the Seebeck effect which describes the dispersion of charge carriers across a temperature gradient, from hot to cold, which results in an electrical potential difference across the material. Thermoelectrics can utilize electrons or electron holes as charge carriers, yielding n-type or p-type thermoelectrics, respectively. In this experiment, the binary compounds YbTe and YbSb, and the alloy $YbSb_xTe_{1-x}$ will be synthesized. Powder x –ray diffraction will be performed to verify synthesis. Alloying may increase the thermoelectric figure of merit (zT,) which is dependent on thermal conductivity, electrical resistivity and the Seebeck coefficient (i.e. magnitude of the Seebeck effect.) Because Sb contributes one less electron than Te, substitution of Sb at the Te lattice site in YbTe should create a p-type thermoelectric. By controlling the amount of substitution (x,) the carrier concentration can be optimized to increase zT by tuning electrical resistivity and the Seebeck coefficient.

An Experimental Study of the PEM Fuel Cell

Ahmed S. N. Khan
Sponsor: Jae W. Park, Ph.D.
Mechanical Engineering

Polymer Electrolyte Membrane (PEM) Fuel Cells are being researched for commercial large-scale stationary power generation as well as mobile power applications and are touted as potential energy conversion devices for the future. Due to their zero source emission, high efficiency potential and low operating temperatures, PEM fuel cells are considered more effective than current internal combustion engines and could potentially serve as a replacement for these and other conventional power sources. PEM fuel cells work by reacting hydrogen and oxygen over a polymer electrolyte based membrane using platinum as a catalyst, which results in power generation and byproduct water. This study focuses on investigating the performance of PEM fuel cells, by experimentally observing the accumulation of water which is a main factor in performance degradation. In-situ neutron radiography and tomography will be used to visualize water distribution in a PEM fuel cell. This study will help to identify the behavior of liquid water in the cell, which will enable further design improvements including cell dimensions and materials, and ultimately leading to higher cell efficiency.

Laser Harp

David J. Killeen
Sponsor: Andre Knoesen, Ph.D.
Electrical Engineering

Current trends show that the US is lagging behind in STEM education. Change needs to be made to remedy the situation, and research shows that the most effective way to increase interest in STEM fields is through hands on engagement with science and technology. Music is a creative medium that can appeal to all audiences. This project aims to stimulate interest in students of all age groups to pursue degrees in the fields of Electrical and Computer Engineering. Our project infuses the musical qualities of a harp with laser and sensor technology. In our rendition of a laser harp, the user plays notes not by plucking a string, but rather by interrupting the path of laser beams. When the user interrupts a laser beam, the microcontroller detects this and plays a corresponding note. Users can then play various tunes by simply placing their hand in the path of the laser beam. Additionally, a teaching mode exists in which the harp will guide a user through playing a pre-programmed song by indicating what notes should be played. The Laser Harp gives people of all ages a fun way to engage with technology and learn more about the field of engineering.

The Influence of Lipoproteins on Human Sebocyte Lipogenesis and Inflammatory Response

Gokulesh A. Killer
Sponsor: Raja K. Sivamani, M.D.
Dermatology

Sebocytes are lipid-producing cells found in the sebaceous glands that are located in high concentrations on the face and scalp. These cells are important in the development of acne. There have been several claims that diet has an effect on acne. One feature of dietary status is lipoproteins. The three main types of lipoproteins are very low-density lipoproteins (VLDL), low-density lipoproteins (LDL), and high-density lipoproteins (HDL). It was hypothesized that VLDL and LDL would increase human sebocyte lipogenesis and release of IL-6, an inflammatory cytokine, while HDL would not. In order to measure changes in lipid content, a Nile red-based lipid assay was utilized. IL-6 levels in sebocyte culture were measured through an enzyme-linked immunosorbent assay (ELISA). Our results show LDL and VLDL increased lipid content, but HDL did not. VLDL increased expression of sterol regulatory element-binding protein 1 (SREBP-1), a lipid synthesis enzyme. LDL alone does not increase the release of IL-6, but when combined with Tumor Necrosis Factor (TNF), an inflammatory cytokine, IL-6 production was increased 23.8 fold. Given this, lipoproteins may influence lipogenesis and the inflammatory responses of sebocytes. Future work will assess the role of lipoprotein oxidation status and lipoprotein lipolysis products on sebocyte lipogenesis.

Spiritual Symbolism

Jeremy J. Kollar
Sponsor: Patsy E. Owens, M.A.
Landscape Architecture

Symbolism has always played a large role in human spirituality. The creation of these spiritual symbols was not always original to their respective faiths, however, but rather created using established and relevant forms from previous religious and occult practices. The result is that common threads can be derived from the examination of spiritual symbolism throughout history, recognizable in the art, design, and architecture of different cultures. While each cultural renaissance used reiterations of past symbols, these were often reconfigured or re-ordered with one another so that meanings and intentions were reflective of the cultural zeitgeist. An analysis of symbolism can be therefore determine the links between form and meaning of the symbols used in separate cultures, showing how certain values or beliefs are exemplified or ignored in each progressive iteration. This can be seen in one of the most recent spiritual movements of New Age spirituality, formed in the late 1960's. The New Age movement incorporates the teachings of a variety of spiritual, religious, and magical beliefs originating in Hinduism, Buddhism, Kabbalah, Christianity, and several more which can be traced back through history.

Engineering Thermostability Into PNGase F for Enhanced Efficiency of Glycoprotein Analyses

Peter Konyn
Sponsor: Justin B. Siegel, Ph.D.
Chemistry

Peptide-N(4)-(N-acetyl-beta-D-Glucosaminyl)asparagine amidase F (PNGase F) is the current industry standard for cleaving nitrogen-linked oligosaccharides from the asparagine residues on the proteins they are bound to. This enzyme is very significant in the world of analytical biochemistry because much research is being conducted to elucidate the function of carbohydrates attached to proteins in nature. However, in order for a high throughput chemical analysis of these glycoproteins to be economically feasible, a more stable version of PNGase F must first become commercially available. Computational enzyme design has proven to be effective in attaining more thermostable mutants of common proteins. Through the use of computer programs such as Rosetta and FoldIt, thermostability can be engineered into enzymes entropically by increasing hydrophobic interactions through core packing or enthalpically by increasing the number of hydrogen bonds on the surface of the protein in the form of surface salt bridges. This project aims to produce a new industry standard PNGase F enzyme using computational methods. The mutants will be tested by comparing their ability to deglycosylate RNase B after being heat shocked to that of the current industry standard PNGase F. Effective mutations will be summed together to achieve a maximum stability mutant.

Inactivation of STEC in Ground Beef Using the MSDD Non-Thermal Technology

Kaitlyn H. Krebs
Sponsor: James S. Cullor, D.V.M., Ph.D.
Population Health & Reproduction

The goal of this research was to successfully eradicate Shiga-toxin producing *Escherichia coli* in ground beef using novel non-thermal technology known as Metabolic Stress for Disinfection and Disinfestation (MSDD). MSDD uses a chamber in which physical phases of decompression and compression cycles are followed by a chemical phase, which introduces ethanol vapors, for maximum killing potential. Overnight cultures of STEC *E. coli* O157:H7 were plated onto TSA with Rifampicin plates. Plates were run through the MSDD system and treated with Nitrogen only or Nitrogen and Ethanol, with a 1-hour chemical cycle, then placed in a Bacteriological Incubator for 24 hours. In a separate experiment, plates were prepared in the same manner as the first. However, the chemical cycle was held for 3 hours and subsequent plates were incubated for 24 hours. Test plates were compared to control plates and average log reduction was calculated. Results showed complete eradication of STEC *E. coli* O157:H7 on the Ethanol treated plates. Further studies with ground beef patties will be conducted using this technology.

Visual Representation and Presentation Styles in Landscape Architecture

Omri Kruvi
Sponsor: Elizabeth Boults, M.S.
Landscape Architecture

In a sense, Landscape Architecture requires a skill set in marketing. The form in which designs are presented serve as an advertisement for a product to be chosen by a client. Landscape Architects commonly use different mediums and presentation styles to showcase their designs. In my time at the UC Davis Landscape Architecture department, presentations tended to be monotonous and repetitive due to lack of exposure to better presentation strategies. This study aims to find how alternative presentation styles can express a design more holistically and in a more engaging, immersive, and exciting fashion. I intend on presenting my findings through a design for a linear park that would replace the train tracks running between Davis and Woodland. A plan to remove the tracks is in early stages with city planners examining the economical and physical viability of the project. Presenting my new design in different styles will show the effect that visual graphics (such as hand drawings, digital renderings, animations, etc.) may have on different audiences or clients, along with the presentations' relationship to the design itself.

Analysis of the Chemical Hazards of Materials Found in Hard Drives

Kayla Kuhl
Sponsor: Julie Schoenung, Ph.D.
Materials Science & Engineering

Despite widespread use, the chemical hazards associated with electronics are often disregarded. Unlike many companies, Seagate Technologies is eager to reduce the human and environmental impact of their hard drives. To provide guidance on substances that may be of concern, I am investigating the potential hazards of twenty substances contained in Seagate hard drives (as voluntarily disclosed to BizNGO) by using the GreenScreen for Safer Chemicals® approach. I am collecting published data on the potential health and environmental effects of each substance and compiling that information into a single benchmark score. Thus far, several materials have hazards that classify them as Benchmark 1 substances, indicating they are chemicals of high concern. Comprising more than 50% of the hard drive, aluminum is of greatest interest. Initial findings indicate aluminum may be a disruptor of endocrine activity. Nickel, fibrous glass wool, and fused silica, which comprise less than 2% of the hard drive, each, are carcinogens. Manganese, which comprises < 1% of the hard drive, is presumed to cause reproductive harm. These findings provide guidance for substance selection and motivation for careful control of manufacturing conditions and end-of-life management implementation, including recycling, incineration, and landfill disposal.

Analyzing *Arabidopsis* Mutants to Confirm New Genes Involved in Quantitative Resistance to *Botrytis cinerea*

Priyanka S. Kulkarni
Sponsor: Daniel J. Kliebenstein, Ph.D.
Plant Sciences

Quantitative resistance (QR) is plant disease resistance that is mediated by multiple genes, each with a quantitative effect on resistance that can stack with other genes. QR is a critical determinant of defense against necrotrophic pathogens, such as *Botrytis cinerea*, a filamentous fungus that infects numerous crops. We have identified several genes mediating QR to Botrytis in the model plant *Arabidopsis thaliana* using genome-wide association (GWA) mapping. GWA mapping uses statistics, so there is potential for identifying genes that are false positives. To help determine the false positive rate of the genetic study, I am using five *Arabidopsis thaliana* mutants that each lack certain genes that were identified from the genomic screen due to a knock out. Currently, I am genotyping the plants to ensure that they are the appropriate knockouts for my study. Upon infecting some individual leaves from the plants with four phenotypically divergent isolates of *Botrytis cinerea*, I will confirm that each of the five different genes is involved in plant defense.

High Throughput Analysis of the USDA Core Collection for Common Bean

Saarah N. Kuzay
Sponsor: Paul Gepts, Ph.D.
Plant Sciences

To meet the rising demand for food, plant breeders are using molecular breeding 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 positions or "loci" in the genome. SNPs are the most abundant genetic marker type and are used to assess genetic relatedness among different crop varieties. For this project, I have determined approximately 6,000 SNP differences across 416 bean cultivars that constitute the USDA Core Collection of common bean. This SNP data was obtained by planting and growing each bean variety to maturity for seed and leaf tissue collection. Genomic DNA was isolated from each leaf tissue sample and sent off to a collaborating lab, which processed the DNA for SNP determination. These SNP differences will then be subjected to a high-throughput analysis to produce a population structure analysis, principal component analysis, and a neighbor joining tree of the 416 common bean varieties. This information will help assess the genetic representation of the USDA Core Collection for common bean and provide bean breeders with new information to make more informed parent crosses.

Examining the Regulation of LET-99 Localization by the PAR-1 and PKC-3 Kinases

Alice H. Kwon
Sponsor: Lesilee S. Rose, Ph.D.
Molecular & Cellular Biology

Asymmetric divisions generate two daughter cells with different fates. The *Caenorhabditis elegans* one-cell embryo undergoes an asymmetric division, where cell fate determinants become polarized along the anterior-posterior axis. The spindle aligns with this axis such that the division produces daughter cells with different determinants. The conserved PAR polarity proteins regulate cortical forces that move the spindle asymmetrically. LET-99 is an essential cortical protein localized in a posterior-lateral band, which is a negative regulator of the force-generating complex. Its localization requires the serine/threonine kinases, PAR-1 and PKC-3. In PAR-1 depleted embryos, LET-99 expands throughout the posterior cortex. In PKC-3 depleted embryos, LET-99 localizes symmetrically to the cortex. Therefore, we hypothesize that phosphorylation by PAR-1 and PKC-3 restricts LET-99 to a posterior-lateral band at the cortex. To test this, I am optimizing the expression of recombinant LET-99 proteins in bacteria to be used for *in vitro* kinase assays. Additionally, preliminary data suggests LET-99 may directly interact with lipids at the cell cortex. I am creating different segments of LET-99 for lipid-binding assays to determine which domains of LET-99 interact with lipids, and ultimately if the kinases regulate this interaction.

Understanding Seed Germination Through Differential Expression Analysis of Lettuce RNA-Seq Data

Kyle Lambert
Sponsor: Kent J. Bradford, Ph.D.
Plant Sciences

Lettuce (*Lactuca sativa*) 'Salinas' seeds will not germinate above 27°C (termed seed thermoinhibition). This causes multiple harvests in producing areas where temperatures at planting exceed the permissive temperature. Identifying genes related to thermotolerance using genetics and RNA-sequencing data could alleviate the seed thermoinhibition problem by enabling breeding for thermotolerant lettuce seeds. A thermoinhibition-associated quantitative trait locus (QTL) (*Hgt9.1*) was identified from a cross between PI251246 (thermotolerant) and Salinas (thermosensitive) genotypes. Transcripts were extracted and sequenced from seeds of three different lettuce genotypes imbibed under optimal and warm temperatures: Salinas, PI251246, and a line in a Salinas background in which the *LsNCED4* gene had been silenced using RNA interference (RNAi). We previously showed that expression of *LsNCED4* is required for thermoinhibition, so this RNAi line is thermotolerant. Using R software, genes that are differentially expressed during germination at high temperature in these three genotypes will be identified. Differential expression of genes located in the QTL genomic region could potentially identify the gene(s) responsible for this QTL, which could be potential targets for breeding thermotolerant lettuce lines. The identified genes would also help us understand the physiological mechanisms responsible for lettuce seed thermoinhibition.

A Natural Free-Fatty Acid That Binds and Activates PPAR-Delta and Induces a Greater Metabolic Adaptation to Exercise

Shanie Landen
Sponsor: Keith Baar, Ph.D.
Neurobiology, Physiology & Behavior

Training in a glycogen depleted state increases skeletal muscle fat oxidation and mitochondrial content. This metabolic adaptation is caused by an increase in the transcription of genes regulating fat uptake and mitochondrial β-oxidation. The increase in free-fatty acid (FFA) availability may initiate the molecular adaptation by binding to peroxisome proliferator-activated receptor delta (PPARδ). PPARδ is a ligand-dependent nuclear receptor that is a key component in activating genes involved in FFA utilization and oxidation. Long chain FFAs are capable of occupying PPARδ binding domains, stabilizing the protein and increasing its transcriptional activity. PPARδ transcriptional activity is sensitive to glucose availability and glycogen content, and is increased following exercise in a glycogen depleted state. Therefore, this study aims to find a natural FFA that when added to a sports drink, will effectively bind and activate PPARδ, enhancing the transcription of genes regulating β-oxidation, and ultimately inducing a greater metabolic adaptation with the same training load.

Identification of Causal Genes of Quantitative Phenotypic Variation by Exploring the Evolution of Gene Duplications in *Arabidopsis*

Lillian Lau
Sponsor: Bindu Joseph, Ph.D.
Plant Sciences

Evolution of gene duplications through genetic sub functionalization could create natural allelic variations that underlie quantitative phenotypic variation. In genotype to phenotype association analysis, this would manifest as members of gene families co-localizing with genomic regions associated with phenotypic variation. Exploring this possibility would help us identify candidate genes for multiple causal regions simultaneously. In this project, three members of the Alkaline/Neutral Invertase (A/N- INV) gene family that co-localize with genomic regions regulating quantitative metabolomic variation in *Arabidopsis* plants are studied. Invertases are enzymes involved in sugar metabolism and recent studies have uncovered the possible role of A/N- INVs in signaling pathways. Sequence analysis of the natural alleles and functional analysis of the loss-of-function alleles of these members were carried out. By measuring plant growth and looking at their metablome profiles, the role of these INV family members in the regulation of metabolome variation will be validated.

Laser Harp

Vivian M. Law
Sponsor: Andre Knoesen, Ph.D.
Electrical Engineering

Current trends show that the US is lagging behind in STEM education. Change needs to be made to remedy the situation, and research shows that the most effective way to increase interest in STEM fields is through hands-on engagement with science and technology. Music is a creative medium that can appeal to all audiences. This project aims to stimulate interest in students of all age groups to pursue degrees in the fields of Electrical and Computer Engineering. Our project infuses the musical qualities of a harp with laser and sensor technology. In our rendition of a laser harp, the user plays notes not by plucking a string, but rather by interrupting the path of laser beams. When the user interrupts a laser beam, the microcontroller detects this action and plays a corresponding note. Users can then play various tunes by simply placing their hand in the path of the laser beam. Additionally, a teaching mode exists in which the harp will guide a user through playing a preprogrammed song by indicating what notes should be played. The Laser Harp gives people of all ages a fun way to engage with technology and learn more about the field of engineering.

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 HIV infection 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 TRIM5-alpha 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.

Does a Watched Pot Boil?: The Correlation Between Visual Fixation Parameters and Time Perception

Cong-huy N. Le
Sponsor: Eve A. Isham, Ph.D.
Psychology

The attentional theory of time perception proposes that the perceived duration of an event varies with the amount of attentional resources allocated to it (Tse et al., 2004). While past studies analyzing pupil dilation have shown that an increase in pupil size correlates with an increase in attention (Hoek 1993), limited research has been conducted on the direct relationship between pupil size and the perception of time itself. The current study examined the correlation between attention-related eye movement parameters (e.g., pupil dilation and saccadic movement), and the perceived duration of a visual event (e.g, a circle). Specifically, the participants were shown a circle that appeared on the screen for a brief duration, between 1600 and 1800 milliseconds. Subsequently, the participants reported the perceived time of the circle via a manual response. An eye tracking system monitored the eye movements during stimulus observation and generated a report on the eye parameters. Based on the known relationship between attention and time perception, we predicted that these parameters would co-vary with the perceived duration of a visual stimulus.

cMyc-Xa21: Another Resource for Studying Rice Plant Immunity

Vu V. Le
Sponsor: Pamela C. Ronald, Ph.D.
Plant Pathology

More than a quarter of the world is dependent on rice, and diseases that target rice can negatively impact rice production and reduce potential yields. The bacterial pathogen *Xanthomonas oryzae* pv. *oryzae (Xoo)* is the causal agent of bacterial blight, a rice disease that causes significant loss of yields throughout Asia. Xa21 (*Xanthomonas* resistance 21), is a gene identified in the rice relative *Oryzae longistaminata* which has been found to confer strong resistance to *Xoo* when put into rice by conventional breeding and transgenic approaches. Despite its importance, much of the molecular mechanism by which XA21 confers immunity in rice is still unknown. Towards this goal, we have generated transgenic rice plants carrying cMyc-Xa21 and have confirmed the presence of the transgene through PCR. Plants that were positive for the transgene were verified for RNA and protein expression of Xa21 through qPCR and Western Blot analyses. Functionality of the transgene was confirmed by inoculating the transgenic rice plants with *Xoo* and measuring the disease progression over time. Success in this research will provide transgenic rice plants carrying tagged versions of XA21 further understanding of the mechanism that confers immunity; creating a platform for studying the XA21 protein complex *in vivo.*

Clinical Electrophysiological Studies of 3,4-Diaminopyridine and Acetylated Diaminopyridine

Diana C. Lee
Sponsor: Ricardo Maselli, M.D.
Neurology

By blocking potassium channels in the presynaptic nerve terminal, 3, 4-Diaminopyridine (3,4-DAP) alters repolarization, lengthens the depolarization time and increases the influx of calcium into the nerve terminal through voltage gated calcium channels (VGCC). Calcium, in turn, increases the release of synaptic vesicles, which contain acetylcholine, to the synaptic cleft of the neuromuscular junction (NMJ). Using *ex vivo* intracellular microelectrode techniques, we were able to verify a marked increase of the endplate potential (EPP) quantal content (QC) of mice diaphragm exposed to 1uM-10uM 3, 4-DAP. Endplates exposed to the acetylated metabolite of 3,4-DAP showed similar results to a lesser extent. The increment of the QC was less pronounced for EPPs stimulated by fast frequencies (30-50 Hz) and was absent when high concentrations of 3,4-DAP (>100 uM) were present. These conditions also increased the frequency of spontaneous miniature endplate potentials (MEPPs). Our results suggest that depletion of synaptic vesicles is an important factor that limits the efficacy of 3,4-DAP which should be carefully considered in future clinical trials designed to test 3,4-DAP in various neuromuscular disorders.

Perinatal Bisphenol A Exposure Changes Expression of Airway Secretory Products in the Developing Mouse Lung

Kelsey H. Lee
Sponsor: Laura S. Van Winkle, Ph.D.
Anatomy, Physiology & Cell Biology

Exposure to Bisphenol A (BPA), a chemical used in the production of plastic products including bottles, can coatings, food packaging and water supply pipes, is widespread yet little is known about its role in changing the growth and development of the lung. Using male and female NIH Swiss mice at 1 day, 3 weeks, and 8 weeks exposed to 10µg/mL BPA in drinking water from gestational day 14 until completion of the study, we examined the effects of BPA on different types of secretory cells, structures important to protecting the lungs from infection and injury. Abundance of mucuous cells after exposure was quantified using alcian blue/periodic acid schiffs staining and muc5b/muc2 gene expression while abundance of Clara cells was quantified using gene expression of secretaglobin 1A1 and immunohistochemistry. While staining techniques did not shown much difference in abundance of mucuous cells between control and test groups, gene expression findings so far suggest that BPA exposure does change expression of secretory products: most notably, muc5b expression in the distal, intrapulmonary airways of male and female mice was minimized two fold. This indicates that exposure to BPA during gestation alters normal murine lung development.

A Novel Alternative to Invasive Retinal Angiography

Michelle T. Lee
Sponsor: John S. Werner, Ph.D.
Neurobiology, Physiology & Behavior

Angiography techniques provide visualization of vasculature within the posterior human eye including retinal and choroidal layers. Clinical application allows ophthalmologists to identify and diagnose potentially blinding ocular conditions due to vascular leakage and neovascularization in diabetic retinopathy and age-related macular degeneration (AMD). Fluorescein angiography (FA) is currently considered the "gold standard" of retinal imaging, but is an invasive procedure requiring intravenous injection that can lead to side effects such as nausea, vomiting and, in rare cases, allergic reactions and even death. FA is also limited in that it produces two-dimensional images that cannot adequately capture the location and in depth information of vasculature. Phase-variance optical coherence tomography (pvOCT) is a novel non-invasive method producing finely detailed images of retinal and choroidal micro capillaries in three dimensions. Its potential as an alternative to FA has been an area of active investigation. I am conducting a case-study of a young female in which I compare the technique and image quality between FA and pvOCT in a portion of her retina. The results of this research will provide evidence that pvOCT is a more efficient technique for distinguishing retinal and choroidal vasculature, noninvasively, in the living human eye.

Project MERCCURI: Bacteria in Space

Ruth D. Lee
Sponsor: Jonathan A. Eisen, Ph.D.
Evolution, Ecology & Biodiversity

Some bacteria grown in microgravity have previously been shown to exhibit different morphological and metabolic capabilities than when grown on Earth. As part of Project MERCCURI's aim to increase microbiological outreach, we sampled at various high-population sporting venues and sites of historical interest nationwide for 48 strains of BSL 1 bacteria. After we grew these bacteria in culture, the 48 strains will be flown to the International Space Station to be "raced" against parallel plates on Earth. We will measure each well's absorbance at 9 different points in each well, every 15 minutes for 96 hours, to compare growth curves generated by a recently installed microplate reader in the International Space Station to those on Earth. Future studies will focus on the bacterial strains that show differences in growth rates when exposed to the microgravity environment. Ultimately, not only do we aspire to expand current knowledge of microbiology in space, but we also intend to raise awareness and ignite the interest of the general population in microbiology and in science.

Production and Analysis of High Molecular Weight Genomic DNA Using Various Extraction Methods

Vivian Lee
Sponsor: Bart C. Weimer, Ph.D.
Population Health & Reproduction

Various extraction methods such as commercial DNA lysing kit, beadbeating, enzymatic lysing, lysis buffer containing SDS and Agilent DNA extraction kit were used to isolate genomic DNA from *Listeria monocytogenes.* These standard extraction methods were modified to yield high quality molecular weight DNA that are useful for further applications such as polymerase chain reactions. The resulting genomic DNA after extraction were quantified using NanoDrop 2000, a microvolume spectrophotometer for measuring DNA which reports sample concentration, purity ratios, and graphical representations. To further assess the quality of high molecular weight DNA, *L. monocytogenes* from different extraction methods were then loaded onto the Agilent 2200 TapeStation System which enables electrophoretic analysis to show an approximate amount of genomic DNA present. The comparison of various extraction methods to *L. monocytogenes* were conducted to see which method can isolate the purest and highest molecular DNA for this gram positive bacilli, which is known to be harder to lyse due to their thick peptidoglycan layer.

Functional Characterization of Polysaccharides in Aerial Root Mucilage Produced by Mexican Landrace Maize

Adrian A. Leelin
Sponsor: Alan B. Bennett, Ph.D.
Plant Sciences

Maize produces a polysaccharide-rich gel matrix called mucilage, localized at specialized organs called aerial roots. This mucilage is hypothesized to be the medium by which mutualistic interactions occur between microbes and plants. Mucilage secreted by aerial roots from a specific landrace of maize harbors a unique composition of polysaccharides, constituted by subunits such as fucose, galactose, and mannose. The polysaccharides within the mucilage were analyzed methodically with a series of enzyme-kinetic assays. Based on preliminary data of polysaccharide composition, the mucilage was treated with two exo-glycosyl hydrolase (GH) enzymes: one β-Galactosidase (*A. niger*) that hydrolyzed 1,4 glycosidic linkages and an α-Fucosidase (*T. maritima*) that cleaved the respective 1,3 glycosidic linkages. The enzymatic activity of both enzymes was observed using an Evolution 60s UV-Visible Spectrometer in union with an SPG 1A Peltier. Thin Layer Chromatography (TLC) and High Performance Anion Exchange Chromatography with Pulse Amerometric Detection (HPAEC-PAD) were used to examine the products that formed after enzymatic hydrolysis of the mucilage. The results from this project will help to elucidate the structural composition of these polysaccharides, which will aid in understanding the effect of extracellular environment in relation to plant microbiome complexity.

GIS Analysis of the Water Balance of Lake Vanda, Antarctica

Sasha Leidman
Sponsor: Dawn Y. Sumner, Ph.D.
Geology

Lake Vanda is a perennially ice covered lake within the McMurdo Dry Valleys, an extremely dry and ice-free area of Antarctica located inland of the Ross Sea. The lake has been rapidly rising for at least 100 years and little is known about how hydrologic factors are contributing to this disequilibrium. The lake's changing volume provides a highly sensitive indicator on the effects of climate change on Polar Regions and more precise quantitative studies could give a detailed climatic history of the area. The lake level is a balance of melt-water entering the lake in the summer from the Onyx River (Antarctica's largest river) and sublimation removing ice from the lake surface. Measurements on the total change in storage of the lake was done using GIS analysis of aerial photographs, digital elevation models, and drill hole sampling data. Subsurface topography show a U-shaped morphology with recent lake level rises accounting for an 85% increase in volume since 1965. The water balance shows a highly variable hydrologic history with decadal scale fluctuations in lake volume increases corresponding to intense flood events. These results could give a valuable perspective on how climate change is affecting Antarctic hydrology.

A Graphical User Interface to Design Safe Terrain Park Jumps

Dean Levy
Sponsor: Mont Hubbard, Ph.D.
Mechanical Engineering

Skiing and snowboarding accidents are the second leading cause of spinal cord injuries in the US. Many of these occur in terrain parks. Current terrain park jump designs are based purely on designer experience with little scientific consideration. A rigorous mathematical design method for these jumps has been proposed, but this approach requires a technical background to understand and implement. The focus of the present research is to create a novel graphical user interface (GUI) that allows non-technical users to employ the technical analysis methods mentioned above without having to understand the details. The GUI (1) allows safe jump design without knowledge of complex differential equations (2) limits the number and range of design parameters to avoid unrealistic jump designs (3) includes a margin of safety to address variable conditions and (4) produces instructions to build the designed jump. The GUI is the first of its kind and will facilitate safe jump designs and thus reduce the number of skier/snowboarder injuries on terrain park jumps. Future work will include creating a similar GUI to analyze a given jump shape to determine if it is unsafe, and working with snow park personnel to build these safe terrain park jumps.

2D Interactive Surface

Alisson Li
Sponsor: Andre Knoesen, Ph.D.
Electrical Engineering

The 2D Interactive Surface utilizes infrared proximity sensing to obtain user input and responds with RGB light from LEDs and sounds. This device demonstrates the practicality and capability of infrared sensors and its compatibility with microprocessors. A compact 30in x 30in x 6in box will be constructed, with a light diffusing acrylic glass surface on the top to cover the internal electronics. The device will be constructed of multiple modules, which can be thought of as "pixels". Each 3in x 3in pixel will be capable of emitting RGB light in response to user input. When an object is detected near the surface, infrared light is reflected back into the receiver, converted to a frequency, and fed directly to a microcontroller. The pixel responds by displaying color light that varies in intensity relative to the distance of the object to the surface. Full intensity is reached when the object is closest the surface and gradually decreases as the object is moved away. The modular design of the pixels allows the surface to be scaled up or down for various applications.

ACL Injury Prevention Training and Its Effects on Landing Biomechanics in Adolescent Female Athletes

Kevin Li
Sponsor: Gretchen Casazza, Ph.D.
Neurobiology, Physiology & Behavior

The anterior cruciate ligament (ACL) is a major knee ligament that provides stability. ACL tears commonly sideline athletes up to a year or more and are more prevalent in females. To reduce the risk of injury, a 30-minute training regimen was created incorporating strengthening exercises and development of proper landing and cutting mechanics for 14-18 year old female high school basketball, soccer, and volleyball athletes. For 6-8 weeks, a conditioning protocol involving balance, coordination, agility, and lower body strength exercises, was implemented and supervised by study personnel. The Landing Error Scoring System (LESS), a clinical screening tool, was utilized to analyze ACL injury risk at the start and end of an athlete's competitive season using force plate and video data. LESS includes measures of knee, hip, and trunk flexion, force of landing, stance width, knee and joint displacement, foot positioning, and symmetry in landing. Data combining the three sports have indicated that the training program significantly improved many measurements, most importantly overall LESS scores, force of landing, knee flexion, maximal hip and trunk flexion, and stance width. These improvements in biomechanics may contribute to a reduced risk of ACL injury as no knee injuries were observed during the study.

Investigating the Role of microRNA-149 in Prostate and Bladder Cancer

Rebecca Lim
Sponsor: Maria Mudryj, Ph.D.
Medical Microbiology & Immunology

In 2008, about 258,000 men worldwide died from prostate cancer, and about 150,000 people died from bladder cancer. Although there have been improvements in prostate and bladder cancer treatments, death rates due to these diseases have remained constant, so novel treatments are needed to help prolong survival. Recent evidence has shown that microRNAs play a role in the progression of cancers, and microRNA-149 (miR-149) has been found to play a role in cell growth, migration, and invasion in cancers of the lung and nasopharynx. miR-149 is also one of the ten microRNAs found to be downregulated in prostate cancer tissue. However, not much is known about the function of miR-149 in prostate and bladder cancer. Data shows that miR-149 expression in bladder cancer is downregulated, and proliferation and colony formation assays show that overexpression of miR-149 in both prostate and bladder cancer cell lines reduces cell viability. Data from western blots identifying N and E Cadherin demonstrate a reversal of the epithelial-to-mesenchymal transition (EMT) in prostate cancer. Based on these data, I hypothesize that miR-149 is a tumor suppressor in prostate and bladder cancers and can be used as a potential therapeutic target.

The Psychological Effects of Racial Microaggressions on Asian Americans

Jonathan Lindh
Sponsor: Nolan Zane, Ph.D.
Psychology

This study focused on the psychological response to racial microaggressions on participants at a research university. Racial microaggressions are subtle verbal, behavioral, or environmental forms of racism that are detrimental to the self-esteem, well-being, and standard of living in many marginalized groups (Sue, 2004). In a lab setting, racial microaggressions were experimentally manipulated in a sample of Asian American undergraduate students (N=43). The study hypothesized that participants would show signs of emotional stress, or an altered mood state as a result of the microaggressions. Participants were randomly placed into either a microaggressions condition, where a verbal microaggression was used, or in a control condition where no microaggression was used. A Positive and Negative Affect Scale (Watson, Clark & Tellegen, 1988) was used during pre and post induction to determine changes in participants' emotional state. Analyses revealed that overall positive affect was significantly lower for those in the microaggression compared to no microaggression condition, $F(1,42)=5.59$, $p=.02$. Since this study utilized a self-reported measure, future studies should utilize various techniques to evaluate an individuals' stress level pertaining to racial micr. Specifically, assessing changes in participants' physiological state may support the notion that racial microaggressions are detrimental toward the health of marginalized individuals.

Determining the Roles of the Components of Schwann Cell Differentiation Medium

Christopher J. Little
Sponsor: David E. Sahar, M.D.
Surgery

Introduction: Adipose-derived stem cell (ASC) differentiation to Schwann Cells (SC) may improve nerve regeneration, but components of ASC-SC differentiation medium are not well-studied. Here, we analyzed the role of individual medium components. Methods: Cells were divided into 6 groups. In group I, complete SC differentiation medium was added to flasks. In group VI, cells were supplemented with normal cell growth medium. In other groups, one component was removed from differentiation medium: GGF in group II, forskolin in group III, bFGF in group IV, and PGDF in group V. The expression levels of the genes S100, integrinβ4, and nerve growth factor receptor (NGFR) were detected with qRT-PCR and confirmed with immunofluorescence (IF). Results: Groups III and IV had the highest expression levels of integrinβ4, and NGFR. Group I showed a 3.2 fold increase in the expression of S100, but expression of integrinβ4 and NGFR was significantly lower compared to groups III and IV. Group II, lacking GGF showed insignificant levels of SC gene expression. IF confirmed qRT-PCR results. Conclusions: Results confirmed GGF is vital for SC differentiation, while bFGF played no significant role in a murine model. Induction of ASCs into SCs can be modified to require fewer growth factors.

Extending Osteochondral Allograft Viability Through Delayed Primary Response Gene Transcription

Nina Liu
Sponsor: Dominik Haudenschild, Ph.D.
Orthopaedic Surgery

Osteochondral allograft transplantations are effective in patients exhibiting cartilage damage or disease. However, osteochondral explants can only be stored for 14 days before chondrocyte viability decreases, which can be associated with increased enzymatic cartilage matrix degradation and loss of mechanical properties. We hypothesize that this is due to the transcription of primary response genes, a category of genes that includes many cytokines and matrix-degrading enzymes. To extend explant viability and increase the window of opportunity for transplantation, we aim to reduce primary response gene transcription by 1) lowering storage temperature, and 2) including flavopiridol to inhibit cyclin-dependent kinase 9 (CDK9), a key regulator of primary response gene transcription. We will store bovine osteochondral allografts in media at 4°C and 37°C, with and without flavopiridol. Every two weeks, we will evaluate cell viability and proteoglycan degradation using a live dead stain and glycosaminoglycans (GAG) assay, respectively. The GAG assay measures the level of proteoglycan release, which results from matrix degradation in response to primary response gene transcription. Mechanical properties will also be analyzed using compression testing to determine tissue stiffness. The results of this study will allow us to establish more effective storage methods for extending osteochondral allograft viability.

Role of NK-1 Receptor-Expressing Spinal Neurons in Chronic Itch With OVA-Sensitized Mice

Emily Lo
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Neurobiology, Physiology & Behavior

Chronic itch involves the sensitization of itch signaling, characterized by increased spontaneous itch, hyperknesis (increased sensitivity to pruritogen), and alloknesis (touch-evoked itch). Neurokinin-1 receptor (NK-1R) expressing spinal neurons are involved in acute itch transmission, but their role in chronic itch has not been tested. We presently developed a mouse model for chronic itch in atopic dermatitis-like condition (AD) with ovalbumin (OVA) by chronic epicutaneous exposure and intraperitoneal injection of OVA. We investigated the role of NK-1R-expressing spinal neurons in these OVA-sensitized mice. Spontaneous itch was measured by counting the hindlimb scratching bouts directed to the OVA-treated site. Alloknesis was measured by scoring scratching behavior that was evoked by an innocuous mechanical stimulus (von Frey filament), while hyperknesis was measured by counting the number of hindlimb scratching bouts directed to the site of intradermal microinjection of different pruritogens (i.e., histamine, chloroquine). To ablate the NK-1R-expressing spinal neurons, OVA-sensitized mice received an intrathecal injection of Substance P- Saporin (SP-SAP). The results show that SP-SAP does significantly reduce spontaneous scratching behavior, alloknesis and hyperknesis in OVA-sensitized mice. This indicates that the NK-1R-expressing spinal neurons do play a key role in sensitization of itch-signaling pathway under the AD condition.

Expression Studies for Mutations in Regulatory Regions of Human *COLQ*

Stephanie P. Logia
Sponsor: Ricardo Maselli, M.D., Ph.D.
Neurology

Six patients with congenital endplate acetylcholinesterase deficiency had promoter regions in the ColQ gene sequenced and analyzed for deleterious mutations in transcription factor binding sites (TFBS) and splicing factors using several genetics and genomics software and online tools. In one patient, a heterozygous single nucleotide mutation (SNP) was found in the ColQ1 promoter (chr3:15540407 C>G) that had not been previously documented in population databases. TFBS analysis showed that this mutation creates a potential CDP-CR3 binding site, a domain of the Cux1 homeodomain protein (core match = 99.8%, matrix match = 90.2%). CDP proteins generally act as transcriptional repressors that involve recruitment of histone deacetylase activity. Expressions of ColQ isoforms differ during myogenic differentiation, where ColQ1 expression is greater than ColQ1a; therefore, altering levels of each ColQ isoform during development may lead to impaired muscular function. Transfection and culturing of Human Embryonic Kidney (HEK), which naturally expresses the Cux1 protein, will allow us to observe whether this mutation causes a change in mRNA production for the ColQ1a isoform. Differences in levels of expression may help promote further studies in regulatory region mutations that can affect expression of proteins comparable to mutations in coding regions.

Analyzing the Immunoprotective Role of the Capsule of *Cryptococcus neoformans* Using a Single-Cell Bioengineering Method

Corey A. Long
Sponsor: Volkmar Heinrich, Ph.D.
Biomedical Engineering

Neutrophils, the most common type of white blood cell, are the principal defenders against harmful microorganisms. Neutrophils eliminate their targets through the immunological mechanisms of chemotaxis and phagocytosis. However, the fungus *Cryptococcus neoformans* is able to evade recognition by neutrophils due to its protective polysaccharide capsule. The experiments here use a dual-micropipette assay to study the single-cell interactions between individual human neutrophils and *Cryptococcus.* The immune reactions are studied between wild type *Cryptococcus* and the CAP 59 and CAP 64 mutants. The CAP 59 mutant forms an acapsular phenotype and is readily targeted and phagocytosed by neutrophils. Research literature states that the CAP 64 mutant also lacks a protective capsule, but the samples in these experiments displayed very little chemotaxis and no total phagocytosis. These results and additional imaging experiments suggest that a capsule exists on the CAP 64 mutant. Furthermore, fluorescence microscopy experiments reaffirmed that a capsule exists based upon several similarities to the capsular wild type specimens. These results provide more insight on neutrophil interactions, infections by *Cryptococcus*, and immunity responses. This bioengineering approach provides an exclusive visualization of the biological mechanisms that are constantly occurring in humans.

Investigating the Role of the AKH Family of E3 Ubiquitin Ligases in *Arabidopsis thaliana* Stress Responses

Zoie C. Lopez
Sponsor: Judy Callis, Ph.D.
Molecular & Cellular Biology

Ubiquitin is a highly conserved protein in eukaryotes that attaches to substrate proteins, altering the substrate's stability, activity or localization. Attachment of one or more ubiquitin molecules to a substrate protein involves three catalytic steps. The third step is catalyzed by E3 ubiquitin ligases, a diverse class of enzymes that confer substrate specificity. In plants, a subset of E3 ligases has been implicated in cellular responses to biotic and abiotic stress. Previous studies in the model plant *Arabidopsis* thaliana have shown that the RING-type E3 ligase named AKHERON 3 (AKH3), for the Greek river of the underworld, participates in the response to drought, high salinity and amino acid homeostasis. Because AKH3 is a member of a closely related E3 ligase subfamily delineated AKH1 through AKH5, we are investigating the role of all five proteins in plant stress responses. To do so, we are generating *Arabidopsis thaliana* lines with AKH genes whose expression is severely reduced, creating a complete library of single through quintuple loss of function mutants. We are subjecting the loss-of-function lines to drought, nitrogen starvation, high salinity, and excess exogenous amino acids to gain insight as to how each protein participates in specific stress responses.

The Gut Microbiome and Vitamin B12

Fian Louie
Sponsor: Carolyn Slupsky, Ph.D.
Nutrition Science

The composition of the gut microbiome may have an important role in bioavailability of vitamin B12, a nutrient critical for preventing anemia and maintaining brain and nervous system function. Vitamin B12 must be bound to gastric intrinsic factor for intestinal absorption and possibly for the prevention of metabolic breakdown by intestinal microbiota. Breakdown by microbiota can result in partial degradation in which portions of the B12 structure are not absorbed and are excreted, potentially affecting bioavailability due to malabsorption. The degree of vitamin B12 breakdown is highly variable among individuals, which may be due to variations in the composition of the gut microbiota. To measure the extent of vitamin B12 metabolism based on the microbiome's ability to metabolize B12, we analyzed adult human urine and serum via Nuclear Magnetic Resonance spectroscopy to identify the presence and concentrations of metabolites in the samples. We expect to observe quantitative and qualitative differences in urine and serum metabolites to demonstrate that the highly variable composition of intestinal microbiota affects the extent of vitamin B12 metabolism. The degree of vitamin B12 breakdown may be an important determinant in vitamin bioavailability, susceptibility to deficiency, and overall nutritional health status.

Voter Suppression: Effectiveness of Section 5

Jordan L. Lowery
Sponsor: Daniel Y. Kono, Ph.D.
Political Science

Section 5 of the Voting Rights Act of 1965 had initially been implemented to protect African Americans and later language minorities from obstructions to their voting rights by requiring specific states and locales receive preclearance by the United States Department of Justice and United States District Court for the District of Columbia for any alterations in voting procedure. Recently, the fate of Section 5 of the Voting Rights Act of 1965 was decided in a Supreme Court case, *Shelby County v. Holder*, and is now considered dead legislation. However, what remains unclear is whether the procedures toward voting and registration that Section 5 specifically targets and protects – identification requirements, fully covered states, and early in-person voting – have any real effect upon minority voter turnout. In other words, has Section 5 been effective, and importantly have the procedures that Section 5 protects been effective? We can determine this by examining registration and voter turnout across four presidential elections: 2000-2012. In addition, we can analyze variation in the procedures different among the states to determine effect upon voter turnout of minorities by comparing percentages to nonminority turnout levels in the same state for the 2012 Presidential Election, respectively.

Directed Mutagenesis of Active Site Residues in Mannitol 2-Dehydrogenase to Investigate Structure-Function Relationships in Substrate Specificity

James E. Lucas
Sponsor: Justin B. Siegel, Ph.D.
Biochemistry & Molecular Biology

Alcohol dehydrogenases (ADHs) are an important class of enzymes commonly used in industry for the synthesis of chiral compounds. ADHs utilize NAD+ to catalyze the reversible oxidation of alcohols into ketones/aldehydes. I have investigated the substrate specificity of mannitol 2-dehydrogenase (MDH) derived from *Pseudomonas fluorescens* in an effort to better understand the structure-function relationships within this class of enzyme. Unlike other ADHs, MDH is of particular interest because of its ability to oxidize alcohols without a metal cofactor. The native activity of MDH is the oxidation of D-mannitol, a six-carbon alcohol sugar, into D-fructose. Preliminary experiments have shown that MDH exhibits unexpected substrate specificity towards sugar alcohols shorter than five carbons in length. Several residues in the active site of MDH which may play a role in substrate specificity have been identified and mutated in an effort to observe changes in activity on sugar alcohols of different chain lengths. Alanine point mutants have revealed the importance of specific residues towards substrate binding and may be used in engineering MDH to oxidize sugar alcohols of varying chain lengths.

Understanding the Microbial and Yeast Diversity in Olive Fermentations

Yelizaveta O. Luchkovska
Sponsor: Maria L. Marco, Ph.D.
Food Science &Technology

Production of fermented Sicilian-style table olives is currently a growing industry in California. Because the fermentation of those olives depends on the microorganisms naturally present on the fruits, the presence of undesirable spoilage microbes can lead to product defects. Currently, there is little knowledge on the diversity of yeast and bacteria responsible for the fermentations. We have collected and sampled olives from three commercial olive processors located in Northern CA. Over the course of 9 months, we sampled olives harvested early, mid, and late in the season. We also performed a pilot olive fermentation study, inoculating 14 buckets of fresh olives in brine with various species of yeast or bacteria that were previously found to either hinder or enhance the fermentation process. By applying high-throughput DNA sequencing methods targeting conserved genes in bacteria and yeast, I am analyzing the development of yeast and bacterial communities over the span of nine months for both pilot and commercial olive fermentations. This study will provide the fundamental knowledge on the succession of microbial populations in spontaneous food fermentations that will be useful for improving the efficiency and consistency of olive fermentation and deterring spoilage.

Measure Elastic Moduli and Intrinsic Twist of Simulated Fibrils

Shengqiao Luo
Sponsor: Daniel Cox, Ph.D.
Physics

Amyloids for Nanoparticle Synthesis, Wiring, Energy & Remediation (ANSWER) is a project which aims to use protein amyloid fibrils (largely from Beta Solenoid Proteins [BSPs]). We can use the structural regularity of amyloid proteins to our advantage for nanoparticle templating and synthesis and make possible application like photocatalyzed water splitting for fuel production. My work is part of the project for simulations that contribute to designing BSPs for amyloid stability, minimizing twist, and lateral assembly. I measure elastic moduli which measure tendency to be deformed elastically by twisting and bending when a force is applied to the substance and intrinsic twist of simulated fibrils. More specifically, I measure the twist and twist modulus persistence length in our simulations. By defining a local triad of vectors for each layer and measuring their layer-to-layer change, we can generate distributions of twist angles – the mean is the intrinsic twist per unit length ω_o. By understanding the twisting property of the simulated fibrils, we can work to control or suppress it for applications.

Foveal and Peripheral Differences in Time Perception

Aimee C. Lynch
Sponsor: Eve A. Isham, Ph.D.
Psychology

Recent studies have found evidence supporting the link between physical attributes and time perception. Given these findings, a Theory of Magnitude (Walsh, 2003) proposes that visual spatial information may influence temporal representation such that perceived time varies with different retinal locations. To further examine the spatial-temporal relationship, we asked the participants to judge the duration of a visual stimulus (e.g., a circle) that appeared either at the center of the screen, (i.e., foveal vision) or at a location in the periphery. To ensure the participants' fixation was at the fovea, eye movements were monitored by an eye tracking system. We observed that the perceived duration was shorter when the stimulus appeared on the fovea, and became systematically longer as the stimulus deviated further away from the fovea. These novel findings illustrate that temporal resolution varies with spatial resolution, providing supportive evidence for visual-spatial components as a basis for time perception.

The Relation Between Attending Therapy With a Non-Offending Caregiver and the Accuracy of Child Sexual Abuse Memory

Alexandra Lyon
Sponsor: Gail Goodman, Ph.D.
Psychology

In 2012 alone, nearly 63,000 cases of child sexual abuse were reported in the United States (Administration for Children and Families, 2013). A subset of these victims will attend therapy, either individually or with a non-offending caregiver. While a non-offending caregiver's support following abuse disclosure is associated with increased accuracy of child sexual abuse memories, little is known about how a victim and non-offending caregiver attending therapy together affects memory accuracy. The data analyzed here (n = 103) were collected during a longitudinal study of child sexual abuse victims who participated in a study of memory and legal involvement. Analyses will be performed to determine if the victim's memory accuracy relates to whether the victim attended therapy with a non-offending caregiver, attended therapy alone, or did not attend therapy. The timing, duration, and reason for attending therapy will also be examined. Implications for the legal system and court appointed therapy will be discussed.

The Decline in Neural Signal Transmission During Hypoglycemic Hypoxia Begins With a Decline in Synaptic Function

Jacob E. Mack
Sponsor: Barbara A. Horwitz, Ph.D.
Neurobiology, Physiology & Behavior

Exposure of mammalian hippocampal slices to oxygen glucose deprivation (OGD, a model for stroke) results in loss of neural signaling. We previously examined this loss and the degree to which it recovers in hamsters and in rats. The goal of this study was to determine which portion of the neural circuit was most sensitive to OGD. Thus, I tested the hypothesis that the presynapatic portion of the hippocampal neural circuit (CA3 axons and their terminal endings) was more sensitive to OGD than the postsynaptic portion (the CA1 neuron). To examine the presynaptic component of the circuit, I measured the evoked response amplitude (ERA) following orthodromic stimulation, i.e., stimulation of the presynaptic Schaffer collateral nerve bundle (CA3 axons) that innervated CA1 neurons. To examine the postsynaptic component of the circuit, I measured the ERA following antidromic stimulation by electrically stimulating axons of the CA1 neurons. Preliminary data showed that the ERA for orthodromic stimulation decreased before the ERA for antidromic stimulation decreased, supporting my hypothesis that the presynaptic ability to release neurotransmitter is more sensitive to OGD than is the "receptive" neuron in the circuit.

Double Tangents and Winding Number of Closed Curves in the Affine Plane Without Inflection Points

Emily S. Macway
Sponsor: Abigail Thompson, Ph.D.
Mathematics

For a closed, oriented, differentiable curve in the affine plane with a finite number of crossings, a double tangent is a tangent line which has exactly two points of tangency on the curve. Double tangents can be *exterior* or *interior* depending on whether the convex arcs of the curve in the neighborhood of the points of tangency are on the *same* or *opposite* sides of the tangent line, respectively. Fabricius-Bjerre proved in 1962 that $t - s = d + (1/2)i$ for such closed curves in the affine plane, where t is the number of exterior double tangents, s is the number of interior double tangents, d is the number of double points (crossings) and i is the number of inflection points of the curve. We present a conjectural technique for counting the number of interior double tangents for a subset of closed curves in the affine plane with no inflection points. Since the number of inflection points, i, is 0, we can use this count together with a count of the number of crossings to determine the number of exterior double tangents of these curves by applying Fabricius-Bjerre's formula.

Laser Harp

Nicolas Madrid
Sponsor: Andre Knoesen, Ph.D.
Electrical Engineering

Current trends show that the US is lagging behind in STEM education. Change needs to be made to remedy the situation, and research shows that the most effective way to increase interest in STEM fields is through hands-on engagement with science and technology. Music is a creative medium that can appeal to all audiences. This project aims to stimulate interest in students of all age groups to pursue degrees in the fields of Electrical and Computer Engineering. Our project infuses the musical qualities of a harp with laser and sensor technology. In our rendition of a laser harp, the user plays notes not by plucking a string, but rather by interrupting the path of laser beams. When the user interrupts a laser beam, the microcontroller detects this action and plays a corresponding note. Users can then play various tunes by simply placing their hand in the path of the laser beam. Additionally, a teaching mode exists in which the harp will guide a user through playing a pre-programmed song by indicating what notes should be played. The Laser Harp gives people of all ages a fun way to engage with technology and learn more about the field of engineering.

Designing Strategies to Monitor Small RNA Movement Between the Seed Coat and Embryo in *Arabidopsis*

Megan D. Maerz
Sponsor: John J. Harada, Ph.D.
Plant Biology

Plants have developed mechanisms to suppress transposable elements (TEs), mobile DNA elements that can disrupt plant genomes. One mechanism involves small RNA-induced DNA methylation. Small RNAs are non-coding RNAs usually 21-24 nucleotides in length that regulate gene and TE expression. In *Arabidopsis*, it has been shown that small RNAs are activated in the central cell (endosperm precursor), and migrate into the egg cell (embryo precursor) to silence TEs in the egg cell. This non-autonomous regulation is believed to maintain genome integrity in the embryo by sacrificing the genome of terminal tissues like the endosperm. In soybean seeds, we have observed high methylation in the embryo and low methylation in the seed coat (a terminal tissue), suggesting that a similar mechanism may occur between the embryo and the seed coat. In order to elucidate the movement of small RNAs in *Arabidopsis*, I will use artificial small RNA expressed in the seed coat to silence a reporter gene expressed in the embryo. Considering the importance of seeds in food, medicine, and industry, deepening our understanding of seed development and regulation is critical.

The State of Phylogenetic Data Sharing

Andrew Magee
Sponsor: Brian Moore, Ph.D.
Evolution, Ecology & Biodiversity

Phylogenies–estimates of the genealogical relationships among species–provide an explicit historical perspective that critically informs research in a vast and growing number of scientific disciplines. Estimating phylogenies from molecular sequence data is a technically demanding and computationally intensive endeavor. Accordingly, it is important that phylogenetic data are readily available to the broader scientific community in order to fully capitalize on the time and expertise invested in estimated trees. Despite initiatives to promote data permanence and data sharing–including measures from funding agencies, journal and publisher policies–it remains difficult to access phylogenetic data–sequence alignments and tree files–from published analyses. To gauge the state of phylogenetic data permanence/sharing, we surveyed 277 studies from the primary phylogenetic literature published since 2000. Only 9.3% of these studies successfully made their alignments and tree files publicly available. We solicited data by email from authors of the remaining studies to determine overall response rate, and to assess correlations between the response rate and several other variables: publication year, journal impact factor, and solicitor status (undergraduate, graduate student, and professor).

Isothermal Titration Calorimetry and X-Ray Crystallography to Understand the Binding of Camphor to P450cam

Mavish Mahomed
Sponsor: David Goodin, Ph.D.
Chemistry

The cytochrome P450 superfamily of enzymes is responsible for about 75% of metabolic reactions, including drug metabolism and toxin deactivation in many organisms. Understanding how these enzymes bind to their substrate and convert it to product is of great importance to the pharmaceutical industry for the development of new drugs. Isothermal Titration Calorimetry, a method used to measure the thermodynamics of binding, can be utilized to investigate the binding of substrate to enzyme. P450cam is a protein found in bacteria, and serves as a model enzyme system for all P450's. Understanding how P450cam binds to its substrate, camphor, can provide valuable insight to how other clinically useful P450's specifically bind to their respective substrates. To obtain a complete picture of binding, x-ray crystallography is also used to obtain a crystal structure of the protein-substrate complex. Both of these methods, when combined, can produce a clear picture as to how favorable protein-substrate interactions are, a structure of how the substrate orients itself when it is bound to the protein, and any conformational changes the protein undergoes when substrate binds. Using this information, pharmaceutical companies can understand more about how drugs interact with their respective enzymes that metabolize them.

Asian and Asian American Women in Academia: Institutional Oppression and Its Effects on Health

Jing Mai
Sponsor: Caroline Kieu Linh Valverde, Ph.D.
Asian American Studies

Injustice does more than inspire negative feelings - it can inflict real mental and bodily harm. While seen as liberal havens of meritocracy, institutions in higher education are not necessarily dedicated racial and gender equality. The actions and words associated with institutional discrimination is difficult to retaliate against, because it exists in subtle ways. It becomes very difficult to pin down exactly what had caused the resulting feelings of injustice and hopelessness. Unable to report these phantom-like attacks, Asian American women quietly endure this constant barrage, leading to prolonged stress which, we believe, results in higher rates of health problems. This study looks at the intersections of race, gender, class, and sexual orientation of Asian and Asian American women and how these interact with both discriminatory policies and informal racism, classism, sexism, and homophobia within higher-level institutions to determine whether or not Asian and Asian American women in higher education develop higher rates of disease attributed to the chronic stress from these intersectional attacks.

Preventing the "Transfer Shock": Qualitative Analysis of an Intensive Internship Program for STEM Transfer Students

Jagdish K. Majju
Sponsor: Ana Corbacho, Ph.D.
iAMSTEM Hub

Studies have found a lower rate of community college students achieving bachelor's degrees as compared to students who attend four-year institutions (Bowman, 2012; The Century Foundation, 2013; Martinez, 2012). Hill (1965) hypothesized that this difference is due to a variety of adverse circumstances faced by transfer students, which he termed "transfer shock". This study examined the impact of a two-week intensive program designed for underrepresented cohorts of STEM transfer students (n = 106) from Northern California community colleges in the years 2008-2012. After the program was completed, qualitative analysis and inductive coding were used to find common motifs in students' personal statements. Preliminary analysis indicates that participants felt the program allowed them to build a supportive community, lasting friendships, and work as a cohesive team. Frantz, DeHaan, Demetrikopoulos, and Carruth (2006) have shown that a similar undergraduate research program designed as a collaborative learning model can lead to equivalent or better results in attitudes and confidence towards science than the traditional research apprenticeship model. Further qualitative coding will examine many remaining motifs such as: self-awareness and diversity to examine other potential benefits for this type of program.

Structural Characterization of a Novel Clade C HIV Env Immunogen Illustrates Conformational Changes Upon CD4m Binding

Shawyon Malek-Salehi
Sponsor: R. Holland Cheng, Ph.D.
Molecular & Cellular Biology

The human immunodeficiency virus (HIV) envelope protein (Env) is the only HIV viral protein that presents neutralizing epitopes relevant to vaccine development. Upon binding to host cell receptor CD4 and chemokine co-receptors CXCR4 and CCR5, Env undergoes conformational changes driving membrane fusion and viral entry. A recent focus of vaccine development is designing a soluble Env-based trimeric immunogen that elicits potent and broad antibody responses. gp145 is a novel trimeric clade C immunogen from a Tanzanian cohort with a mutated cleavage site between gp120 and gp41. Using cryo-electron microscopy, structure determination of gp145 in its unliganded and liganded states reveals conformational rearrangements that occur upon CD4 binding. The liganded conformation was derived via binding of gp145 to synthetic CD4-mimetic mini-protein CD4m. gp145 in its liganded state shows each gp120 monomer to rotate along its monomer axis and tilt away from the three-fold axis, likely juxtaposing gp41 to the host cell membrane. In addition, density map analysis illustrates an outward shift of each gp120 monomer away from the three-fold axis, highlighting a diminished gp120-gp41 interface. Conclusions from our studies offer insight in structure-based immunogen design by characterizing the structural antigenic profile of a cleavage-defective trimeric construct.

Histaminergic Modulation of Syrian Hamster Neuronal Activity Persists at Low Temperature and Stimulation Levels

Kevin J. Malins
Sponsor: John M. Horowitz, Ph.D.
Neurobiology, Physiology & Behavior

Syrian hamsters hibernate in short bouts of 3.5-5 days, with body temperatures reduced to ~2°C higher than that of their environment. Previous work showed that histamine (HA) infused into hippocampi lengthened hibernation bouts by ~50%. However, it is unknown if HA directly modulates CA1 pyramidal neurons (a principal cell type in the hippocampus) at low levels of synaptic stimulation comparable to those of animals in hibernation. Thus, I tested the hypotheses that HA modulation of Syrian hamster CA1 pyramidal neurons increased evoked response amplitude (ERA) to threshold level voltages, and that this modulation persisted at temperatures below 37°C. Schaffer collateral stimulation elicited a range of ERAs, beginning below the excitation threshold and approaching the maximum response ("max") at 30°C (n=14) and 20°C (n=17). Addition of 10μM HA to the perfusate increased near-threshold stimulation ERAs. That is, taking the max response before HA as 100%, near-threshold ERAs increased from 2.7% to 12.9% at 30°C ($P<0.01$) and from 2.5% to 20.7% at 20°C ($P<0.001$). These HA-mediated increases in ERAs were attenuated as stimulation intensity approached max. These results support my hypotheses and are consistent with the proposal that HA directly modulates a low-level signal from CA1 pyramidal neurons, resulting in prolonged torpor.

Evolution of Phytochrome Interacting Factors: Statistical Inference of Diversifying Selection

Phil Mann
Sponsor: Julin N. Maloof, Ph.D.
Plant Biology

Phytochrome interacting factors (PIFs) are integral to the process of controlling how a plant adapts to its environment by modulating the expression of genes that control plant growth and development. Additionally, PIFs are important due to their role in integrating signals from both phytochromes and cryptochromes (both light receptors) as well as plant hormones. Traditionally, it has not been trivial to build a good phylogenetic tree of these proteins because they are a member of the basic Helix Loop Helix (bHLH) super family. bHLHs are poorly conserved outside of the bHLH domains (of which PIFs reside) and phylogeny construction has been problematic thus far. We seek to build a phylogeny of PIFs through a combination of statistical and computational methods such as profile hidden markov models and codon substitution models. After a phylogeny is complete, if evidence is found for certain evolutionary patterns within this lineage, further experimentation can occur to test the importance of certain amino acid sites and changes in the function of PIF proteins.

Shifa Community Clinic's Healthy Breast Program: Promoting Breast Health and Overcoming Barriers in South Asian and Middle Eastern Women

Mehreen S. Maqsud
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Internal Medicine

According to the American Cancer Society, one in eight women in the United States will develop breast cancer and 232,670 new cases of invasive breast cancer are estimated to be diagnosed in women in 2014. Shifa Community Clinic's Healthy Breast Program, supported by the Susan G. Komen Foundation, aims to increase breast cancer awareness among under-served 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 over 300 South Asian and Middle Eastern women. Subjects disclosed socio-economic demographic status, personal knowledge about breast cancer, and attitudes regarding breast cancer screening. The average age of the respondents ranged from 40 to 50 years old. Data showed that 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 never received a mammogram, about 40% faced language barriers while communicating with health professionals, preventing them from obtaining mammograms. With these barriers identified, educational material and outreach approaches can be developed to target South Asian and Middle Eastern female communities.

Low Zinc Availability's Effects on Astrocyte Formation in the Rat Brain Cortex

Regina C. Marino
Sponsor: Patricia Oteiza, Ph.D.
Nutrition Science

With a growing number of children being diagnosed with behavioral conditions such as autism, understanding the potential causes of neurodevelopmental disorders is vital. One factor that may lead to the onset of neurodevelopmental disorders is a diet deficient in zinc. Zinc deficiency slows down the activation of the STAT3 signaling pathway, altering the formation of astrocytes, a type of brain cell that helps to stabilize the brain's internal conditions. STAT3 is a protein that plays a key role in differentiating cells in the cortex into astrocytes. Many researchers have reported that abnormal astrocytes in the brain are involved in behavioral changes and neurodevelopmental disorders. In this study, we are investigating how low zinc availability alters the number of astrocytes present in the rat brain cortex. Using Western blot analysis, we are measuring the amount of astrocyte markers (S100β and GFAP) present in rat cortical cells at embryonic day 19 (E19). With this study, we can gain a better understanding of how nutrient deficiencies affect early developmental processes and the formation of neurodevelopmental disorders.

Genetic Analysis and Physiological Response of Farnesol in *Candida albicans*

Alexandro Marquez
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Biological Sciences

Farnesol is a natural alcohol produced in the mevalonate pathway, important for the synthesis of sterols. Farnesol is a secondary metabolite, and a potential biofuel alternative to ethanol. Currently, the only known organism that can synthesize and tolerate high concentrations of farnesol is *Candida albicans*, a human pathogenic fungus. In order to develop farnesol as an alternative biofuel source, a more complete understanding of the factors that enhance or deplete farnesol synthesis must be reached. *C. albicans* has two lipid phosphatases, encoded by the genes *DPP2* and *DPP3*, either of which code for enzymes that convert farnesol pyrophosphate to farnesol. Farnesol synthesis is regulated, but the underlying mechanism is currently unknown. We examined *C. albicans* strains differing in their ability to synthesize farnesol in order to determine if farnesol production is regulated at the level of *DPP2* and *DPP3* transcription. Furthermore, farnesol synthesis is regulated in response to environmental conditions, but all the environmental factors have not yet been identified. We developed a new embedded bioassay, which would enable for high throughput screening of the environmental factors that influence farnesol synthesis. This new understanding of farnesol synthesis will help engineer other organisms for the large-scale production of farnesol.

Clearing the Smoke: The Cognitive, Neuroanatomical, and Functional Impact of Cannabis Use in Schizophrenia

Alex Mawla
Sponsor: Cameron S. Carter, M.D.
Psychiatry & Behavioral Sciences

Schizophrenia is a mental disorder characterized by impaired cognition, affective flattening, and prominent positive symptoms (i.e., delusions and hallucinations). Impaired performances on cognitive control tasks (i.e., tasks that require maintaining goals to guide behavior), as well as thinning of the frontal cortex, have been strongly implicated in schizophrenia. Moreover, cannabis use is very common in the disorder and while use has been linked to the onset of psychotic symptoms, it remains unclear what influence cannabis has on brain structure and function in these patients. To better understand this relationship, this study compared 24 schizophrenia-spectrum patients with no drug history to 35 patients with mild-to-moderate cannabis history. The AX Continuous Performance Task (AX-CPT) was administered during functional magnetic resonance imaging (MRI) and used as a measure of cognitive control ability. Additionally, structural MRI scans were obtained and processed using Freesurfer to obtain measures of cortical thickness. While structural and functional MRI data analysis is ongoing, preliminary results of AX-CPT revealed better cognitive control performance ability in patients with a history of cannabis use compared to non-users. The final results of the study will provide a more comprehensive assessment of the impact of cannabis on cognition, brain structure, and function in schizophrenia.

The Scent of Citrus Infection: Using Volatile Organic Compounds to Identify Diseased Trees

Mitchell M. McCartney
Sponsor: Cristina E. Davis, Ph.D.
Mechanical Engineering

Huanglongbing (HLB) is an incurable citrus disease that threatens the entire citrus industry in the United States and worldwide. Early asymptomatic detection of the disease is currently difficult, allowing HLB to quickly spread. Our experiments study the volatile organic compounds (VOC's) emitted by infected and healthy citrus plants with hope to provide growers with a way to diagnose HLB trees at early infection stages before visual symptoms appear. We perform two analytical chemistry techniques to determine the identity of VOC biomarkers induced from HLB positive trees: gas chromatography / mass spectrometry (GC/MS) and gas chromatography / differential mobility spectrometry (GC/DMS). Our GC/DMS data creates a "fingerprint" of the citrus disease to separate and identify the myriad of citrus VOCs, while the GC/MS data provides us with chemical compound identification for the VOCs of interest. The GC method separates the compounds through individual attractions to a solid and mobile phase, while DMS identifies compounds based on their response to an applied electric field. The MS method uses a mass-to-charge ratio to provide information on the chemicals of interest. Together, all of this information helps us to diagnose citrus infection in an entirely novel way.

Sword and Shield: A Critical Look at the Collision of Rape Laws and Rape Culture in the United States That Punishes Female Sexuality

Reilly P. McFadden
Sponsor: Charlotte Biltekoff, Ph.D.
American Studies

This paper explores how rape laws and notions of rape within a rape culture collide during an acquaintance rape trial which demonstrates that there still exist restrictions on women's sexuality in a society where rape culture prevails. Today there is immense stratification between the representation of female sexuality and the legal application of rape law during an acquaintance rape trial. A trial serves as the site where those tensions collide, and as the trial unfolds, attitudes and assumptions manifested by a rape culture infiltrate the trial and affect the verdict. By analyzing the elements of acquaintance rape trial proceedings, looking at manipulation tactics, the informal processes that affect judicial discretion and jury decision making, and gendered cultural and social expectations, I demonstrate the tension between the legal application of rape law and the rape culture that it works within. These tensions generate competing social and cultural opinions of what constitutes consent and what can be reasonably assumed to be resistance. Although efforts are made to filter such biases from the trial process, those outside elements infiltrate the presumably unbiased court room and dictate the outcome of the trial.

Radio Observation of Ultra High Energy Cosmic Rays

Scott McIntosh
Sponsor: John Conway, Ph.D.
Physics

Earth's upper atmosphere is constantly bombarded by ultra-high energy subatomic particles traveling through space at nearly the speed of light known as cosmic rays. Particles on the lower end of the energy spectrum are believed to originate in distant deep space objects like quasars and the remnants of supernovae, terminating in massively energetic collisions with gases in our atmosphere, while the origin of the most energetic particles still remains a mystery. During these collisions, the particles interact to create new particles which in turn collide with other nearby particles which also interact to create a new sets of particles. This chain reaction results in what is known as an Extensive Air Shower (EAS), which is essentially a shower of these particles. The purpose of this project is to observe the radio signals given off by the highest energy showers, employing arrays of specially designed antennae to triangulate the origin of the particle showers in the upper atmosphere.

Beneficial Reuse of Dredge Material in the San Francisco Bay Area

Arek N. Medina
Sponsor: Brett Milligan, M.A.
Landscape Architecture

From the 1780's to the 1980's, approximately 91% of California's wetland habitat has been lost. Wetlands are invaluable habitat for waterfowl, migratory birds, and many other wildlife species. Additionally, they also provide valuable services such as flood control, increased water quality, and groundwater recharge. One emerging method of wetland restoration and creation is the beneficial reuse of dredge material from California waterways. Dredging operations in the Sacramento – San Joaquin River Delta and the San Francisco Bay Area produce between three million to one million cubic yards of excavated sediment each year. The Army Corps of Engineers and many other agencies within California have several sites currently receiving dredge material for beneficial reuse, but there are many sites that are underfunded or currently ignored that would be ideal for a wetland creation project. The goal of my senior project is to identify one or many sites within the San Francisco Bay Area that are appropriate for or in need of wetland creation via beneficial reuse. Ideally, these potential sites would serve a dual use as both a wetland and an area for public access, recreation, and awareness.

PDGF Effects on MSC Migration

Avi Mehari
Sponsor: Roslyn R. Isseroff, M.D.
Dermatology

In 2011, 25.8 million people, or 8 percent of the United States were reported to have diabetes. Without proper treatment, long-term complications can lead to diabetic foot ulcers that are difficult to treat and in extreme cases require amputation. Mesenchymal Stem Cells (MSCs) are adult stem cells that are found in mesenchymal tissues, such as bone marrow. These cells play a key role in wound healing by differentiating into other cell types necessary for the healing process, as well as secreting cytokines and factors to regulate the surrounding environment and guide tissue repair. Platelet Derived Growth Factor (PDGF) is most commonly produced, stored and released by platelets activated by the immune system. It regulates cell growth and aids in the creation and growth of new and existing blood vessels. MSCs possess receptors to respond to this stimulus. Therefore, I hypothesize that PDGF treatment on MSCs result in an increase in cellular migration, which improves the wound healing process by shortening the travel time of the cells to the wound site. To investigate this, I monitored the movement of individual cells under a microscope while tracking their average migratory speed at different dosage levels of PDGF.

Deep Brain Stimulation Improves Coherence of Theta Oscillations and Cognition following Traumatic Brain Injury

Mikhail Melnik
Sponsor: Gene Gurkoff, Ph.D.
Neurological Surgery

Over 5.3 million people suffer from chronic deficits following traumatic brain injury (TBI) in the United States. The majority of reported deficits are related to learning and memory. Previous research on rodents has suggested that theta oscillations, which occur between 5-12 Hz, play a critical role in learning. One measure of theta is the coherence of oscillations between distal regions of the brain. Coherence has been hypothesized to optimize learning. We previously reported that lateral fluid percussion, the most utilized rodent model of TBI, reduces theta power. We hypothesized that in addition to a loss in power, we would observe a reduction in coherence between distal brain regions. Furthermore we hypothesized that deep brain stimulation (DBS) in the theta frequency would increase theta coherence and learning in injured animals. Analysis of oscillations revealed that TBI significantly reduced oscillations between medial septum, hippocampus and prefrontal cortex and that DBS improved theta coherence, ultimately improving cognitive function. In conclusion, theta oscillations are disrupted following TBI. DBS represents a new and exciting therapy that may one day be used to improve learning and memory by restoring oscillations in TBI patients.

Preventing Childhood Obesity in the Central Valley of California

Dulce R. Mercado-Rodas
Sponsor: Linda S. Whent, Ph.D.
Chicana/Chicano Studies

The paper uses data from a multidisciplinary research study focused on preventing childhood obesity in the Central Valley of California. As part of the intervention, curriculum on physical activity is completed at schools. Data on classroom physical activity, as well as teachers' characteristics is collected using weekly surveys in participating communities. Information about teacher's individual characteristics, background, and own physical activity level, along with classroom and school information, is correlated to children's weekly physical activity. Descriptive, correlational, and logistic regression analysis is used to examine the effect of teacher, classroom and school characteristics on children's level, diversity, and intensity of physical activity at schools. By analyzing the activity levels, we explore the underlying factors that help prevent and keep supporting efforts to prevent childhood obesity. The physical activity of children are a reflection of the educational and barrier factors affecting low-income communities, however through the methods used for this project we can provide guidelines for the improvement of physical activity and education available to these communities. In general, schools with better infrastructure, and teachers with more positive attitudes toward exercise are expected to have positive effect on time, levels and intensity of physical activity among children.

Income Inequality and Its Effects on Human Development

Jonathan Z. Michaiel
Sponsor: Ed Taylor, Ph.D.
Managerial Economics

Unequal access to resources, such as income, is a significant issue in the world with especially severe consequences on human development in poor countries. In 1990 the United Nations Development Program (UNDP) created the Human Development Index (HDI), defining human development to be "a process of enlarging people's choices and enhancing their capabilities." If adjusted to include inequality, the HDI declines by 10% in high income countries and 35% in low income countries. This paper draws from UNDP data sources to explore the effects of income inequality on human development. I provide a theory as to why income inequality has such a large impact on human development then test the hypothesis that income inequality hinders human development with greater degree in poor countries. The variables in my study include the Human Development Index (HDI) as a measure of human development, Gross National Income (GNI) as a measure of income and the GINI coefficient as a measure of income inequality. Through basic econometric modeling and regression analysis I hope to shed new light on the relationships among these three indicators and provide insight into how income inequality affects the development process.

A Screen to Identify Genes That Inhibit Ectopic Loci Interactions

Carlos L. Mikell
Sponsor: Sean Burgess, Ph.D.
Molecular & Cellular Biology

Chromosomes are organized non-randomly within the nucleus. This dynamic organization is important for normal cellular functioning. Physical interactions are generally inhibited, excluding several processes such as DNA repair and meiotic pairing. In these exceptions, interactions between allelic loci are allowed to occur, while interactions between non-allelic (ectopic) loci are inhibited. Physical interactions between ectopic loci can form deletions, insertions and translocations. Our lab has previously shown that in the absence of the Rec8 cohesin protein, the budding yeast *S. cerevisiae* exhibits increased ectopic interaction during meiosis. Here we will identify genes inhibiting ectopic interactions in somatically dividing cells. To determine the rate of interactions, we use a visual *in vivo* 'collision' assay to quantify the spatial proximity between two ectopic loci based the number of fluorescent sectors in individual colonies. We determined the rate of collisions in wild-type strains and are now screening for mutants exhibiting increased rates of collisions after enriching for temperature sensitive mutants with ultra-violet radiation. Once strains displaying higher rates of collisions are collected, genetic analysis can unveil the genes disrupted by mutagenesis and responsible for keeping ectopic loci spatially separated.

At 35°C Recovery of Neural Signaling After Oxygen Glucose Deprivation is Greater in Hippocampal Slices From Hibernating vs. Non-Hibernating Hamsters

Alexandra Mikhailova
Sponsor: Barbara A. Horwitz, Ph.D.
Neurobiology, Physiology & Behavior

We previously demonstrated that recovery of synaptic transmission following brief oxygen glucose deprivation (OGD) was greater in hippocampal slices from euthermic (nonhibernating) hamsters (EUH) vs. those from rats, indicating inherent neuroprotection. This study tested the hypotheses that recovery of synaptic transmission from OGD would be more complete in slices from hibernating hamster (HH) slices than in EUH slices (i.e., induced neuroprotection) and that decreased temperature would further enhance recovery. For this, I measured evoked response amplitudes (ERAs) of CA1 neurons to stimulation during a 15 min control period [slices perfused with oxygenated artificial cerebrospinal fluid (O_2ACSF, 10 mM glucose)], followed by OGD (ACSF gassed with nitrogen and no glucose) for 10 min and a 30 min recovery period (O_2ACSF, 10 mM glucose). At 35°C, 10 min after OGD treatment, HH slice ERAs had recovered to 65.7 ± 12.6% (n=9) of control while those of EUH slices had recovered to 22.9 ± 8.0% (n=17; $P<0.05$). Lower temperatures (25°C, 30°C) provided additional neuroprotection for both HH and EU slices. These data support my hypotheses and indicate the presence of inherent as well as inducible neuroprotective mechanisms in the neurons of this facultative hibernator.

Analysis of Aristotle's Prophecy of Synergy Involving Protein Translocation via Hsp93 and Hsp70 in the Toc/Tic Pathway

Lillian Miller
Sponsor: Steven Theg, Ph.D.
Plant Biology

Plant cells contain chloroplasts, which convert sunlight into chemical energy. More than 95% of chloroplast proteins are encoded in the nucleus, translated in the cytosol, and translocated into the chloroplast. Protein complexes called translocons facilitate and regulate the translocation of precursor proteins across the chloroplast's outer and inner membranes. Two heat-shock proteins, Hsp93 and Hsp70, associate with the translocons on the inner membrane (Tic) and provide the energy for translocating proteins through ATP consumption. Historically, it was believed that Hsp93 solely provided the energy needed for protein translocation. Recently, Hsp70 has been shown to play a central role in importing proteins. We hypothesize that instead of working independently, Hsp93 and Hsp70 work synergistically to provide the energy for translocating proteins into the chloroplast such that together Hsp93 and Hsp70 import proteins more efficiently than either one individually. To test this, I am creating single and double temperature-sensitive and K_M mutants of the Hsp93 and Hsp70 genes in the moss, *Physcomitrella patens*. The effects of these mutations on the efficiency of protein import into chloroplasts isolated from moss will be tested.

The Prevalence and Character of Violent Fashion Images on Pinterest

Viktoriya Mlonchina
Sponsor: Laramie Taylor, Ph.D.
Communication

Violence has sometimes been used in advertisements as a provocative tool to garner an audience reaction. One contemporary way in which violent images may be displayed is through the online site Pinterest, known for its display of fashion photography. In order to study the question of the prevalence and character of violent fashion images on Pinterest, I first collected data regarding the proportion of fashion-related images that depicted violence. Such images were extremely rare, mostly occurring in association with one specific brand. Next, I gathered 67 violent images based on a "violence index" and used the structural features of Pinterest to trace their origins. 97% of violent fashion images on Pinterest were originally pinned to boards critical of violent fashion imagery and 61% originated from websites criticizing the ads. This research indicates that Pinterest users are actively working to draw attention to the negatives of violent fashion and that the site's search function as a whole is effective in not propagating violent images.

Comparing Voting Systems Using Kemeny Rankings

Melody Molander
Sponsor: Jesús De Loera, Ph.D.
Mathematics

Imagine we are voting to elect a new president. We can use two different voting methods which may or may not result in different winners. The first method we can use is majority rule, meaning individuals vote for a single candidate. The second method we can use is voting by ordering all the candidates by preference, called preference voting. We would like to determine when majority rule and preferential voting result in different outcomes. At first, our team created a function to determine this difference. To make our function capable of taking in more data, our group decided to incorporate Kemeny rankings, a method of choosing a winner that compares every two candidates. Kemeny rankings are NP-hard, but bounds are known to give approximate solutions. Using Kemeny rankings would allow us to see not only that one candidate is preferred over another, but how much one candidate is preferred over the other.

Analysis of the Function of a Divergent Flamin Protein, FLN-2 in *C. elegans* Larval Hypodermal P-Cells

Robert E. Monroy
Sponsor: Dan A. Starr, Ph.D.
Molecular & Cellular Biology

During development in *C. elegans*, P-cell nuclei migrate from the lateral side into the ventral cord and give rise to the hypodermis, vulva, and motor neurons. Mutations in KASH (UNC-83) and SUN (UNC-84) proteins, which reside at the nuclear envelope, disrupt nuclear migration by removing interactions between the nucleoskeleton and cytoskeleton. Genetic screens for enhancers of the nuclear migration defect of *unc-83/84* mutants have identified two genes, *toca-1* and *fln-2*; I will focus on the large divergent filamin, *fln-2*, which is presumably involved in actin organization. The morphology of cytoplasmic actin in P-cells appears normal prior to nuclear migration in *unc-84/fln-2* worms; however, actin cytoskeleton is disorganized during nuclear migration. This suggests that *fln-2* may be involved in actin regulation during nuclear migration in, and we hypothesize that FLN-2 organizes actin in these cells. I will undertake both a biochemical and cytological approach to dissect *fln-2*'s function in P-cell nuclear migration. I will clone parts of *fln-2* and perform an in-vitro actin-binding pull-down assay. I will also tag *fln-2* with GFP to examine the *in-vivo* localization patterns in these cells. These approaches will allow us to begin to dissect the role of *fln-2* in nuclear P-cell nuclear migration.

The Effects of Campaign Contributions on Political Representation

La Quan Moore
Sponsor: Walter Stone, Ph.D.
Political Science

The median voter theorem explains social choice on all issues that are both single-peak and one-dimensional. In this study, I plan to use the median voter theorem to examine the effects of campaign contributions on representation, by comparing the difference in ideological preference of the median voters of 154 congressional districts with the candidates for office in the 2010 election. Because candidates solicit funds from multiple sources, and make multiple and sometime conflicting promises to gain support, candidates who receive the majority of their contributions from outside of the district's boundaries are further away from the median voter than candidates who depend primarily on in district contributions. Additionally, the study will look at incumbents and challengers separately, as the effects of spending and campaign contributions effect incumbents differently than challengers. By observing the relationship between money and representation, we can see the effects of where these contributions come from, and how money affects representation.

Prolactin in Anestrous Mares Under Ambient Lights after Recombinant Equine Follicle Stimulating Hormone (reFSH)

Elizabeth Moreno
Sponsor: Janet F. Roser, Ph.D.
Animal Science

Mares' ovaries shut down during deep anestrous when daylight decreases. Significant interest exists in hastening commencement of ovulation and cyclicity for breeding so foals are born earlier the following year. The typical treatment to do this has been to use artificial lights. Both follicle stimulating hormone and luteinizing hormone are known to rise as daylight increases, inducing follicular growth and the first ovulation of the year, but the role of prolactin (PRL) is unknown. Usually prolactin rises during the transitional period from winter anestrous to cyclicity. In a previous study, it was demonstrated that deep anestrous mares treated with reFSH ovulated early in the year without artificial lights. It was noted that the surge of circulating estrogens from the growing follicles was high and prolonged. It has been shown that an increase in estrogen from growing follicles increases prolactin levels, suggesting a role for prolactin in ovulation.The goal of this research is to evaluate plasma levels of PRL by radioimmunoassay in the deep anestrous mares from the previous study in order to determine changes in PRL that may correlate with estrogen profiles and ovulation.

Physical Exercise as a Coping Strategy for Male and Female College Freshmen

Maria I. Moreno-Gonzalez
Sponsor: Adrienne Nishina, Ph.D.
Human Development

Effective coping is important for college adjustment. However not many studies have examined the role that physical exercise has as a potential coping strategy for college students, and none have explored whether there are gender differences in the association between physical exercise and adjustment. Specifically, using data obtained through surveys from college freshmen (N = 406, 75% female), I examined the association between the use of physical exercise frequency, exercise as a general coping strategy, and exercise coping in response to hypothetical social stressors, and college students' depressive symptoms, self-esteem, and social anxiety. For both men and women, exercise frequency was not associated with adjustment. For women, using exercise as a coping strategy was associated with less social anxiety and more self-esteem, whereas for men it was associated with low social anxiety (similar to women), but more depressive symptoms. For women, using exercise-based coping for hypothetical social stressors was also associated with higher self-esteem. In sum, using physical exercise specifically as a coping strategy was beneficial for women but had mixed results for men. The findings also suggest that for college freshmen that experience social anxiety symptoms, engaging in exercise when encountering stressful situations can be beneficial.

Purification and Characterization of Newcastle Disease Virus' Antigenic Protein, HN

Alexandra E. Moskaluk
Sponsor: Karen McDonald, Ph.D.
Biochemical Engineering

Newcastle disease virus (NDV) is an avian pathogen that is contagious and fatal for most avian species, and is particularly devastating in dense poultry flocks. This virus is part of the subfamily Paramyxovirinae and possesses two surface glycoproteins, hemagglutinin-neuraminidase (HN) and fusion (F) proteins. The HN protein is responsible for virus attachment to sialic acid-containing receptors, therefore, this protein is ideal for producing a subunit vaccine. A subunit vaccine is preferable for this disease since the vaccine will be composed of the antigenic protein and not the actual contagious virus. To create this subunit vaccine, we constructed transient expression systems containing the HN protein in *Nicotiana benthamiana* due to the short production time in plants. The harvested leaves were vacuum agroinfiltrated with the three different expression systems and purified using magnetic bead affinity chromatography columns. In order to further characterize the glycosylation sites our current focus includes increasing the purification percent yield as well as the total amount of purified HN protein which will serve to further the development of this subunit based vaccine.

Gestational Diabetes Mellitus and Its Effects on Breast Milk and the Infant

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

Gestational Diabetes Mellitus (GDM) afflicts up to 17% of the U.S. population and is defined as insulin resistance during pregnancy. As pregnancy progresses, the placenta grows and increases production of hormones (estrogen, placental lactogen, and cortisol) which can cause extrahepatic tissues to be resistant to the action of insulin necessary for the uptake of glucose by peripheral tissues. Normally, the pancreas will offset the insulin resistance by increasing insulin output, yet in women who cannot produce sufficient levels of insulin, GDM will ensue. Milk protein composition is altered in women with GDM vs. in women without GDM. Yet it is unknown how altered protein composition in colostrum affects the health of the infant. Investigating the proteome or protein cargo of early milk (colostrum) will expand our understanding of protein composition and function in the neonate. Protein was extracted from human colostrum collected on day 3 postpartum using the Wessel Flugge method, followed by reduction with tris (2-carboxyethyl) phosphine, alkylation with iodoacetamide and overnight digestion with trypsin. The proteomic data are in the process of being statistically analyzed. These results will expand our knowledge of the differences in protein composition between colostrum from women diagnose with vs. without GDM.

Increased Photoelectrochemical Activity in Rhodium Doped SrTiO3 Nanoparticles as a Visible-Light Induced Solar Hydrogen Evolution Photocatalyst

Justin Mulcahy
Sponsor: Frank E. Osterloh, Ph.D.
Chemistry

$Rh:SrTiO_3$ is an earth-abundant nanoscale photocatalyst capable of hydrogen evolution for the overall water-splitting reaction in the presence of visible light. The generation of clean, renewable, and cost-efficient hydrogen-based fuel systems remains of significant economic and political interest for increased environmental sustainability and energy security. Improving the photocatalytic efficiency of this material has been difficult to achieve with significant engineering challenges. Here it is shown that modifying the surface of these nanoparticles with inorganic compounds increases charge-carrier concentration which allows for a greater rate of hydrogen production. To reach these conclusions, $Rh:SrTiO_3$ nanoparticles were synthesized hydrothermally. Surface photovoltage spectroscopy (SPV) revealed an excess of electrons on the surface, indicating an n-type semiconductor, and an electron trap site for water reduction. UV-Vis spectroscopy showed a large increase in absorption within the ultraviolet range with some absorption in the visible range. Irradiation exhibited a steady linear increase in hydrogen production. Measurements of the particles stability in suspension with a zetasizer indicated a decreasing trend in zeta potential with increasing pH. Overall, these findings demonstrate an enhanced nanoscale photocatalyst capable of solar hydrogen evolution for overall water splitting.

Hard-Boiled Masculinity and the Oppression of the Feminine

Frances Munton
Sponsor: Ana Peluffo, Ph.D.
Spanish

Hard-boiled detective fiction has been lauded for its social criticism as much as it has been criticized for upholding oppressive social orders, particularly in regard to the portrayal of women. In the Mexican neopolicial *Cosa fácil* (1977) by Paco Ignacio Taibo II, hard-boiled tropes are used to investigate the exploitation of the female body and the structural oppression of the feminine. *Cosa fácil* can be seen as an investigation of sex and gender both in Mexico City and in the hard-boiled genre. The expansive novel *2666* (2004) by Roberto Bolaño also makes use of hard-boiled tropes to explore the femicide of Ciudad Juárez, Mexico within the fictionalized context of Santa Teresa. Whereas Taibo II fully immerses himself in the genre and Mexico City, Bolaño co-opts detective tropes intermittently in a larger literary and transatlantic context. In the comparison of these two novels, I will be exploring the violent effects of the idealization of hard masculinity and the ways that the detective genre can limit or enhance a discussion on sexual and gendered violence.

Codon Optimization: Cracking the Genetic Code

Katherine A. Murphy
Sponsor: Joanna C. Chiu, Ph.D.
Entomology

Since the structure of DNA became known in 1953, an astounding amount of progress has been made toward unraveling the genetic code. However, many functional aspects of the genetic code, such as codon usage bias, remain mysterious to this day. Codon usage bias is widespread in the genomes of many organisms and may partly be explained by selection for codons with higher rates of translation. Although, some genes show little or no codon usage bias, and many genes that are biased have regions of optimal codons interspersed with regions of non-optimal codons. These observations indicate that other factors aside from translational efficiency are at play. I plan to investigate the functional significance of biased codon usage by studying the *period* gene in *Drosophila melanogaster*. PERIOD is a key protein that regulates the animal circadian clock. Preliminary data shows that when codon usage is artificially optimized in the *period* gene, daily locomotor rhythms are diminished, suggesting that codon bias is important for normal function of this circadian protein. The findings of this project will advance our understanding of the genetic code.

Autophagy's Contribution to SPS Lifespan Extension in Budding Yeast

Victoria Myers
Sponsor: Su-Ju Lin, Ph.D.
Microbiology

Yeast cells with a null mutation of Ssy5 (*ssy5*Δ) have been shown to inactivate the Ssy1-Ptr3-Ssy5 (SPS) amino acid sensing pathway and extend lifespan. By inactivating the SPS amino acid sensing pathway, the *ssy5*Δ mutant may mimic amino acid starvation, which is linked to the activation of autophagy. To study the effect *ssy5*Δ has on cell lifespan I am examining autophagy as a possible contributor. In addition, I am studying autophagy in the mutant *ycl047c*Δ, a gene involved in NAD^+ metabolism essential for cell lifespan and survival. My hypothesis is that autophagy activity is increased in both mutants, which may contribute to their observed lifespan extension. Using a modified alkaline phosphatase activity assay I have measured the activities of both non-specific autophagy and mitochondria-specific autophagy known as mitophagy. My preliminary data showed strains with *ssy5*Δ indeed have increased non-specific autophagy activity, leading us to believe there is a connection between autophagy and *ssy5*Δ lifespan. This project is part of a study looking into the SPS pathway and cell lifespan, which hopefully gives us a greater understanding of aging and age-related diseases such as cancer and diabetes.

Impact of U.S. Aircraft Accidents on Occupancy Rate for Commercial Airlines

Stephanie A. Nail
Sponsor: Katrina K. Jessoe, Ph.D.
Agricultural & Environmental Education

This paper analyzes the effect of aircraft accidents on occupancy rate. This analysis will provide insights into the length of the effect as well as information for airlines to make important strategy decisions following an accident. Using detailed monthly data collected from the U.S. Department of Transportation between 2000-2013, I find that major domestic accidents led to a reduction in occupancy rates for the affected flights up to five months after the accident. These results are robust to the inclusion of carrier controls and macroeconomic variables. Decreased occupancy rates extend beyond the affected flight and impact occupancy rates for all routes serviced by the affected airline. This suggests that the reputational effects of an accident extend beyond the affected flight to all routes flown by an airline. As a result, airlines should work to rebuild their safety reputation as a whole following an accident.

Impacts of Individual Variation in Infectiousness on Disease Persistence

Anna M. Naranjo
Sponsor: Sebastian Schreiber, Ph.D.
Evolution, Ecology and Biodiversity

Mathematical models of infectious diseases can provide insights into the interplay between epidemiological and population processes. Evidence from previous research shows that individuals in a population exhibit different degrees of infectiousness; some individuals do not infect others, while others are highly infectious. Despite this evidence, it is not known how this variability affects the persistence of diseases within populations, or how this persistence depends on population size. Here, we explore variability in individual infectiveness using a stochastic discrete-time model. By incorporating different distributions for infectiousness, we can characterize the relationship between the duration that the pathogen can persist, individual variation and population size. In smaller populations we expect greater variation among individuals; the disease will exhibit greater fluctuations, and therefore the disease will not persist as long. This variation can also affect the frequency of fade-outs and reintroduction of disease. However, for large populations, the variation in individual infectiousness will have less of an impact, and persistence times should look similar to models that use the same value of infectivity for the entire population. By comparing the new model that incorporates individual variability to the homogeneous model, we can identify when individual variation has a significant impact on disease persistence.

Sacramento Light Rail Village Development: Towards Regional Multi-Modality

Marisa K. Naughton
Sponsor: Michael Rios, Ph.D.
Landscape Architecture

Realizing the auto-centric nature of transit in the Sacramento metro region, concepts for Transit Oriented Development of Light Rail stations along the Gold line of the system will showcase people-centric lifestyles and the practicality of rail. Three stations along the line will be chosen for design development and compared for feasibility, practicality, and local benefit. This project is meant to be a study in urban design that uses design as the medium for understanding community space and form. Additionally, a quantification of provided social, economic, and environmental benefits of each development will be conducted. Through the conclusion of this project, one new Transit Oriented Development will be presented in detail, as well as a regional analysis of potential station retrofits and resultant benefits of diverted automobile volumes. Influences on design will stem from the research of transit village methodologies and existing literature on mixed-used form and structure. The methodologies undertaken in this study will include case studies, and regional and site analysis often applied in landscape architecture coursework. This project will contribute to the field of landscape architecture through the vein of land use planning, alternative transit strategies, site planning, and local benefit calculations.

cMyc-Xa21: Another Resource for Studying Rice Plant Immunity

Mbowoi Faith Ndama
Sponsor: Pamela C. Ronald, Ph.D.
Plant Pathology

More than a quarter of the world is dependent on rice, and diseases that target rice can negatively impact rice production and reduce potential yields. The bacterial pathogen *Xanthomonas oryzae* pv. *oryzae (Xoo)* is the causal agent of bacterial blight, a rice disease that causes significant loss of yields throughout Asia. Xa21 (*Xanthomonas* resistance 21), is a gene identified in the rice relative *Oryzae longistaminata* which has been found to confer strong resistance to *Xoo* when put into rice by conventional breeding and transgenic approaches. Despite its importance, much of the molecular mechanism by which XA21 confers immunity in rice is still unknown. Towards this goal, we have generated transgenic rice plants carrying cMyc-Xa21 and have confirmed the presence of the transgene through PCR. Plants that were positive for the transgene were verified for RNA and protein expression of Xa21 through qPCR and Western Blot analyses. Functionality of the transgene was confirmed by inoculating the transgenic rice plants with *Xoo* and measuring the disease progression over time. Success in this research will provide transgenic rice plants carrying tagged versions of XA21 further understanding of the mechanism that confers immunity; creating a platform for studying the XA21 protein complex *in vivo*.

Infant Face Perception and Discrimination of Dynamic Faces

Andrew P. Nelson
Sponsor: Lisa M. Oakes, Ph.D.
Psychology

It takes practice and experience to scan faces quickly to get information needed to learn about and identify them. Infants' experience with faces starts at birth and research has shown that between 6 and 9 months old infants become better able to discriminate faces within their own race than outside of it. Because most previous research has examined infants looking at static images of adult faces, this study examines face-scanning patterns of eight-month-old infants in a more naturalistic setting using dynamic moving faces. In this on-going study, we are presenting 8-month-old infants with video recordings of adults reciting a nursery rhyme. Four of the adults are Asian and four are Caucasian. We anticipate that 60% of the infants we test will be Caucasian, and thus the Caucasian faces will be own-race and the Asian faces with be other-race. Most other infants included will be biracial, allowing us to study infants who have experience with a variety of faces. We will examine where infants direct their attention as they watch the faces in these videos. We expect infants in their own race category to direct their attention to the mouth region because of their familiarity with this type of face.

Analysis of Seasonality in Mussel Shells From CA-SOL-364 Using Oxygen and Carbon Stable Isotope Analysis

Ryan Nesbit
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Anthropology

Shells are a visible component of the archaeological record and can reveal much to archaeologists about ancient lifeways. While shells may seem insignificant compared to other archaeological artifacts, analysis of shells can provide information on diet, trade, environmental conditions, and settlement patterns. This project focuses on reconstructing Native Californian settlement patterns through the isotopic analysis of shells from CA-SOL-364, an archaeological site near Suisun Marsh and located in Fairfield, California. Radiocarbon dates indicate the site was occupied between 2500 and 1500 years ago. Oxygen and carbon stable isotope signatures are incorporated into the aragonite of growing shells, and vary in a predictable way with salinity and water temperature. In Suisun Marsh water salinity has a predictable seasonal pattern, with brackish waters during summer and fall, and freshwater conditions during winter and spring, corresponding with seasonal rainfall patterns. Isotopic signatures in the terminal growth band on a shell can inform on the season when a shell was harvested. Determining season of harvest across a large sample of shells can then tell archaeologists about the season(s) a site was occupied. This project aims to determine if CA-SOL-364 was a sedentary site, occupied year-round, or was used on a more limited seasonal basis.

Xystocheir dissecta (Wood) Fluorescence Compound Extraction and Identification (Polydesmida: Xystodesmidae)

Alexander A. Nguyen
Sponsor: Bruce D. Hammock, Ph.D.
Entomology

We observed the millipede species *Xystocheir dissecta* (Wood) to exhibit blue-green fluorescence when irradiated with ultraviolet light during a routine rodent survey of Alcatraz Island, California. Subsequent investigation revealed that many members of Xystodesmidae exhibit very similar fluorescence under ultraviolet light. This observation supports anecdotal accounts of various fluorescing millipedes found throughout California. No current consensus exists on the identification of this compound. Preliminary analysis using HPLC of hexane extracted millipede exoskeleton suggests the compound has an absorbance of 330 nm and fluorescence of 420 nm and 450 nm. The compound appears to be fairly stable in the environment due to the fact that preserved museum collected specimens and dead millipede fragments in nature exhibit very similar fluorescence to living individuals although not as brilliant. We are now establishing colonies of *Xystocheir* to facilitate further study of this compound though MS or NMR. *Xystocheir* from nearby Stebbins Cold Canyon Reserve are suitable for analysis.

Dissecting the Signaling Pathway Regulating Early Stages in Parasitic Plant, Host Plant Interactions

Lee Nguyen
Sponsor: John I. Yoder, Ph.D.
Plant Sciences

Parasitic plants pose a serious threat to the world's agriculture and environment. Understanding the parasitism signaling pathway will help identify methods of pest control as well as pest resistance. One gene that enters the parasitic signaling pathway early is TvQR1, a gene that encodes an enzyme that catalyzes an oxidation-reduction reaction crucial for development of a root like outgrowth called a haustorium. In parasitic plants, TvQR1 is transcriptionally activated upon host contact and my project is to study the promoter of this gene, pQR1, in a nonparasitic plant. The promoter was cloned into a plasmid vector containing the GUS reporter gene and transformed into *Arabidopsis*, a nonparasitic plant. I am selecting for transformed seeds by plating them on culture medium containing the antibiotic kanamycin. The successfully transformed seeds will be verified by PCR. Then, transcription regulated by the pQR1 promoter will be analyzed from the GUS expression patterns. The results will demonstrate how the promoter is regulated following contact with host plants and illustrate how TvQR1 is *cis*- or *trans*- regulated. Understanding how parasitic plants identify their hosts by studying this signaling pathway will suggest novel approaches for biologically controlling parasitic weeds.

Intellectual Ability Correlates With Morphology and Development of the Hippocampal Subiculum in Children

Desiree J. Nieves
Sponsor: Simona Ghetti, Ph.D.
Psychology

Intellectual ability is measure by an intelligence quotient (IQ), a score derived from one of many standardized tests designed to determine intelligence. Research indicates that subfields of the hippocampus contribute significantly to the neural processes underlying human intellectual abilities and are correlated with obtaining a higher IQ score. We are interested in analyzing the morphology and development of the different subfields of the hippocampus to determine if any correlate with IQ scores in children. Specially. I hypothesized that having a higher intellectual ability is correlated with the anterior aspect of the hippocampus, especially in the CA3/DG subfield. To test my hypothesis, magnetic resonance imaging scans, the Wechsler Abbreviated Scale of Intelligence (WASI) and the Wide Range Assessment of Memory and Learning (WRAML) data were collected from 20 children. I evaluated the volume of the hippocampal structure by tracing each participant's hippocampus anterior region. The WASI and WRAML data were evaluated for correlation with the volume of the hippocampal subfields. Although there was no significant relationship between CA3/DG and CA1 volumes with IQ or with the WRAML2 Visual Index, there was a strong statistical relation between the right Subiculum volume subfield, IQ and WRAML2 Visual Index.

A New Approach to Measuring Skeletal Muscle: 3D Volumetric Analysis Using PET/CT Imaging

Vinay R. Nittur
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Radiology

The loss of skeletal muscle has long served as a poor prognostic factor, accompanying several disease conditions such as cardiovascular, pulmonary and renal diseases, and various types of cancer. Skeletal muscle depletion is related to abnormal function, yet current quantification methods based on imaging extrapolate whole body skeletal muscle quality from only two consecutive imaging sections through the abdomen, leading to varying estimations based on slice selection. We hypothesize that PET/CT imaging will provide biomarkers of muscle quality that will help in the personalization of treatment. The aim of this study is to use novel, 3D volumetric analysis of PET/CT images to measure biomarkers of muscle quality and correlate these findings with clinical outcomes in cancer patients. PET/CT images of 16 sarcoma patients were selected regardless of histologic type and were cropped to include all abdominal skeletal muscles. Manual segmentation of muscle, using the established Hounsfield Unit window [-29,150], and software post-processing was performed to yield muscle metrics. In early results, the muscle metrics measured are muscle volume, muscle radiodensity, and metabolically active muscle volume. These metrics will be tested against known patient outcomes. We believe that utilizing PET/CT images may improve clinical decision making in cancer.

Relationships Between Aquatic Primary Productivity and Flow Regime in Regulated and Unregulated Rivers of the Sierra Nevada, California

Alyssa N. Obester
Sponsor: Jay Lund, Ph.D.
Civil Engineering

Disturbance as a result of a flood flow is considered to be one of the driving variables influencing aquatic and riparian community structure. However, the demand for water, power and flood control in California has resulted in the construction of dams on nearly every major river in the state. Dams compromise the natural flow regime by altering the magnitude and timing of flow. While the majority of current literature focuses on the effects of flow alteration on consumers and higher trophic levels, fewer studies have focused on impacts to basal aquatic resources and primary producers, particularly periphytic algae. In an effort to better understand the impacts of flow-related disturbance on algal resources, this study examines the relationship between algal ash free dry mass (AFDM) and the timing and magnitude of peak flow and water temperature in six regulated and unregulated streams of the Sierra Nevada across wet and dry water years. Results support previous findings that flow disturbance can reset algal community succession, and that growth patterns are related to water temperature. Given the ease in collection and analysis, AFDM can provide a simple quantitative measure for monitoring aquatic primary production in regulated and unregulated streams.

Vanishing Act

Claire O'Connor
Sponsor: Tom Bills, M.F.A.
Art Studio

I've drawn since I was young, and I feel it is a gift that shouldn't be taken for granted. There is no end to researching in art, but rather constant change and growth as the process evolves. It is a constant experiment, with lot of failures for a few successes. I consider art a safe place to explore controversial issues. It is way to subtly express myself without being present. My paintings are water based oil paint, which has less of an environmental impact than traditional oils. The sculptures are steel, and a series of trials and tribulations. They start as a concept in my head, then the medium guides me as I work on it. It never turns out the same. I am inspired by the natural world, and moments in humanity. This series signifies things that are diminishing or disappearing in our world, from intangible ideas such as chivalry to entire ecosystems which we depend on.

The Presence and Concentration of Specific Antigens in Maternal Autoantibody Related Mothers is Related to the Onset of Autism in Developing Children

Jonathan Odufalu
Sponsor: Judy Van de Water, Ph.D.
Immunology

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that affects children early in development. This disorder is defined by a number of abnormalities related to verbal and non-verbal communication, often with impaired learning. Previous studies have shown that maternal autoantibodies linked to the onset of ASD by their recognition of fetal brain antigens. These autoantibodies recognize lactate dehydrogenase A and B, Y-box, collapsin response mediator proteins 1 and 2, and stress-induced phosphoprotein (STIP1). Our aim is to determine the presence and concentrations of these antigens in maternal autoantibody related (MAR) mothers. The procedure is two fold: western blots are run on various samples to see which of the seven autoantibodies to the specific antigens are present in each sample. After we have determined the presence of a specific autoantibody within each sample, an enzyme-linked immunosorbent assay (ELISA) will be designed and run for each sample in order to test the pattern and relative amount of autoantibody present in the samples. The pattern of reactivity will then be related to diagnosis and autism severity. Our overall goal is to determine how the presence of certain autoantibodies in MAR mothers effects their unborn children, which could eventually lead to the onset of ASD.

Quantum Particles on Finite Graphs

Everardo Olide
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Mathematics

To study the dynamics of a quantum system it is essential to obtain detailed information about the eigenvalues and eigenvectors of its Hamiltonian. For a particle living on a finite graph the Hamiltonian is a Hermitian matrix, which determines its dynamics through the Schrödinger equation. In this project we study a number of simple model systems and investigate the effect of an impurity in the system on its eigenvalues and eigenvectors. It is expected that impurities can lead to bound states for the particle. In this situation and for specific values of the energy, the particle does not diffuse throughout the entire system but remains localized in a small region indefinitely. Among the simplest example systems are the finite linear and cyclic chains, which we analyze in complete detail. Understanding the dynamics of a quantum particle in such systems is essential for applications of quantum mechanics to quantum chemistry, and quantum information and computation.

DMRT1 is Required for Male Sex Determination in Zebrafish

Angel Ordaz
Sponsor: Bruce W. Draper, Ph.D.
Molecular & Cellular Biology

Little is known about sex determination and regulation in zebrafish. Unlike mammals, zebrafish lack sex chromosomes, and it is not known what genes are involved in determining their sex. Regardless of the mechanism of sex determination, all metazoans appear to require the gene *dmrt1*, which encodes a DM domain transcription factor for male development. In zebrafish, *dmrt1* is known to be expressed in the male testis, but its role in sex determination, if any, is not known. To test the hypothesis that dmrt1 is involved in male sex determination in zebrafish, we have used TALENs, a new gene editing technology, to induce loss-of-function mutations in *dmrt1*. To determine the phenotype of *dmrt1* mutants, we produced animals that were homozygous for the mutation using standard breeding and compared their sex ratios to that of wild type zebrafish. We found that whereas the sexes of wild-type animals were 44% female and 56% male, *dmrt1* mutants were 82% female and 18% males. These data therefore show that *dmrt1* function influences male sex determination in zebrafish, and identifies for the first time a gene that is involved in sex determination in this important model organism.

Deep Brain Stimulation Restores Cognitive Function in Pilocarpine-Induced Status Epilepticus Rats

Rafael Ordaz
Sponsor: Gene Gurkoff, Ph.D.
Neurological Surgery

Epilepsy is a chronic neurological condition that affects approximately 1% of the population worldwide. The cost of diagnosing and treating intractable epilepsy in the United States alone is as high as 4 billion dollars annually. Patients with epilepsy and particularly temporal epilepsy often report chronic learning and memory deficits. In a rodent model, pilocarpine-induced status epilepticus (SE) results in chronic abnormalities in hippocampal physiology which correlate with impaired cognition. We hypothesize that deep brain stimulation of the medial septum in the theta frequency range would drive hippocampal theta and improve cognitive function in pilocarpine-induced SE rodents. In our study we recorded hippocampal and septal EEG for one week following injury as well as during behavioral tasks. Both sham and SE rats were randomized into continuous theta stimulation (7.7 Hz at 80 uA) or non-stimulation groups during the learning tasks. Currently there is no approved therapy for restoring cognition in epilepsy patients. Deep brain stimulation therefore represents an exciting and novel way to improve the quality of life for millions of epileptic individuals suffering from chronic cognitive deficits.

Segregation Distortion of the CLPS Allele in the Nova Scotia Duck Tolling Retriever

Joseph R. Owen
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Population Health & Reproduction

CLPS is a recessively inherited locus that causes craniofacial defects in the Nova Scotia Duck Tolling Retriever (NSDTR). NSDTRs with two copies of this allele are born with severe birth defects and as a result are often euthanized. In Mendelian inheritance, the two parental alleles typically have equal probabilities of being passed from parent to offspring at a 1:1 ratio. However, in the event of segregation distortion, this can result in unequal transmission of alleles causing frequencies to deviate from expected. We hypothesize that there is a correlation between the CLPS allele and segregation distortion based on observed transmission within a few generations. Chi-square (χ^2) analysis of genotypes from 21 parents that carry the CLPS allele and their 76 offspring will determine if the CLPS allele is being transmitted at a ratio greater than 1:1. Determining whether there is a correlation between this mutation and segregation distortion will allow us to inform breeders of the possibility that the CLPS allele is inherited at a higher rate than expected.

How Far Have We Come, Baby?: Feminist Legal Theory in the Twenty-First Century

Kayla Pace
Sponsor: Julie Setele, Ph.D.
Sociology

Law is fluid, based on societal norms and expectations. Many groups have and continue to deal with the shortcomings of our legal system. One such group is women. In 1989, a school of thought evolved known as Feminist Legal Theory. This paper will look at what it is, how it has affected our laws, and the implications this theory has for the future. Through analysis of: *Applications of Feminist Legal Theory to Women's Lives, Feminist Jurisprudence, Law in America,* and *The World Split Open*, Feminist Legal Theory is evaluated. Assessing Feminist Jurisprudence allows to us critique current laws and predict future implications. The public debates of the "War on Women," has inspired me investigate how the law effects the lives of many women today. Social norms die hard; the future appears bleak for many women in the legal system. Through this research I will discover the strengths and weaknesses of feminist jurisprudence, and examine its utility today.

Authoritative Parenting and Its Relations to Both Physiological and Self-Reported Measures of Empathy in Children

Mikela M. Padilla
Sponsor: Paul D. Hastings, Ph.D.
Psychology

Authoritative parenting, characterized by moderate levels of control and high levels of warmth and responsiveness, promotes children's development of empathy, the ability to understand and share another person's feelings. Empathy is supported by effective physiological regulation, and, particularly, activity of the parasympathetic nervous system (PNS), but few studies have examined whether parenting is related to the physiology of empathy. This study will examine whether authoritative parenting predicts the correspondence between parasympathetic and emotional aspects of empathy in 70 children (mean age = 4.13 years). I will measure respiratory sinus arrhythmia (RSA), an indicator of PNS activity, and reported sadness while children watch a 60 second video of a sad event. Mindware equipment is used to measure their RSA during the video, followed by an interview to gauge their emotional reaction to the video. Mothers will complete questionnaires to determine parenting style. I hypothesize that more authoritative parenting will predict higher correspondence between child self-reports of empathic sadness and higher RSA, indicating that children experience and express empathy as a well-regulated emotional response. Parenting that promotes more emotionally well-regulated, empathic children ultimately should lead to children who are more prosocial and compassionate with others.

Role of Triglyceride-Rich Lipoprotein Lipolysis Products in Renal Inflammation and Permeability

Rahul Pandey
Sponsor: John Rutledge, M.D.
Internal Medicine

Hypertriglyceridemia along with microalbuminuria are known risk factors for diabetic nephropathy, a complication of diabetes that damages kidneys. However, the role of postprandial hyperlipidemia, abnormally elevated levels of triglyceride-rich lipoproteins (TGRL) in the blood after a meal, in the setting of diabetic nephropathy is not clear. In order to investigate the role of TGRL, three months old C57BL/6 mice were infused with TGRL lipolysis products (TGRL+lipoprotein lipase, LpL) or saline for control. Mice were also infused with FITC albumin together with TGRL lipolysis products to assess renal permeability. To determine the mRNA and protein expression as well as histological analysis kidney samples were collected at different time points (1.5, 3, and 6 hours). Fluorescent microscopy revealed widespread fluorescent staining in the TGRL + LpL-injected mice glomeruli with 1.5 hours post injection indicative of increased albumin permeability. TGF-β protein expression in the kidney was up-regulated 2 hours post-injection of TGRL lipolysis products compared to saline control and returned to pretreatment levels by 6 hours. Inflammatory markers ATF3, CXCL1, and ICAM, were up-regulated up to 6 hours post treatment. In conclusion, this study highlights that TGRL lipolysis products increases glomerular permeability, renal inflammation, and mesangial dysfunction, resulting in kidney dysfunction.

Expression of Recombinant Human Butyrylcholinesterase (rhBuChE) in *Nicotiana benthamiana* and Its Postproduction *In-Vitro* Glycan Modification

Matthew C. Paranial
Sponsor: Raymond L. Rodrigez, Ph.D.
Molecular & Cellular Biology

Organophosphates (OPs) are inhibitors of acetylcholinesterase, the enzyme needed to breakdown the neurotransmitter acetylcholine. Acetylcholine accumulation leads to respiratory collapse and death. Butyrylcholinesterase (BuChE) is a bioscavenger of OPs like sarin. Current therapies elevate the serum levels of OP bioscavengers like hBuChE but this approach is limited by availability and high cost, with plasma-derived hBuChE costing more than $20,000/400mg/treatment. These limitations necessitate alternative expression platforms capable of large scale, low-cost production of a fully active and efficacious recombinant hBuChE (rhuChE). Development of an effective rhBuChE is a national security concern in terms of protecting military and civilian populations from sarin gas attack. We describe the use of viral expression systems based on the *Tobacco mosaic virus* (TMV) to express rhBuChE in *Nicotiana benthamiana* plants using vacuum agroinfiltration. Plants are incapable of sialylating glycoproteins naturally, a process essential for the normal serum half-life of proteins. To increase the number of sialic acid residues per rhBuChE molecule, we systematically added GlcNAC, galactose and sialic acid to N-glycans using "one-pot" multistep enzymatic reactions (i.e., *in vitro* sialylation). Preliminary results indicate approximately 11%-39% of the N-glycans on rhBuChE were sialylated. These results could make plant-made pharmaceuticals a viable alternative to traditional mammalian expression systems.

Lack of Mitotic Spindle Forces Leads to a Decrease in Cell Viability

Dillon M. Patel
Sponsor: Ken Kaplan, Ph.D.
Molecular & Cellular Biology

The maintenance of chromosome stability requires the careful orchestration of DNA replication and sister chromatid segregation in mitosis. Miscues in these events can lead to chromosome instability, a state often associated with human diseases. When the machinery that replicates chromosomes experiences difficulties, it is imperative that cell division events respond to preserve the correct order of events (i.e., replication is completed before cell splitting). Recent work from the Kaplan lab demonstrates that slowing replication progression in budding yeast using the drug, hydroxyurea (HU), activates a novel pathway that increases mitotic spindle forces in anaphase through regulation of *BIM1*, a microtubule-associated protein. Importantly, in cells lacking *BIM1*, spindle forces fail to increase, chromosome instability is elevated and cell viability decreases. However, the precise role of *BIM1* and this pathway is not well understood. Our initial model is that delays in replication progression signal to spindle proteins to increase the forces acting on sister chromatids, a necessary step in the resolution of sister chromatids in anaphase. As a test of this model, we propose the hypothesis that there are genes that cooperate with *BIM1* in responding to replication stress and that when over expressed will rescue the HU toxicity of *bim1*Δ.

Analysis of American Household Energy Usage and Fuel Poverty

Vedang J. Patel
Sponsor: Bagher Modjtahedi, Ph.D.
Economics

Poverty in the United States is a very real issue. We analyzed the relationship between energy usage and income levels in the United States. One theory is that low income households essentially spend more on energy usage than high income households to live a sustainable lifestyle. This means that to cool or heat their homes, low income households have to spend more of their income than high income households. Preliminary findings do show this result. The reasoning for this may include several variables. Some theories include poor insulation of low income households, and perhaps inefficient appliances, among others. In this research we analyze the relationship between energy usage, amount spent on energy, and income levels to suggest certain governmental policies or awareness methods to help low income households who may be suffering poverty due to differences in income levels. All Americans use energy in one form or another and this analysis can help to develop a better understanding of the energy landscape in this country.

Encoding Effects on Working Memory Capacity

Hydie A. Pavick
Sponsor: Steven J. Luck, Ph.D.
Psychology

Working memory research remains at the forefront of cognitive psychologists' attention. This system of the brain that stores transitory information to integrate with future and previous knowledge has a limited capacity and can affect processes such as reading, reasoning and problem solving. Cognitive scientists are curious if certain circumstances can increase or decrease working memory capacity. Specifically in this experiment, we are interested in finding a relationship between stimulus encoding times and the working memory capacity on a multiple change detection task and a change location task. The first factor for the experiment is the way working memory capacity is measured. Multiple change detection consists of observing whether the stimuli presented change in anyway or remained the same between the two presentations; while change location consists of noting the location of an exact change between two presentations of the stimuli. The second factor is the encoding duration; in this case either 100 milliseconds of 500 milliseconds. So far the preliminary data suggests that encoding time does play a role in working memory capacity measurements but to what extent is still unclear. A stronger understanding of encoding times in relationship with working memory capacity could enhance the way humans obtain and integrate information to knowledge.

Four-Month-Old Infants Face Detection in Videos and Pictures

Francisco J. Perez
Sponsor: Lisa M. Oakes, Ph.D.
Psychology

Previous studies have yielded inconsistent findings regarding infants' preferences for faces - infants older than 6 months have a strong preference for faces, but infants at 6 months and under often are drawn to other items more than faces. In this lab, we found that the saliency of a object significantly affects 4-month-old infants' preference for static faces. In this on-going study, we compare infants' looking at faces in dynamic events (e.g., videos), which are more representative of an infant's day to day experience, and their looking at static images. We examined whether infants' looking in the two situations is related. We are analyzing the data from 9 4-month-old infants whose gaze was recorded as they looked at static images of faces paired with static images of objects with high salience (e.g. brightly colored flowers) and as they watched two video clips from Sesame Street (one featuring Earnie and one featuring Cookie Monster). Our preliminary results suggest that the infants look longer at dynamic faces than static faces. Additional analyses will reveal how individual infants' performance in the two tasks was related, allowing better understanding their looking to faces in various situations.

Chondrocyte Single Cell Compression

Badrdin Pernas
Sponsor: Volkmar Heinrich, Ph.D.
Biomedical Engineering

Chondrocytes are responsible for the upkeep of healthy cartilage. Cartilage is found in joints which are areas subject to a variety of strenuous forces and high pressures. Due to this, chondrocytes must be able to resist high forces and shear stresses. Using a custom built high resolution horizontal atomic force microscope; we ran single cell compression experiments on chondrocytes to model their responses under varying pressures and compression speeds. Compression forces were kept constant at 1000 pico-newtons, whereas pressures used were 4cm and 12cm of H_2O and approach speeds varied between 100 nanometers per second and 1 micron per second. What was found was an drastic change in Chondrocytes behavior as any of the above factors were changed. Under higher pressures and speeds, a more linear response was detected whereas under lower pressures and speeds, nonlinearities began to be exhibited. This showed that chondrocytes were a highly elastic cell which showed viscous tendencies under certain conditions. Nonlinear Fitting techniques were used to model the chondrocytes responses using Origin 8.0.

Exploring the Influence of Porosity on Microbial Preservation in Iron Rocks With Computed Tomography and Scanning Electron Microscopy

Athena Phan
Sponsor: Dawn Y. Sumner, Ph.D.
Geology

The physical evidence left by microbes in rocks helps scientists study the environment they once lived in. Certain environments coat microbes with iron minerals to preserve micrometer-scale filaments in rocks. Iron mineral precipitation is controlled by the acidity and chemistry of the water that flowed through the rock pores. To investigate how minerals preserve the microbes, the porosity and permeability of iron rocks from Iron Mountain, CA, were examined. The porosity, formed by a quartz box-work structure within the rock, was evaluated by using x-ray and neutron-ray computed tomography (CT) and is a novel approach. The methods differ in resolution and atomic attenuation. The KeckCAVE 3D visualization system uses CT scans to virtually reconstruct the sample for analysis of the rock interior. Scanning electron microscopy was used to characterize mineral morphology, which suggests constraints on precipitation environment. Mineral growth rate influenced mineral morphology, permeability and formation of void spaces. Pore sizes ranged from 0.783mm – 3.878mm and goethite coating around quartz box-work structures ranged from 0.018mm – 0.093mm thick. Goethite precipitation on microbes in the rocks preserved them as mineralized filaments. Further research on these filaments provides context to search for similar features on Mars with the Mars Curiosity rover.

Next to Kin: Re/Presenting Ethnicity and Family in the University

Justin Phan
Sponsor: Amina Mama, Ph.D.
Women & Gender Studies

Students coming from diverse cultural backgrounds arrive at the university as individuals seeking out new forms of sociality. Student sociality oftentimes manifests as a quest for people and communities one can easily identify with. At UC Davis, an organizing group of Asian-/American students are advocating - as part of a formed MOS (My Own Story) Family - that the university administration institutionalizes a particular performance course, which has made them feel 'at home', 'safe', and 'empowered'. With the USA's particular legacies of racism, ethnic diversity and stratification, and the mediation of these by gender, sexuality and class differences, it is perhaps not surprising that student sociality and a sense of community manifests readily along ethnic and racial lines. Hence, my project asks, why this mobilization? What is it about this course that would make these students organize for its institutionalization? My paper attempts to explore how students on a quest for emotional and social support express these desires through metaphors of family in student sociality and activism. Through qualitative research, I seek to understand what emotional work invocations of 'family' and 'community' signify and/or perform for students, and what administrative work these invocations perform for the institution.

"Easy as ABC": Teaching Parents of Children With Autism Spectrum Disorder Intervention Techniques to Influence Learning in Their Children

Tran N. Phan
Sponsor: Cynthia Zierhut, Ph.D.
Psychiatry & Behavioral Sciences

The purpose of this project is to examine if parents of children with autism spectrum disorder can take the skills mastered in parental coaching sessions during the course of early intervention and engage in age and context appropriate interaction with their child. This study is a subset of a larger study known as Parents and Toddlers at Home. Parents are required to attend a coaching session in the clinic and read one chapter weekly from "An early start for your child with autism." I am assessing the quality and quantity of learning opportunities collected from parent-child interaction home videos from twelve subjects at two different time periods: before and after the caregiver has undergone coaching on how children learn topic. This chapter is important because it focuses on how to increase and reinforce wanted behaviors which can be done by recognizing and understanding the components of a behavior principle "ABC's" (antecedent, behavior, and consequence) of each learning opportunity. It is predicted that the quality and quantity of learning opportunities will increase after the coaching on this topic has occurred. This study underlies the importance of equipping parents with skills that can be incorporated in any parent-child interaction.

The Anxious Notion With Recognizing Emotion: Anxiety, Gender, and Emotion Recognition Among Mexican-Origin Adolescents

Tara Piryaei
Sponsor: Amanda Guyer, Ph.D.
Human Development

Accurate emotion recognition is a critical skill for healthy adolescent social development. For adolescents, research has demonstrated that higher levels of social anxiety are associated with greater accuracy in recognizing negative emotions through facial expressions (Kortekaas, 2010), suggesting heightened vigilance for negative social cues. This association has not been studied within ethnic minority adolescents nor has it been examined as a function of gender differences. Mexican-origin adolescents represent the fastest growing minority group in the U.S. and face high risk for social anxiety, making it important to examine social-emotional outcomes within this population (Cardenas, 2012). Adolescents, specifically, are subject to increased social anxiety: 25% of them experience social anxiety (Simon, 2013)& females are more likely than males to experience social anxiety (Lewinsohn, 2013). Examining a sample of 150 Mexican-origin adolescents (age 16), the study will use the Screen for Childhood Related Anxiety Disorder (Birmaher, 1995) and the Mind in the Eyes task (Baron, 1997) to compare differences in mean levels of social anxiety and accuracy of emotion recognition as a function of gender and valence of emotional faces. I expect that higher levels of anxiety in females vs. males will relate to higher accuracy in identifying negative vs. positive emotions.

Scared to Death: Public-Private Surveillance Networks and the Red Scare in California Higher Education

Scott A. Pittman
Sponsor: Kathryn Olmsted, Ph.D.
History

Americans' fear of communism overthrowing the government has existed since the 1917 Bolshevik Revolution. Like those on the national stage, California politicians utilized a two-prong approach to eradicating communism: loyalty oaths and public investigations. In 1940, the California Un-American Activities Committee was established to lead the charge against communism. Although the committee's chair would change three times, it was the chief counsel and lead investigator, Richard E. Combs, who decided what cases and institutions to investigate. Throughout the 1940s, Combs sought the guidance of retired Major Gen. Ralph H. Van Deman, who operated a private intelligence agency out of his home in San Diego since 1932. Combs, Van Deman, and other public and private agencies collaborated to spy on California professors throughout the 1940s and 1950s. Historians have written about the loyalty oath controversies, but no one has examined the role that private surveillance networks played in enforcing ideological conformity at the University of California. This presentation will examine how government and private anti-communists worked together to monitor the hiring and firing of professors and to create a chilling effect in California higher education.

Characterizing Key Low Molecular Weight Forms of Androgen Receptor in Bladder Cancer

Alexander J. Platero
Sponsor: Maria Mudryj, Ph.D.
Medical Microbiology & Immunology

Bladder Cancer is the second most common genitourinary malignancy, often leading to significant morbidity and mortality. Men in particular are four times more likely to develop bladder cancer than women and the underlying reasons still remain unknown. It has been suggested that hormonal differences between the sexes may play a role in the progression of the disease. Recently, discovery of Androgen Receptor (AR) in bladder cancer has motivated studies of its function and it has been suggested that AR plays a role in the development and progression of the disease. However, the exact mechanisms behind how AR regulates bladder cancer still remain elusive and mostly unknown. Studies in our lab have suggested that full length AR is not the only form of this transcription factor playing a significant role in bladder cancer. We have identified novel low molecular weight forms of AR that experiments suggest to be critical in disease progression. Here we present characterization of this form of AR in the context of bladder cancer.

Foreign Students and Transfer From Community Colleges to Four-Year Universities

Linda Plutino
Sponsor: Giovanni Peri, Ph.D.
Economics

Not all students who aspire to a college education attend a four-year university right after high school. Many students choose to enroll in community college first and consequently transfer to a four-year university. Foreign students seem be among these students. In particular, they might choose to enroll in community colleges because they are less able to signal their abilities to four-year universities or need English remediation, which is often not offered at four-year universities. My research question is: Do foreign students have better transfer outcomes than their native peers? For my research, I analyzed data from the California Community College Chancellor's Office and the National Student Clearinghouse. I used linear regression models to analyze the probability of transfer of foreign students. Preliminary results indicate that even after controlling for demographic and academic characteristics, foreigners seem to transfer at higher rates than natives. So there seem to be unmeasured characteristics that positively affect foreign students' academic outcomes. In particular, there might be differences in persistence, attitude toward school, and motivation/determination to transfer.

New Tools for Imaging Synapses and Circuits in the Avian Brain

Stephanie L. Pollitt
Sponsor: William DeBello, Ph.D.
Neurobiology, Physiology & Behavior

Learning involves changes in the strength and pattern of connections between neurons, but how these processes are orchestrated on a circuit level are unknown. Two new methods have been developed to fill this gap in understanding. Array tomography (AT) uses antibodies raised against synaptic and neuronal proteins to visualize their distribution in ultra-thin brain sections. CLARITY, in contrast, visualizes intact circuits in chemically clarified (defatted) brains. We would like to apply both methods to the analysis of learning in the barn owl auditory localization pathway, a well-studied model system. This requires development of an antibody toolkit for use in avians. Antibodies were vetted using western blots, immunhistochemistry and array tomography. Data for both successful and unsuccessful antibodies were assembled into a searchable online database called ADAPT (Antibody Database for Avian Protein Targets). The ADAPT toolkit will be used in conjunction with AT to measure learning-driven changes in synaptic proteins, and in conjunction with CLARITY to measure the remodeling of axonal projections and to develop a 3D map to aid microelectrode navigation *in vivo*.

Comparing Voting Systems Using Kemeny Rankings

Hannah J. Polterock
Sponsor: Jesús De Loera, Ph.D.
Mathematics

Imagine we are voting to elect a new president. We can use two different voting methods which may or may not result in different winners. The first method we can use is majority rule, meaning individuals vote for a single candidate. The second method we can use is voting by ordering all the candidates by preference, called preference voting. We would like to determine when majority rule and preferential voting result in different outcomes. At first, our team created a function to determine this difference. To make our function capable of taking in more data, our group decided to incorporate Kemeny rankings, a method of choosing a winner that compares every two candidates. Kemeny rankings are NP-hard, but bounds are known to give approximate solutions. Using Kemeny rankings would allow us to see not only that one candidate is preferred over another, but how much one candidate is preferred over the other.

Living in the Fruit Bowl and Only Getting the Twigs: Exploring the Lack of Healthcare Access in a Rural Farmworker Community

Gladys E. Preciado
Sponsor: Bruce D. Haynes, Ph.D.
Sociology

California agricultural output is vital to the US economy. According to the US Department of Agriculture, in 2011, California's farm revenue was about $43.5 billion. This represents 11.6% of the nation's agricultural revenues. Essential to this process, however, are Spanish-speaking Latina/o farmworkers who provide low-cost labor. Despite Latina/o farmworkers' important economic contributions, the communities in which they reside are characterized by low-performing schools, high unemployment rates, high level of poverty, and especially poor quality medical care (Arcury and Quandt, 2007; Danenberg, 2002; Taylor and Martin, 2000). Although macro-level statistics capture the numbers, very little is known about individual farmworker's access to healthcare in these communities. The present research, then, is an ethnographic case-study of healthcare access in a particular farmworking community–Knights Landing, California. Using historical archives, fieldwork, and in-depth interviews, I explore the barriers to healthcare access in the farmworking population of Knights Landing. My research indicates that the current range of healthcare services available is both inadequate and inaccessible to farmworkers and their families due to their limited access to financial resources, legal documentation, and language barriers. This research study has implications for policy-makers and legislators in terms of healthcare access laws.

The Powwow at UC Davis

Pamela Pretell
Sponsor: Jessica Bissett Perea, Ph.D.
Native American Studies

Powwows are defined in many ways, but are typically understood as Native American social gatherings that celebrate tribal and intertribal songs, dances, art, and foodways. While powwows are very popular, and take place in many cities throughout the United States, my research focuses on the phenomenon of university affiliated powwows in general and the UC Davis Powwow more specifically. In its forty-second year, the UC Davis Powwow has been proudly organized and hosted by the Native American community on campus since 1969. In addition to providing a celebratory and social space, the UC Davis Powwow serves as a tool for asserting Native American presence on campus. However, the institutionalization of the powwow has not happened without controversy, which primarily lay in misunderstandings between the Native American community and university administration regarding appropriate cultural protocols. My research features Native American student and faculty testimonials in order to both offer a window into the complex situation of UC Davis' institutionalized powwow and to suggest constructive responses to the concerns of community members regarding the future and sustainability of the powwow.

Park Marina Esplanade: The Rejuvenation of a Riverfront Park Marina Drive, Redding CA

Sofia K. Prokop
Sponsor: David de la Peña, Ph.D.
Landscape Architecture

This project evaluates the riverfront stretch of Park Marina Drive for its impending redesign that will highlight the Sacramento River for its recreational potential and ecological significance. The Sacramento River cuts directly through the center of Redding. The river is a crucial part of the image of the city. The stretch of river bounded by Cypress Bridge to the South and Highway 44 Bridge to the North is severely lacking in access and appeal. Park Marina Drive follows this stretch of the river closely, offering views of the river and access points. However, surface parking lots and outdated commercial, residential, and recreational buildings obstruct these views of the river. This section of river lends itself perfectly to a redesign with public access and ecology in mind.A redesign of the site could have the potential to become a draw for tourists, water sport enthusiast, and outdoor recreators. Conceptually designing this stretch of river to have a bike trail, space for diverse water sport activities, and riverfront stores. This redesign will allow Park Marina to become a crucial link from the I-5 highway corridor to the downtown of Redding.

Open Source Development of Optomechanical Devices

Natalie C. Pueyo Svoboda
Sponsor: Sebastian Wachsmann-Hogiu, Ph.D.
Pathology & Laboratory Medicine

Optomechanical devices such as filter wheels and mechanical stages are essential components in devices used throughout the health and science industries to analyze samples such as cells and tissues. The high cost, large size, and very precise technology used to build these devices, however, makes them inaccessible for many researchers and health professionals, especially in low resource areas. In order to make these complex systems more accessible for researchers and educators, we have been developing optomechanical devices that are open sourced and built using materials that can be cheaply and quickly assembled. The parts are designed and built using three-dimensional printing and LEGO motors and pieces, with the circuitry and programming code designed around open source electronics. We will present several prototypes for several devices that we have designed and built following this philosophy, with a 10-100x reduction in price compared to off-the-shelf counterparts from optomechanical supply companies. Final results from this project, including 3D CAD files, code, and circuit schematics will be made open to the public at no cost, with the goal of encouraging use and further innovation of these devices in a wide array of application areas.

The Branch and Bound and Chubanov Methods for Binary Integer Knapsack Problems

Corina Putinar
Sponsor: Jesús De Loera, Ph.D.
Mathematics

The Knapsack problem is an optimization problem in which a subset of elements needs to be chosen to maximize profit. Using a Mixed-Integer Knapsack problem, the Binary-Integer solution of the Knapsack problem can be derived by using the branch and bound technique on the Mixed-Integer problem. This Branch and Bound technique is used by solving a linear relaxation problem at each node of the Branch and Bound tree. In this poster, the Branch and Bound technique is being compared to another algorithm, the Chubanov Relaxation Algorithm. The Chubanov Relaxation Algorithm immediately returns whether the Binary Knapsack problem has a feasible solution, cutting the number of branches the problem has to go through by eliminating the infeasible branches of the problem. The Chubanov Algorithm saves space and overall minimizes the time complexity of the Binary Knapsack problem. This Binary Knapsack solution can be applied to network flow, vehicle routing, and production planning problems.

Infant Cortisol Levels and Behavior Across Contexts

Marianne Pyon
Sponsor: Leah C. Hibel, Ph.D.
Human Development

The current study examined infant's biobehavioral relationships across two contexts. Salivary cortisol was assessed in six-month-old infants surrounding a benign mother-infant interaction and an infant-targeted stress task. Saliva sampling was designed specifically to capture biological responses to each task. The stress task included two episodes from a temperament assessment; a mask task meant to elicit fear responses, and an arm restraint task meant to elicit frustration. Infant's behavioral expression of mood during the mother-infant interaction, and behavioral response (i.e., crying intensity) to the stress task, were coded by trained undergraduates. A change score was calculated by subtracting post-task cortisol from pre-task cortisol levels to represent cortisol reactivity to each task, separately. Infant's cortisol reactivity to the mother-infant interaction was not associated with infant's behavioral expression of mood. Conversely, infant's cortisol was associated with infant's behavioral response to the stress inducing tasks. These findings suggest that the strength of the relationship among an infant's physiology, behavior, and mood, is dependent on the emotional valence of the context examined. Future studies are necessary in order to determine the specific aspects of an infant's context that serve to associate or dissociate behavior and biology.

Dyskeratosis Congenita TIN2 Mutant Causes Telomere Shortening by Inhibiting Telomerase

Roy W. Qu
Sponsor: Lifeng Xu, Ph.D.
Microbiology

Telomeres are repetitive sequences at the ends of eukaryotic chromosomes which protect genetic information from being lost due to the end replication problem. Telomerase, a multisubunit reverse transcriptase, directs the synthesis of telomeres. Human telomeres are bound by shelterin, a multiprotein complex that regulates the activity and recruitment of telomerase. TIN2, a shelterin subunit, interacts with telomerase indirectly through another shelterin component TPP1. Heterozygous TIN2 mutations have been identified in patients of Dyskeratosis Congenita (DC), a multi-organ stem cell failure syndrome. DC patients with TIN2 mutations have extremely short telomeres. The mechanism of telomere shortening in TIN2 mutation cases is not characterized. I hypothesized that telomere shortening in DC patients with TIN2 mutations is telomerase-dependent. Engineered cell lines that are either homozygous for wild type TIN2 or heterozygous for the R282H TIN2 mutation were infected with a dominant negative (DN) form of hTERT to inhibit telomerase activity. The cell lines were passaged and telomere length over time was analyzed using a Southern blot with a telomeric probe. Our data showed that the decrease in telomere length by inactivating telomerase is epistatic with TIN2 mutation, suggesting that the TIN2 mutation causes telomere shortening through inhibiting telomerase.

Cell Sorting in Engineered Tissues

Joanna Quach
Sponsor: Kyriacos Athanasiou, Ph.D.
Biomedical Engineering

In the United States, knee meniscus tears are the most common orthopedic injury, affecting all age groups and genders. The tissue is highly avascular, and thus does not repair itself. In the Athanasiou Lab, we are engineering knee meniscus with a scaffold-free methodology (The Self-Assembling Process) using two types of cells, articular chondrocytes and meniscus cells. When assembled, these cells sort within the engineered tissue constructs, with the meniscus cells on the outside and the articular chondrocytes on the inside. In order to achieve the native organization of the tissue, we are examining how cell types sort within our engineered tissues. We believe that these cells sort because they have different cytoskeletal organization, which can be measured with a proxy, such as cell stiffness. In addition, cytoskeletal organization might be manipulated prior to tissue generation, and thus allow for tissue engineers to control cell sorting in engineered tissues. By altering different parts of the cytoskeleton with chemical agents, confirming their effects on single cell stiffness, and then correlating this to measurements of cell sorting, we will be able to find and understand the drivers of cell sorting in scaffold-free engineered tissues and control this parameter in engineered constructs.

Analysis of Z^0+jet Production in Pythia vs. Fastjet pp at $\sqrt{s_{NN}}$ = 7 TeV

Chadwick Rainbolt
Sponsor: Manuel Calderón de la Barca Sánchez, Ph.D.
Physics

The focus of this research is to analyze proton-proton collisions that create a jet with a Z^0 boson. We use simulations of proton-proton collisions. Protons contain even smaller entities inside of them called quarks and gluons. When two protons collide at high energy it is actually the quarks and gluons that collide. In some collisions between a quark and a gluon, one can create an event in which the quark scatters in the direction of the detector with a newly created Z^0 boson moving in the opposite direction, due to conservation of momentum. The physics of quarks is such that they cannot exist in free space. Due to this, the remaining quark from the collision bursts into many stable particles that continue moving in a direction similar to the scattered quark–this is called a jet. We have tools to simulate and analyze such events. For instance, Pythia is an event generator that can create one of these collisions via simulation. Another important tool is Fastjet; it is an algorithm which can analyze the final state particles of such a collision. With these simulations we can determine whether conservation laws are conserved and observe differences in the detector.

Probing Structural Elements of HIV-1 Env-Based Trimeric Immunogens via Single Particle Reconstruction

Amritpal S. Randhawa
Sponsor: R. Holland Cheng, Ph.D.
Microbiology

The Env protein is the first target for neutralizing antibodies against human immunodeficiency virus (HIV-1). Approaches to design vaccine components include focusing on pre-infection events by targeting the Env protein on the surface of the HIV-1. Env is translated as gp160, then cleaved by furin, a host serine protease, into gp41 and gp120. The gp120 subunits bind to CD4, the primary receptor, initiating a secondary epitope, to which the coreceptor CCR5 or CXCR4 bind. Obtaining the correct structure of the protein is pivotal for designing vaccines. Cryo-electromicroscopy is the process by which specimens can be visualized in their native environments. At approximately 465 kDa, the gp145 trimer is on the edge of detectability by the cryoEM technique, and this poses a difficult problem of extracting the best possible particles from the noisy, heterogeneous data set. In addition to quantifying each particles cross correlation efficient to a respective class average, validating the structure via MAP-EM, which incorporates a Bayesian inference assisting to derive the maximum likelihood in 3d classification, contributes to validating our information. The structures can be used as a physical template to help explain antigenic interactions, and possibly exposed regions that could be revealed.

Behavioral Consequences of Decreased Myelin Basic Protein Expression Within the Ventromedial Prefrontal Cortex

Maria G. Rangel
Sponsor: Karen Szumlinski, Ph.D.
Psychology

Human cocaine addicts have been shown to have deficits in working memory, a cognitive function partly mediated by the prefrontal cortex. Consistently, both humans and preclinical animal models of cocaine addiction show a decrease in white matter volume and proteins essential to the stability of the myelin sheath. The myelin sheaths surrounding the axons of neurons are necessary for efficient and reliable action potential propagation, and therefore, proper function of mammalian nervous systems. However, little is known about the behavioral consequences of manipulations to specific myelin-related proteins such as myelin basic protein (MBP). Therefore, we employed lentiviral transduction particles encoding small hairpin RNA against MBP transcripts, or control viral particles, microinjected into the ventromedial prefrontal cortices (vmPFC) of adult male Sprague Dawley rats to address the question of the role of MBP on behavioral measures of working memory. Neither the novel object nor the object-in-place behavioral tasks revealed a significant deficit in working memory function within rats with decreased levels of MBP compared to animals with normal levels. While the level of MBP may not underlie deficits in these two working memory tests, future experiments will assess other cognitive functions mediated by the vmPFC, including anxiety and goal-directed behaviors

Automated Spotlight Tracker

Lindsey A. Raven
Sponsor: Andre Knoesen, Ph.D.
Electrical Engineering

The "Spot Project" is designed to produce interesting visual and audio feedback to a user's movements through the use of a spotlight and an audio speaker system. A person moves in a random pattern, triggering the spotlight to follow and musical notes to play corresponding to where they move. A camera takes multiple images per second that are processed by the BeagleBone Black electronic processor. The BeagleBone Black process the images to find the user's position and detect movement. Once a change in position is detected, the BeagleBone responds by adjusting the spotlight's coordinates using electrical motors mounted in a mechanical fixture. In this manner, the spotlight follows the person. Simultaneously, data is sent to an electronic sound system to produce audio tones in a loudspeaker. In this collaborative project between electrical, computer and mechanical engineers, we demonstrate how the skills of engineers can be applied in making a fun and interactive project.

Understanding Uncertainty: Pakistan's Role in the Afghan War

Ahmad S. Raza
Sponsor: Gabriella Montinola, Ph.D.
Political Science

With the US war in Afghanistan coming to a close, there is a great deal of uncertainty regarding the future of Afghanistan. There are countless factors causing this uncertainty, both internal and external. One of the external factors is Pakistan, Afghanistan's neighbor to the south. Drawing on my experience as an intern at the US Department of State, I will put Afghanistan and Pakistan's rocky relationship in a historical context. This will include Pakistan's rationale for its Afghan policy, how Afghanistan's history as a frontier region may factor into its present instability, and how Pakistan's policy, if not is posture, has changed since the US invasion and the ouster of the Taliban. I will also pinpoint the underlying reasons for the uncertainty that exists in Afghanistan today, including Pakistan's interests vis a vis the Afghan presidential elections, and what the possibilities for the future.

Efficiency of Cellulolytic Enzymes Extracted From Tomato Pomace Microbial Cultures in Hydrolyzing Cellulose

Morgan Rease
Sponsor: Christopher Simmons, Ph.D.
Food Science &Technology

Tomato pomace is California's largest source of agricultural waste. Currently, pomace is mostly used in animal feed and pet food as dietary fiber or simply taken to landfills. Cellulolytic enzymes are currently commercially available. However, commercially produced enzymes are not designed to function under high solids conditions. Enzymes isolated from high-solids agricultural waste conditions have been enriched with these conditions in mind and may exhibit greater efficiency. Success of the cellulolytic enzyme cultures on tomato pomace could lead to reduced amounts of bio-waste in California, reduced water waste due to the high-solids nature, and new markets for California's already massive processing tomato industry. If pomace could be incorporated into the biofuels industry, which is being looked to for sustainable fuel sources, it would add value to what is currently cheap waste. Microbe cultures were enriched on high-solids tomato pomace and their enzymes were extracted. High solids conditions were chosen because reduced water levels not only would minimize water waste, but would also lower the energy required to run hydrolysis. Extracted enzymes were compared to commercial enzymes in regards to their digestive capability under high-solids conditions. Digestive capability was assayed with DNS reagent and read on a plate reader.

Activism Across Time at UC Davis

Jimmy Recinos
Sponsor: Gary Goodman, Ph.D.
Communication

Many activists today are still grappling with precisely what the events of November 18, 2011 at UC Davis accomplished. They are also questioning how and why critical dialogue about the event has largely lost momentum. One helpful way of reaching a few answers might be to juxtapose Occupy/Decolonize Davis with other forms of activism at the university as lead by organizations such as KDVS, The Third World Forum, and the hunger strikes at Davis which lead to the Ethnic Studies department and crosscultural center on campus. By exploring this history, this analysis aims to dispel a common misperception that UC Davis has historically been disengaged with movements for social change. More importantly, by looking at the various generational accomplishments made by the aforementioned organizations at UC Davis, this analysis will consider how student movements can and have established continuity at the university beyond the general four to five-year span of the undergraduate career.

Quantifying Non-Uniform Mapping due to Charge Transport and Its Effect on Images

Elodie Resseguie
Sponsor: J Anthony Tyson, Ph.D.
Physics

In instrumentation, there are many systematic errors that need to be minimized. One of these systematics can be examined by measuring the mapping of star images projected on the charged couple device (CCD) to the output pixels. Using the Large Synoptic Survey Telescope (LSST) reimaging system, galaxies and stars can be modeled using a pinhole array and by shifting the position of the reimaging system, the resultant position of the image can be compared to the original position of the array. The non-uniform mapping, causing astrometric errors, is due to charge transport in the silicon, a problem aggravated by the fact that the CCDs used are 100 um thick. Thus the goal is quantify this effect using vendors' CCDs. With understanding of the mapping process in silicon CCDs, images from the Deep Lens Survey (DLS) will be analyzed to correct for this effect, which would improve the knowledge of the shape transfer function leading to smaller systematic errors in galaxy shapes.

Childless Hope: Examining Assisted Reproductive Technologies in Ultra-Orthodox Judaism

Paula Reves
Sponsor: Meaghan O'Keefe, Ph.D.
Religious Studies

This project is a Religious Studies and Bioethics paper examining assisted reproductive technologies in Ultra-Orthodox Judaism. The commandment, "be fruitful and multiply" is very important to Ultra-Orthodox Judaism. As it is a prescribed commandment from the Torah, the inability to procreate can be seen as embarrassing or shameful among married couples in the community. This paper addresses the permissibility of artificial insemination, in vitro fertilization, and surrogacy among Ultra-Orthodox Jews. It also, on a larger level, examines how Ultra-Orthodox Judaism engages with modern medical technologies. It uses case studies and contemporary rabbinic opinion to work through the different reproductive technology and the challenges that it poses. It is important to acknowledge that many of the assisted reproductive technologies come with challenges and restrictions. The issue is further complicated when examining egg storage and donation, an important aspect of assisted reproductive technologies. With the growing biotechnologies available, some of them may be at odds with traditionalist religious communities, such as Ultra-Orthodox Judaism. This project has significance for examining how traditionalist communities adapt to modern technologies.

Examination of Root Angle Phenotype in Heterozygous Loci in *Solanum lycopersicum* x *Solanum pennellii* Hybrids

Zachary C. Reynado
Sponsor: Siobhan M. Brady, Ph.D.
Plant Biology

As global temperatures rise we must look into developing more drought resistant crops. My research is using a wild relative of tomato to discover new alleles that alter traits. To carry this out, I will be using a variety of domesticated tomato (*M82*) and a wild tomato relative, *Solanum pennellii (Penn)*. Experiments have shown that *Penn* is far better at handling drought than *M82*. This difference may be due to angle of growth of the root. *Penn* roots grow at about 50 degree angle to gravity, compared to an almost-vertical 10 degree angle for domestic tomato. Other data collected with *M82*/*Penn* introgression lines, which are individuals with small insertions of DNA from *Penn* placed into a large background of *M82*, show that there are several individual loci that control root angle. Each of these introgression lines are homozygous across specified loci. With this knowledge I have crossed introgression lines to *M82* to produce F1 generation hybrids that are heterozygous across these loci to see how phenotype is affected. I will continue to produce more hybrids at different introgression loci, and will measure their angle phenotypes and determine the phenotypic ratios of different angles in their offspring, the F2 generation.

Corticotropin Releasing Hormone Gene Methylation in Human Placenta Samples From Pregnancies at Risk for Autism Spectrum Disorders

Kira D. Rienecker
Sponsor: Janine M. LaSalle, Ph.D.
Medical Microbiology & Immunology

Autism spectrum disorders currently are diagnosed as impairments in learning and social interactions as well as restricted and repetitive interests and behaviors by age three. A prospective study at the UC Davis MIND Institute, Markers of Autism in Babies: Learning Early Designs (MARBLES), aims to identify genetic, environmental, and epigenetic biomarkers useful for early diagnosis. We hypothesize that autism may be associated alterations of the epigenetic mark of DNA methylation, resulting in the improper transition of autism-associated genes present in partially methylated domains (PMDs) in undifferentiated tissues to highly methylated domains (HMDs) in neurons. Human term placenta is a highly accessible tissue that contains detectable PMDs and HMDs and is collected in the MARBLES study. Corticotropin releasing hormone (CRH) is a stress hormone whose early elevation of expression in placenta during pregnancy is correlated with a higher incidence of preterm births and autism. This project seeks to investigate possible epigenetic dysregulation of CRH in autistic versus typical development placenta samples by using bisulfite conversion and pyrosequencing to measure the methylation CRH. Differing methylation levels could support the current model of the relationship between CRH and autism and provide an epigenetic biomarker for early diagnosis.

The Baggins End Collective Community: Cooperation, Conflicts and Institutions

Elias J. Rivera
Sponsor: Richard McElreath, Ph.D.
Anthropology

Human societies exhibit large-scale cooperation with non-relatives – a unique feature dissimilar from any other animal. In cooperative societies, group cohesion involves mitigating conflicts that arise from collective-action problems. This study investigates whether the role of governance institutions in solving collective-action problems is affected by community turnover. Here, I examine the decision-making that goes on within and between cooperative housing units in Davis, California. This is comprised of ethnographic data from community meetings at the Baggins End Collective Community in Davis. I also take a quantitative approach that is comprised of aggregated data from archival documents – this data will examine turnover rates and membership patterns from the Baggins End Collective Community since its inception in 1972. This study finds that group selection plays an important factor in group formation – moreover, there are aspects of individual behavior that characterizes how institutions work in various cooperative housing units. Analysis is ongoing, preliminary results suggest that where the rate of turnover is significantly high, conflicts of interests arise in the absence of a stable institution to assist in facilitating cooperation.

A Method for Blood Biomarker Amplification Using High-Intensity Focused Ultrasound

Elise Robinson
Sponsor: Katherine Ferrara, Ph.D.
Biomedical Engineering

Nonsurgical and sensitive diagnostic techniques are important for early detection of cancer. Assays that measure the serum biomarker carcinoembryonic antigen (CEA) are commonly used in clinical settings to indicate the presence of colon cancer. However, tumors naturally release CEA in small amounts, resulting in low blood concentrations that are difficult to detect. I propose the use of high-intensity focused ultrasound (HIFU) to increase the release and surface expression of CEA *in vitro*. I have designed a 3-D encapsulation phantom and developed a method to accurately recover and count cells. Subsequent experiments in which I targeted the 3-D phantoms with HIFU indicated that CEA release is proportional to the HIFU amplitude and that longer exposure times decreased cell viability. Phantoms targeted with 45 seconds of HIFU showed a 10% increase in CEA cell surface expression versus no treatment controls. Using this procedure, I will determine the HIFU parameters that maximize CEA release and determine the timing of CEA expression, quantifying all results. This research project aims to increase levels of blood biomarkers and is therefore an important step toward disease detection and management.

Genetic Analysis of a Recently Identified Suppressor Mutation of the *Arabidopsis* Ovule Mutant, *ino-4*

Selina M. Rodriguez
Sponsor: Charles Gasser, Ph.D.
Molecular & Cellular Biology

As the precursor to seeds, ovules play a critical role in plant sexual development. The Gasser lab focuses on understanding the genetic regulation of the development of ovules. *Arabidopsis thaliana*, a plant model organism, is used in this study due to its rapid generation time and extensive genetic resources. The ovule has two integuments (inner and outer), which protect the embryo sac and will later develop into the seed coat. The *INO (INNER NO OUTER)* gene is required for the initiation and growth of the outer integument. When mutated, the ovule produces only an inner integument. A partial loss of function mutant, *ino-4*, causes the plants to have reduced outer integument growth, yet still produce seeds. Using this mutant an enhancer/suppressor mutant screen was performed to isolate other genes that affected integument growth. One suppressor that was found (*i20*) showed a very noticeable restoration of the outer integument and previous analysis showed that it acts semi-dominantly. This study works to understand the *i20* mutant by analyzing whether it can suppress other *ino* alleles and assessing if the expression of *INO* is affected. The current focus is to identify which gene has been mutated through mapping and sequencing.

Tracking Pairing and Compaction of Meiotic Chromosomes Using Fluorescence Microscopy in *Saccharomyces cerevisiae*

Tomás C. Rodríguez
Sponsor: Sean M. Burgess, Ph.D.
Molecular & Cellular Biology

Meiosis is a specialized process involving two rounds of cell division and recombination between homologous chromosomes during which faithful pairing and segregation of the homologs is integral in the formation of viable haploid gametes. Because Meiosis I is a period defined by especially dynamic chromosome movements, understanding how these structures are directed before segregation is key in understanding molecular events preventing nondisjunction. I hypothesize that compaction and pairing of centromeres and telomeres on homologous chromosomes are spatially and temporally coordinated. To address this question I developed an assay to track the pairing behavior of fluorescently-tagged chromosomal loci during meiosis in *Saccharomyces cerevisiae*. First, I created a yeast strain with fluorescent centromeres and telomeres on chromosome V. Next, I synchronized a population of cells at G_0 phase and collected three dimensional image stacks of individual cells in one hour increments throughout meiosis. Z-projections of these stacks reveal discrete foci representing CENV and TELV. I found that the 1 TELV:2 CENV foci arrangement was the predominant class showing a bimodal distribution during pairing and unpairing events, suggesting telomeres lead pairing. Additionally, measurements taken in >500 cells show a coordinated compaction of chromosomes. Finally, I noted a novel conformation in meiotic chromosomes.

Miscues in Skew: Tackling Misconceptions in Graphical Analysis Using Bio-Statistics Curriculum Modules

Luis D. Rodriguez Sainz
Sponsor: Marco Molinaro, Ph.D.
iAMSTEM Hub

Recent studies have shown an ever-growing need for teaching statistical analysis techniques across all disciplines. Being able to provide evidence-based arguments and critically evaluate data-based claims are important skills all students should have (Garfield & Ben-Zvi, 2007). The current study analyzed methods of engaging students in learning bio-statistical terms and methods and identifies students' common misconceptions in the process. The focus of this poster is the misconceptions students have in accurately recognizing the direction of skew in distributions. The study included a nationwide convenience sample of 25 teachers and 649 students. To collect learning gains, a pre- and post-lesson assessment was administered. Quantitative data was collected through multiple-choice questions where students must correctly identify a distribution as skewed right or left and open-ended questions prompting students to identify two similarities and two differences on a pair of distributions using statistics terms. Coding was used to extract useful data from student responses. Preliminary analyses show a reduction in student misconception of skew and gains in students understanding of skew. Furthermore, the study suggests effective methods of cutting knowledge gaps in students and furthering their understanding of skew and distributions.

Internalization, Systemic Transport and *In-Planta* Survival of *Salmonella enterica* in Cilantro and Celery After Soil Contamination During Irrigation

Jeremy Roland
Sponsor: Trevor Suslow, Ph.D.
Plant Sciences

Salmonella enterica contamination of produce, consumed fresh, has been increasingly associated with incidents of illness and multistate outbreaks over the past ten years. In the last decade, several studies have demonstrated the potential for human pathogens to enter plant tissues, including through root absorption and transport within the plant vascular system. Once internalized, surviving populations are protected from surface disinfectants during washing. This project aims to characterize the extent of internalization and survival of *Salmonella enterica*, marked with antibiotic resistance to facilitate recovery, in both cilantro and celery in micro and mesocosm studies. Cilantro and celery plants, will be inoculated with four *Salmonella enterica* concentrations, log 2, log 4, log 6, and log 8 CFU/mL. After 24 to 96 hours, the aerial shoots will be harvested and processed for qualitative and quantitative evidence of pathogen survival and distribution in the plant tissue. For cilantro, after harvesting, the plants will be re-grown under greenhouse conditions, as is commercial practice, to determine the presence of the inoculated, *Salmonella enterica* in the new young leaves. The results of this ongoing project are intended to better understand irrigation water quality and risk potential of internalized *Salmonella* as endophytes in plant tissues.

Exploring the Genetics of Leaf Development Through Hybridization and Transcriptomics

Eric J. Ronne
Sponsor: Neelima R. Sinha, Ph.D.
Plant Biology

Leaves are the interface through which plant species capture sunlight and carbon dioxide in order to synthesize sugars. Leaf morphology, therefore, plays an important role in determining a plant's photosynthetic ability. Here, we seek to characterize the development of leaf morphology from a genetic standpoint by performing genetic analyses of hybrid offspring of two plant species, *Lepidium hyssopifolium* and *Lepidium oleraceum*. While the parental species have simple and complex leaves, respectively, the hybrid lines exhibit a wide variety of intermediate leaf morphologies. First, a transcriptome (set of expressed RNA molecules) for each parent species is assembled from parental sequence data. Mapping of sequence data from the hybrid lines back to each parent transcriptome reveals the parental origins and expression levels of the expressed genes in the hybrid lines. This information, along with the observed leaf phenotypes of the hybrid plants, will provide insight into the roles that specific genes and groups of genes play in the regulation of leaf development and morphology.

Insights Into Alumni Giving at UC Davis

Danielle Rosenberg
Sponsor: Katrina K. Jessoe, Ph.D.
Managerial Economics

Using individual data from the entire population of UC Davis alumni and donors, this study explores if patterns exist in alumni and non-alumni giving. This study is the first to explore the behavior of non-donors, small donors, medium donors, and large donors as well as between alumni and non-alumni friends of the University. Four main results emerge from this analysis. Age and physical distance to UC Davis are significantly and meaningfully correlated with the probability of making donations. Both the probability and the size of donations increase with age and physical proximity to the campus. A third insight from our study is that participation in student groups and alumni organizations is positively linked to the likelihood and magnitude of donations. Lastly, the largest donations to UC Davis are from friends and organizations, rather than alumni and individuals. These results are informative for designing better targeting strategies for future fundraising efforts.

The Protestant Reformation, the Development of Individualism, and Americanism

Samuel Rothmann
Sponsor: Allison Coudert, Ph.D.
Religious Studies

Individualism is one of the premier features of Western culture. Evidence can be seen in American political ideologies, such as Libertarianism, which emphasize the individual over communal ways of thinking. A key factor in the development of individualism was the Protestant Reformation, but this has not been sufficiently stressed in most discussions of individualism. The purpose of this paper is to rectify this inadequacy by explaining how key factors during the Protestant Reformation, such as the Protestant doctrine of the "Priesthood of all Believers" and the notion that every individual should read the biblical text, were essential for the development of individualism. Martin Luther ignited a revolution that undermined the institutional foundations of the Catholic Church and fostered entirely new ways of thinking about individual rights and responsibilities. These ideas have had a profound influence on shaping the Western, notably American, character.

Yttrium Nanoparticles: Coating Optimization for Use in Biological Systems

Mark Rupasinghe
Sponsor: Angelique Louie, Ph.D.
Biomedical Engineering

Cancer is one of the leading causes of death in the United States, making early detection and treatment crucial for patient recovery. Current detection methods such as positron emission tomography (PET) have high sensitivity, and tumor marker blood tests have high specificity, but treatment options such as radiation therapy and chemotherapy are non-targeted and nonspecific. Therefore, a theranostic probe capable of both earlier detection and more targeted treatment of cancer is needed. Previous studies have shown that yttrium-89 becomes PET-active zirconium-89 when irradiated with protons, and becomes therapeutic beta-minus emitting yttrium-90 when irradiated with neutrons. In order to use yttrium's diagnostic and therapeutic properties in biological systems, it must be made water soluble. We hypothesize that coating yttrium nanoparticles with either (3-aminopropyl) tetraoxysilane, polyethylene glycol, dextran, or micelles, will allow us to make yttrium nanoparticles water soluble. To confirm successful coating and solubility, a combination of attenuated total reflectance, scanning and tunneling electron microscopy, and dynamic light scattering techniques will be used. By coating the surface of yttrium nanoparticles to make them water soluble, yttrium's theranostic properties could be used in biological systems for earlier detection and treatment of cancer.

The Middle East and Muslim Women in U.S Media Representations: An Analysis of the Term Arab in the *New York Times* in the Years 1930-1939

Gheed Saeed
Sponsor: Suad Joseph, Ph.D.
Anthropology

The following analysis is an evaluation of the textual representations associated with the term "Arab" as identified in the *NYT* for the decade of 1930 to 1939. Articles found in Proquest were inclusive of unfavorable jargon, including, but not limited to, the term "slain" when discussing Arab transgressions and Arabs as "rebels." The *New York Times* (*NYT*) is hailed as a fact-based, unbiased and in-depth newsource, however, my work dismisses this claim in terms of its portrayal of Arabs and the Arab world. The *NYT*'s portrayal of the Arab world is framed in the context of Edward Said's Orientalism in its exemplification of the misuse of "othering" and Western superiority in the U.S. media in relation to the region of the Middle East. A comprehensive archival evaluation of 509 *NYT* front page articles, editorials, and editorial cartoons, was implemented in the abovementioned period via Proquest, an online newspaper archive, for the purpose of gaining insight into the evolution of the Western lens on the Arab world. This research is part of a larger project analyzing 150 years of The *New York Times* conducted in the lab of Professor Suad Joseph.

Ischemic Conditions Drive Mesenchymal Stromal Cell (MSC) Osteogenic Differentiation

John Sagun
Sponsor: J. 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 such as limited availability and cost. Mesenchymal stromal cells (MSC) 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 levels. While the effects of hypoxia on MSC are known, MSC behavior under serum deprivation is poorly characterized. The purpose of this project is to assess the contribution of both serum and oxygen concentrations on MSC osteogenic differentiation *in vitro*. MSC will be subjected to both growth and osteogenic media containing 1%, 5% or 10% serum under hypoxic (1%), normoxic (5%), or atmospheric (21%) oxygen tension in 2D culture for 3 weeks. Data show that low serum environments stimulate alkaline phosphatase activity, calcium deposition, and other markers of osteogenic differentiation, over the given culture period.

Ecological Diversity in the Effects of High and Low Nutrient Levels on the Plant Shade Avoidance Syndrome

Kamalpreet Sahota
Sponsor: Julin N. Maloof, Ph.D.
Plant Biology

When plants grow in dense stands they use energy and resources to grow upwards to compete for light at the top of the canopy. This response is termed the Shade Avoidance Syndrome (SAS). While the SAS response is beneficial in nature, it can cause reductions in crop yield if resources are used for competitive growth rather than for yield. Additionally, plants are competing for nutrient resources below ground. The purpose of this research is to gain more knowledge about the interaction between shade avoidance aboveground and nutrient availability belowground in the model plant *Arabidopsis thaliana*. I tested this interaction by growing accessions of *Arabidopsis thaliana* for the shade avoidance response in contrasting nutrient conditions in sun and shade. I am comparing the their response to a wild-type control. Based on previous experiments, Col has been shown to have longer petioles in the shade. I predict that Col will have a longer blade length and larger area in both HN and LN treatments in the shade condition. I also predict that the Bur will not differ in its response to shade in the either high or low nutrient treatment. I hypothesize that the petioles and leaves will be more elongated in Sha in the shade than in the sun treatment, and that Sha in the low nutrient treatment will show less of a shade avoidance response in comparison to the control Col.

The Genetic Underpinning of a Modified Fruit Fly Ovipositor

Raul Salazar
Sponsor: Artyom Kopp, Ph.D.
Evolution, Ecology & Biodiversity

Drosophila species typically lay their eggs in decaying fruit and other dead vegetation, making them harmless to agriculture. However, the invasive pest, *Drosophila suzukii*, which has caused severe agricultural damage, is capable of depositing its eggs into certain intact, ripening fruits. This acquired ability has been attributed to a distinct morphological difference in the egg-laying organ, the ovipositor, which has undergone a recent evolutionary change granting *D. suzukii* access to an ecological niche inaccessible to other *Drosophila* species. To better understand the evolutionary origin of this trait, we seek to identify the genetic changes necessary to generate a serrated, elongated ovipositor from the blunt, non-serrated ovipositor of the model species, *D. melanogaster*. Utilizing the UAS-GAL4 system, a widely used method for driving spatially restricted gene expression, we have analyzed the effect of modulating the levels of specific candidate genes in the *D. melanogaster* ovipositor during the development of this structure. Our analysis of the genetic avenues available for modifying the morphology of the egg-laying organ may lead researchers closer to an understanding of the genetic basis of the evolution of a novel, adaptive phenotype in an ecological setting.

Black Aryans?: A Study of Iranian National History From the Perspective of Enslaved Africans and Their Descendants in Iran

Mona Salimi
Sponsor: Bettina Ng'weno, Ph.D.
African American & African Studies

The trade of enslaved Africans is a significant part of Iran's history but one that has been generally glossed over or mentioned in passing in national historiographies. Enslaved Africans and their descendents were identified by names such as *zangi, nubeh, siyah, bombassi, balooshi* and *habeshi*; names that continue to be used to refer to Africans as well as dark-skinned peoples in general. I am researching the textual presence of enslaved Africans and their descendants in Iran in order to reconstruct the experience of slavery as a history of Iran. What can we learn about social life and politics from this account? My aim is to rearticulate national history in a way that is faithful to the experiences of the sub-nationalized. If enslaved Africans existed in Iran and were a part of the country's history, what are the consequences for Iranian national identity? What are the implications of a decolonized, Afro-centric Iranian national history? I argue that the cultural dominance of the Aryanist paradigm maintains a biased account of Iranian history that excludes African-Iranians and their descendants. How does putting ourselves in the shoes of the enslaved challenge Euro-centric, nationalist constructions of Iranian identity?

Purification of HIV-1 Env Trimer for Incorporation Into Nanolipoprotein Discs

Varsha S. Salunkhe
Sponsor: R. Holland Cheng, Ph.D.
Biochemistry & Molecular Biology

The challenges faced when isolating the HIV-1 (human immunodeficiency virus type 1) envelope, Env, protein are due to its unique and delicate biochemistry. gp160 is encoded by the *env* gene, a component of the HIV-1 genome, and is the precursor to non-covalently bound subunits gp41, a hydrophobic transmembrane protein, and gp120, a hydrophilic protein. To isolate the gp160 complex in its native state, it is important to stably extract it and prevent the separation between gp41 and gp120. Trimeric Env was expressed in Chinese hamster ovary (CHO) cells previously transfected with HIV-1 *env*. Stabilization of a membrane-embedded trimeric complex bound non-covalently is a challenge to purify, and thus a protease inhibitor cocktail was used during lysis to ensure that the quaternary structure is retained. Methods of detergent solubilization and phase separation were employed to reconstitute native-like Env trimers. Results proved that detergent solubilization kept gp41 and gp120 intact. To concentrate the gp160 complex, lectin agarose bead affinity chromatography was used. This lysis and purification process ensures that Env protein will be in its native form and be ready to be incorporated into nanolipoproteins, nano-sized discs that mimic a lipid bilayer, for further structural analysis by cryoelectron microscopy.

Chronic Exposure to Cigarette Smoke Enhances Proliferation of Airway Epithelial Cells by Engaging the Ceramide-Generating Machinery

Michelle R. Santoso
Sponsor: Tzipora Goldkorn, Ph.D.
Internal Medicine

Lung cancer is the second most common form of cancer and is the leading cause of cancer death among both men and women. Cigarette smoke has long been established as the main contributor to the disease, accounting for 80-90% of lung cancer cases. We herein propose a mechanism for cigarette smoke (CS) promoted proliferation of human airway epithelial (HAE) cells, with implications for tumorigenesis and subsequently cancer of the lungs. We determined that the enzyme principally responsible for this proliferation is neutral sphingomyelinase 2 (nSMase2), which is over-expressed upon chronic exposure to CS. This connection was established following comparison of proliferation rates amongst HAE cells chronically exposed to CS and HAE cells over-expressing nSMase2. Further experiments then determined that the proliferative role of nSMase2 is specific to the catalytic activity of nSMase2 that breaks down sphingomyelin and generates ceramide. Finally, we showed that the CS-dependent enhanced proliferation of HAE cells can be inhibited by drugs that target sphingosine kinase-1 and sphingosine-1 phosphate (S1P) receptors, implicating the conversion of ceramide to S1P. These findings thus propose that nSMase2 has a role in CS-induced lung epithelial proliferation and suggest its inhibition as a target for further therapeutic research in lung cancer.

Nanos2 is Required for Germline Stem Cell Production in Zebrafish

Federica Sartori
Sponsor: Bruce W. Draper, Ph.D.
Molecular & Cellular Biology

Zebrafish females can produce hundreds of eggs per week. It is hypothesized that continuous egg production requires a population of germline stem cells (GSCs), but it is not known how these stem cells arise during development. In mice, the *nanos2* gene, which encodes a conserved RNA binding protein, is a specific marker of GSCs in the testis and is required for GSC specification. The Draper lab has recently determined that the zebrafish *nanos2* ortholog is expressed in a subset of premeiotic germ cells in the ovary. We therefore hypothesize *nanos2*-expressing cells are GSCs, and that *nanos2* is required for GSC production. As a test of this hypothesis, we have used the TALEN genome editing technology to produce loss-of-function mutations. Consistent with our hypothesis, we have found that nanos2 mutant animals do not produce and/or maintain germ line stem cells. We are in process of further characterizing this mutant phenotype.

Obsidian Trade Networks at CA-CCO-138

Andrew D. Scott
Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

Obsidian was a valuable material in pre-contact California, and was used by tool-makers to produce a wide variety of tools, including arrow points and knives. While highly desired as a raw material, obsidian sources are few and far between in California, and the stone was extensively traded throughout the state. This study uses geochemical techniques (X-Ray Fluorescence) to determine the source of obsidian artifacts found at CA-CCO-138, or the Hotchkiss mound, an ancient site located in the California Delta near the modern city of Oakley. This site was occupied mainly between AD 1000 and 1700, by Miwok peoples at the time of contact. Two potential obsidian sources, one in the Napa Valley, the other on the eastern side of the Sierra Nevada, are hypothesized to have supplied flintknappers at the site. By comparing the distribution of obsidian sources at this site against others dating earlier in time, we can trace changes in ancient trading networks.

Correlation Between Cervical Muscle Strength to Its Cross-Sectional Shape and Area

Charmaine Seguro
Sponsor: Nesrin Sarigul-Klijn, Ph.D.
Aerospace Science & Engineering

The demand for evidence based medicine is growing. Clinicians as well as policymakers and insurance companies want to be informed about the best available evidence for the effectiveness of treatment modalities. Considering neck pain, a common musculoskeletal disorder, there is still a lack of evidence in favor of any treatment modality, specific clinical test or questionnaire. Based on literature values, the aim of the present study was to analyze the differences in muscle size and muscle shape of specific neck muscle groups, such as the cervical multifidus muscle, between adult patients with chronic neck pain and healthy individuals. These results may facilitate clinical decision making and reasoning concerning the choice of treatment. Thus far, initial findings suggest that individuals with generalized neck pain have smaller cross sectional area of the muscles compared to healthy individuals. Cervical musculature is also found to be significantly weaker among patients with chronic neck pain than among healthy controls, showing that decreased neck muscle strength may be a contributing factor to neck pain. Concentrating on intensive strengthening of these cervical musculature may significantly reduce pain and disability, which would also increase the patient's range of motion and mobility.

Expanding the MALDI-TOF MS Library to Include *Actinomyces*, a Bacterium Encountered in Companion Animal Abscesses

Guadalupe E. Sepulveda
Sponsor: Heather Fritz, D.V.M., Ph.D.
Pathology, Microbiology & Immunology

Bacteria belonging to the genus *Actinomyces* are commonly associated with abscesses secondary to foxtails and grass awns in companion animals. *Actinomyces* are not readily identified using traditional biochemical methods, yet it is essential to accurately identifying the causative organism in an infection to direct appropriate antibiotic therapy. A novel approach to bacterial identification that has very recently been introduced in diagnostic microbiology laboratories is Matrix-Assisted Laser Desorption Ionization - Time of Flight Mass Spectrometry (MALDI TOF MS). This method generates a protein spectrum profile for an unknown isolate which is unique to a given species, much like a fingerprint, and can be matched to a reference spectrum for identification. While this method has been validated for a wide variety of bacterial organisms, it has not yet been validated for *Actinomyces* because the existing reference spectra database does not include *Actinomyces* (no matching spectra available). In this study, spectra will be generated for 30 confirmed *Actinomyces* isolates from the UC Davis Veterinarian Medical Teaching Hospital. Each sample spectrum will be used to build a reference library. MALDI-TOF will then be evaluated for an additional 30 banked 'suspected' *Actinomyces* isolates and compared to the identifications using the 'gold-standard' method of DNA sequencing.

Assessment of Motor and Cognitive Function in a Rodent Model of Sports-Related Concussion

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 US with over 5.3 million TBI patients suffering from persistent deficits and reduced quality of life. The pediatric population makes up nearly 1/2 million TBI related ER visits in the US annually. The goal of this project was to develop a model of sports-related concussion in the pediatric rodent. We hypothesized that concussive injury would lead to motor and cognitive deficits in the first weeks following injury and that deficits would increase in an injury severity-dependent manner. Motor behavior was assessed before and after injury and cognitive function in a spatial maze task was evaluated after injury. We observed a significant motor impairment that recovered over the first four days post injury. Following a moderate but not a mild injury we observed significant impairment in spatial learning. Histological analysis of the CA1 and CA2/3 regions of the hippocampus did not identify any changes in the number of hippocampal pyramidal neurons. With the number of sports-related concussions on the rise, it's imperative to develop a rodent model that can be used to better understand the pathophysiology of injury and for development of potential treatment options.

Muscle Protein Synthesis, Degradation and the Effect of mTORC1 After Resistance Exercise

Baubak Shamim
Sponsor: Keith Baar, Ph.D.
Neurobiology, Physiology & Behavior

The mammalian target of rapamycin complex 1 (mTORC1) is a protein complex responsible for cell growth, protein synthesis, and transcription. Activation of mTORC1 through acute resistance exercise has been shown to increase rates of muscle protein synthesis immediately after exercise. However, it remains unclear whether mTORC1 signaling impacts muscle protein synthesis in later stages of recovery. Thus, the aim of the current study is to measure anabolic signaling, rates of muscle protein synthesis, and proteasome activity after acute resistance exercise. To do so, 8 month old rats underwent unilateral hindlimb stimulation to simulate resistance exercise. Muscle samples were collected at 1.5, 3, 6, 18 and 36 hours after resistance exercise, as well as at 18 hours after resistance exercise with rapamycin treatment to inhibit mTORC1 activity. Muscle samples from the stimulated leg were analyzed relative to the contralateral non-stimulated leg which acted as a rested control. The results of this study can help provide a better understanding of the effect mTORC1 has on ribosomal biogenesis and muscle protein synthesis.

An Improved Method of Fatty Acid Analysis in Blood Plasma by GC-MS

Deepika Sharad
Sponsor: Oliver Fiehn, Ph.D.
Biochemistry & Molecular Biology

Fatty acids play an essential role in human body function. Their functions include cell phospholipid membrane development, signaling pathways and most notably contribute to ATP formation. Optimum levels of fatty acids in the body are critical, as low levels are associated with neurological diseases. Additionally, high levels can contribute to diabetes, cardiovascular disease, and various types of cancer. Analyzing the fatty acid composition and level is essential for medical analysis in many cases. Several methods exist for fatty acid analysis in blood plasma using Gas Chromatography-Mass Spectrometry (GC-MS). These methods, however, demand long analysis time. This study is designed to establish a robust method for screening fatty acids in blood plasma. 44 fatty acids, both saturated and unsaturated were analyzed using C9:0 as internal standard. Fatty acids were methylated with methanol/acetyl chloride/toluene solution and a short sonication time. The short GCMS run time shows 84–86% recovery of free fatty acids and 96% recovery of triglycerides and phosphatidylcholine.

A House Divided: Gender Division and Architectural Specificity in Susan Glaspell's *The Verge* and *Alison's House*

Hannah N. Sharafian
Sponsor: Jon D. Rossini, Ph.D.
Dramatic Art

During the 1910s and 20s, the women's rights movement and an increase in female playwrights meant more American plays dealt directly with issues of female independence and gender onstage. Often these plays frame the dialogue between genders as one that retains the innate "femininity" of women despite calling for equality of opportunity. Susan Glaspell's *Trifles* depicts gender in a similarly divisionary vein through the use of domestic space. However, in her later plays, *The Verge* and *Alison's House*, men and women negotiate ownership, authority and liberation in ways less tied to normative gender identities. These plays shift away from traditional associations between domesticity, femininity and the space of the kitchen to suggest more fluid and ambivalent relationships that reflect both the challenges of 1920s feminism and Glaspell's own life and complicated marriage to George Cram Cook. *The Verge* and *Alison's House* are less invested in traditional gender divisions than in specific and overlapping issues of ownership, desire and power in rooms beyond the kitchen, offering a response to feminism's struggles in the face of universal suffrage that reflects the real complexity of gender relationships both onstage and off.

Bovine Milk Peptides Stimulate Lipogenesis and Inflammatory Response in Human Sebocytes

Shreya Sharma
Sponsor: Raja K. Sivamani, M.D.
Dermatology

Acne is a widely prevalent chronic inflammatory disease. Lipid production, by human sebocytes, plays a critical role in acne pathogenesis. The correlation between diet and acne has been controversial with some epidemiological studies associating milk intake with worsening acne. Here, we investigate the influence of bovine milk peptides (bMPs) on human sebocyte lipogenesis and inflammatory response. The bMPs (0.01 mg/mL) were incubated with an immortalized human sebocyte cell line (SEB-1). Modulation in lipid content was assessed with a Nile Red lipid assay and levels of the inflammatory cytokine IL-6 was measured by ELISA. The bMPs increased SEB-1 lipid content by 20.2% ($p<0.001$). bMPs increased SEB-1 production of IL-6 by 10.2-fold ($p<0.001$) in comparison to the untreated control. Although tumor necrosis factor (TNF) elevated sebocyte IL-6 release by 4-fold ($p<0.001$) the combination of both TNF and bMPs elevated IL-6 production by 22.8-fold ($p=0.001$). In summary, bMPs activate lipogenesis and an inflammatory response in sebocytes.

The Middle East and Muslim Women in U.S. Media Representations: Arab Tales: Deconstructing Imperialist Narratives in the *New York Times*

Saliem W. Shehadeh
Sponsor: Suad Joseph, Ph.D.
Anthropology

My research questions the *New York Times* (*NYT*) portrayal of the Middle East through textual and visual data from the years 1900-1909. My research demonstrated that a pattern of misrepresentation existed within the *NYT*. People of the Middle East were systematically represented as carefree, simple, and relaxed. This judgment reinforced notions of incompetency in areas of economic, civil, and political development, further reinforcing the belief that there was a need for European assistance in the Middle Eastern region. Edward Said's *Covering Islam* argues that the unquestioned authority of the media improperly frames the construct of Islam in the Middle Eastern region for its readership. Such frames include an outmoded, anti-intellectualist, and dangerous Islam. This type of representation in the *NYT* not only counters its reputation as a liberal and unbiased news source in the U.S., but also leads to skewed perceptions of this region within academic scholarship. I examined 1626 articles under the term "Arab" in the *NYT*. Through in-depth analyses of 106 relevant articles I document aforementioned reoccurring patterns. This research is part of a larger project analyzing 150 years of the *New York Times* conducted in the lab of Professor Suad Joseph.

Tolerance Levels of Different Yeast Strains in Ionic Liquids

Shuang Shi
Sponsor: Christopher Simmons, Ph.D.
Food Science &Technology

Production of fuels from carbohydrates in food processing waste is important for sustainable energy. In order to improve the breakdown of lignocellulose, the primary source of carbohydrates in most food processing wastes, pretreatment is needed. Dissolving waste biomass in ionic liquids (IL) is a promising new pretreatment strategy. One challenge is that small amounts of the residual ionic liquid remain on pretreated lignocellulose, which can inhibit the yeast responsible for fermentation of biomass into biofuel. The goal of this study was to identify yeasts tolerant to the ionic liquid 1-ethyl-3-methylimidazolium acetate that can either ferment sugars from IL-treated biomass or provide IL-tolerance pathways that can be engineered into other yeasts. In this study, 80 strains of yeasts were screened for tolerance to four different levels (0%, 1%, 2% and 4%) of ionic liquid. Growth rate was monitored by measuring the absorbance of the cultures every six hours. Differences between various yeast strains in tolerance of ionic liquid were observed. These data were used to characterize yeast strain IL tolerance and assess their potential as sources of pathways for ionic liquid-tolerance in yeast.

Examination of Cellular Activity for Preserving Cartilage Cell Viability During Allograft Storage

Kie Shidara
Sponsor: Dominik Haudenschild, Ph.D.
Orthopaedic Surgery

Osteoarthritis is a degenerative joint disease where the cartilage of joints wears away with overuse. It is the most common type of arthritis, affecting an estimated 27 million Americans over the age of 25. A leading way to treat this disease is by surgically removing cartilage from donors to replace the focal defects in affected patients. Cartilage explants can only be stored for 12-14 days because the cellular activity progressively decreases during this time, and an increasing number of protein-degrading enzymes are released into the cellular matrix. Allograft storage is a way to preserve cell viability during this short time frame. We hypothesize that reducing cell stress response with a small-molecule drug, and adjusting the storage temperature, will reduce damaging cellular activity and help preserve the cartilage. Every two weeks, we are testing cell viability by counting live and dead cells, testing markers of cartilage degradation using a glycosaminoglycan (GAG) assay, and analyzing mechanical integrity by compression testing. Our study will allow us to construct effective methods for preserving cell viability during allograft storage in order to provide better treatment for patients in need of knee cartilage transplants.

Minority Status and Its Effect on the Ideological Vote Directions of Supreme Court Cases from 1967-2013

Marcy Shieh
Sponsor: John B. Gates, Ph.D.
Political Science

Justice Sandra Day O'Connor's career on the United States Supreme Court has become a prime example of a conservative minority justice who votes liberally on equality cases pertaining to race and gender. Because of O'Connor's reputation, the media generally seem to believe that minority justices on the Court vote more liberally on equality cases. As a result, the views of potential minority justices on controversial gender or race-related issues are often heavily scrutinized during the senate confirmation hearings. By analyzing the ideology of votes provided by the Supreme Court Database, this research investigates whether or not the media's claims are true. The findings show that while minority justices do vote more liberally on equality cases than on non-equality cases, they do not vote more liberally than their non-minority colleagues on equality cases. Furthermore, this reveals that the media's reception of a justice's minority status is often misleading. The empirical evidence found in the data analysis contrasts with the popular assumption that a justice's race or gender can drastically impact the Court.

Development of Biochemical Tools to Study Soluble Epoxide Hydrolase and Epoxy-Fatty Acids in Chickens

Diyala S. Shihadih
Sponsor: Bruce D. Hammock, Ph.D.
Entomology

In vertebrates, soluble epoxide hydrolase (sEH) metabolizes epoxy- eicosatrienoic acids (EETs), formed in the cytochrome P450 branch of the arachidonic acid cascade, and other natural epoxy-fatty acids (EpFAs), to their corresponding fatty acid diol (DHETs). New reports suggest a role for the EETs in regulating inflammation and angiogenesis. In general, EETs seem to reduce inflammation and promote angiogenesis, thus having a positive role on tissues recovery from injury. Chick embryos are currently being used as a human model to study angiogenesis and its role in cardiovascular biology and pathology. Stabilizing EETs by using potent inhibitors of the chicken sEH (chxEH) would permit to better understand in the chick embryo model the role of EETs and other EpFAs on angiogenesis. This study attempts to find effective inhibitors of chxEH that could be used in current and future research studies. Toward this goal, a library of 2,300 EH inhibitors was screened, and a handful of compounds that are very potent against the chxEH and that have good solubility and stability were selected.

Metagenomic Data: A Tool to Discover/ Understand Novel Carbohydrate Uptake Pathways in Nitrogen Fixing Bacteria

Pratichhya Shrestha
Sponsor: Alan B. Bennett, Ph.D.
Plant Sciences

The development of high throughput sequencing technology coupled with bioinformatic analysis has opened the possibility for the study of complex metagenomes, such as those comprised by bacteria participating in mutualistic symbioses on different environmental levels. This information can be exploited to acquire a deeper understanding of complex biological mechanisms. This study involved Metagenomic libraries that were extrapolated from polysaccharide-rich mucilage that derived from the aerial roots of a *Zea mays* landrace variety. A Bioinformatics approach was applied to the Metagenomic data from the mucilage in order to study carbohydrate uptake by microbes present in the mucilage. First, gene mining was performed using a collection of online databases. Subsequent expression of targeted genes and downstream recovery of respective enzyme products was performed using *Escherichia coli* in a recombinant system. Afterwards, the recombinant enzymes were biochemically characterized to confirm their role in microbial uptake of carbohydrates. The results of this study may contribute to the discovery of novel metabolic pathways and the putative enzymes involved.

Role of WRN in D-loop Synthesis

Joong Hoon Sim
Sponsor: Jessica L. Sneeden, Ph.D.
Microbiology

The WRN protein is a helicase involved in maintaining genomic stability. Its activities include a 3' to 5' ATP-dependent helicase, a 3' to 5' exonuclease, and ssDNA annealing activities. Defects in the WRN gene have been found to be the cause of Werner's syndrome (WS), a disease characterized by premature aging and atypical short stature. Patients exhibit susceptibility to diseases normally associated with aging, including osteoporosis, cancer, and cataracts. As such, WS and WRN are ideal models for studying these diseases, which affect billions of people around the world. WRN is known to be involved in the regulation of DNA structures such as D-loops, Holliday junctions, G-quadruplexes, and telomeres and to facilitate replication by resolving template secondary structures and to dissolve D-loop substrates. In my research, I will be investigating the role of WRN in homologous recombination, a key DNA repair pathway for repairing double-stranded breaks. Specifically, I will be investigating whether WRN stimulates the activity of DNA polymerases δ and η on D-loop substrates and the effects on synthesis past secondary structures in D-loops. This research will improve our understanding of homologous recombination and the maintenance of genomic integrity.

Regulation of Auxin Pathways in Shade Avoidance Syndrome

Navi Singh
Sponsor: Julin N. Maloof, Ph.D.
Plant Biology

Plants detect neighbor proximity using light quality. Canopy shade is one example of reduced light quality due to neighboring plants. In shade conditions plants tend to have more auxin and elongate, thus growing faster than those under sun conditions. The purpose of this research is to gain a better understanding in regulation of auxin pathways in Shade Avoidance Syndrome (SAS). Shade Avoidance Syndrome is a set of responses that plants have in shade: hypocotyl elongation, petiole elongation, flowering acceleration, and leaf hyponasty. Auxin is a plant hormone that promotes elongation. We hypothesized that shade regulates auxin sensitivity. Our results showed shade conditions sensitize the hypocotyl to auxin. We are also exploring the shade avoidance characteristics in mutants of auxin signaling genes such as SAURs, GLV1, and MEL6. I am currently working with mutants in new components of shade avoidance to look at gene expression levels using. By gaining phenotype and gene expression information we will gain more insight on how auxin pathways are regulated in SAS.

Investigating Proteins of Unknown Function in the SYP61 Proteome

Vikram Singh
Sponsor: Georgia Drakakaki, Ph.D.
Plant Science

Evolution has chosen cell wall to give plants the integrity to grow and adapt to different environmental conditions. The plant endomembrane system facilitates vesicular trafficking of protein and other cargo within the cell and plays a vital role in the biosynthesis and secretion of cell wall components. SNARE proteins serve an important role in vesicle targeting and fusion, leading to the release of its cargo. The *trans*-Golgi network vesicles containing the SNARE protein, syntaxin of plants 61 (SYP61) were isolated using immunoisolation approach and their proteome was identified. Bioinformatics analysis revealed the presence of cell wall biosynthesis and stress response proteins in the identified proteome, suggesting that the SYP61 pathway is involved in cell wall deposition. In the identified proteome 13 proteins with no previously defined function were present. We hypothesize that since the unknown proteins were colocalized with the cell wall synthesis proteins, they might have cell wall involvement. To understand the function of these unknown proteins we have taken a reverse genetics and RNAi approach. Further phenotypic characterization of these lines in combination with cell wall analysis will be carried out to understand the role of the candidate proteins in cell wall development.

Modeling the Crayfish Nervous System Using an Electronic Circuit

Abhinav Sinha
Sponsor: Timothy J. Lewis, Ph.D.
Mathematics

Neurons and neural networks are often modeled by simple analog electrical circuits. Examining these electrical circuits can provide insight into the mechanisms that coordinate activity in neural systems. In this project, we constructed and analyzed an electrical circuit that models the neural circuit underlying limb coordination during swimming in the crayfish. We first explored the behavior of a single neuron using the electrical circuit proposed by Keener (1983). Then we extended the Keener circuit to include two cells coupled by reciprocally inhibitory connections. This two cell network models the pattern-generating unit which drives a single limb of the crayfish. We found that this two-cell circuit generates an anti-phase oscillation that is observed in the nervous system of crayfish. Finally we explored activity in chains of pattern-generating units to model the neural circuit coordinating the crayfish's limbs. We show that only certain network topologies yield the activity analogous to that observed in the limb coordination of the crayfish.

The Role of Palmitoylation on SynDIG4 Localization and Function in Synapse Development

Edward Siu
Sponsor: Elva Diaz, Ph.D.
Pharmacology

Synapses are specialized connections between neurons important for brain function. Synapse differentiation induced gene 1 (SynDIG1), the defining member of the SynDIG family of proteins, plays a critical role in regulating synapse development. SynDIG4, a related protein, was recently identified as a component of postsynaptic receptor complexes. Palmitoylation is the attachment of fatty acids to cysteine residues in order to regulate the subcellular localization and function of synaptic proteins such as SynDIG1. SynDIG1 and SynDIG4 share a pair of cysteine residues in similar locations that have been shown to be palmitoylated in SynDIG1. In addition, SynDIG4 has another potential site for palmitoylation not present in SynDIG1. Mutating these cysteine residues to an amino acid residue that cannot be palmitoylated, such as alanine, in combination with the acyl-biotin exchange assay, which detects palmitoylation, allows us to map the palmitoylation sites in SynDIG4 and determine the effects of palmitoylation at each of these sites on synapse development and on the localization, stability, and function of SynDIG4.

Bioremediation of Acetylsalicyclic Acid by *Pseudomonas putida*

Belle M. Smith
Sponsor: Rebecca E. Parales, Ph.D.
Microbiology

Pharmaceuticals and their metabolites, such as acetylsalicyclic acid (ASA), the active ingredient in Aspirin, are accumulating in wastewater throughout the world. As the consumption of both prescription and illicit drugs grows, so do the impacts of excreted metabolites. Salicyclic acid, for example, which is an intermediate in ASA breakdown, is a plant hormone capable of disturbing plant growth and development. A strain of *Pseudomonas putida* that was found to completely degrade ASA, using it as a carbon and energy source, was also able to sense and respond to it using a process called chemotaxis. This research aims to identify which of the 27 predicted cell-surface chemoreceptors (or methyl-accepting proteins [MCPs]) in *P. putida* is responsible for chemotaxis to ASA. We generated 27 *P. putida* mutants, each lacking one MCP gene, and are using chemotaxis assays to identify the MCP responsible for ASA chemotaxis. In these assays, mutant strains are screened for a defective response by monitoring the movement of cells towards ASA using a light microscope. Once the MCP receptor is identified and the degradation pathway of ASA is determined, ASA degradation by *P. putida* will serve as a test case for bacterial bioremediation of pharmaceutical metabolites in wastewater.

Imaging Particle Deposition in Airways

AnnaLisa M. Smullin
Sponsor: Anthony Wexler, Ph.D.
Mechanical and Aeronautical Engineering

Particle inhalation is a route for pharmaceutical delivery as well as for toxicological health effects from factors such as the industrial work environment and tobacco smoke. However, the detailed location of particle deposition throughout the airways has not yet been measured. So far, all studies have been done using modelling, replica airways, or sub-sections of the lung. Mapping the distribution of particles is crucial since the location and distribution of particles may determine clearance and the health effects elicited from the particles as well as possible treatments. Using laboratory rats, we are able to track where fluorescent particles deposit in the lungs after inhalation. Once the rats have inhaled the particles, the lungs are frozen to lock deposited particles in place and are filled with a material that does not disrupt the particles but supports the tissue. Once cured, an imaging cryomicrotome sections the lung and images it and the particles. Computer software then reconstructs the airways and maps the particles. This method could also be used to image particles in any location in the body such as vessels, liver, kidney, or brain. We will present our current results developing the methods and imagine the airways and particles.

Nongenomic Thyroid Hormone Mediated Effects on Gene Regulation in Rat Pituitary GH3 Cells

Stephanie R. Soderberg
Sponsor: David J. Furlow, Ph.D.
Neurobiology, Physiology & Behavior

Thyroid hormone (TH, L-thyroxine, T_4, or 3,5,3'-triiiodo-L-thyronine, T_3) induces proliferation of various cancer cell lines *in vitro.* This proliferative effect is potentially mediated through a nonclassical membrane-bound receptor (αVβ3 integrin), which is also associated with angiogenesis. In the rat pituitary tumor GH3 cell line, microarray and other analyses showed that TH activates gene expression via the classical, nuclear receptor (TR) mediated pathway as expected. However, TH also induces the activation of several genes normally associated with the integrin mediated pathway. In this study, we are investigating the relative importance of each r pathway in GH3 cell responses to TH. First, we are determining αV and β3 integrin subunit relative expression levels and other potential downstream targets of this nonclassical pathway. We are then testing the role of the αVβ3 integrin more directly by exploiting the relative potency of T_4 versus T_3, tetraiodothyroacetic acid as an antagonist of the integrin pathway but a weak agonist on the TRs, and the Arg-Gly-Asp (RGD) peptide, which blocks TH binding to the αVβ3 integrin but does not affect the nuclear TRs. These studies are important for revealing the various mechanisms involved in TH regulated target cell responses in a pituitary tumor model system.

Effect of Type 2 Diabetes on the Proteasome in Mouse Skeletal and Cardiac Muscle

Mandeep Sohal
Sponsor: Aldrin Gomes, Ph.D.
Neurobiology, Physiology & Behavior

Type 2 Diabetes Mellitus (T2DM) is a major cause of worldwide death and morbidity which also results in debilitating muscular atrophy. As the proteasome is involved in the degradation of proteins, it is conjectured to be involved in muscular atrophy. In contract to this, the role of proteasomes and two proteinases, Cathepsin L and Calpain, were evaluated in the heart and gastrocnemius muscle of T2DM leptin-deficient (ob/ob) mice of various ages. Although the gastrocnemius weight to tibia length ratio indicated that ob/ob mice have decreased skeletal muscle mass at the 4 week and 15 week time point, there were no such changes found in the heart weight to tibia length ratio. Accordingly, the activity of β1 caspase-like catalytic subunits of 26S proteasomes at the 15 week time point in gastrocnemius tissue was upregulated in ob/ob mice. In addition, the activity of β2 trypsin-like and β5 chymotrypsin-like catalytic subunits of 20S proteasomes at the 2 week time point was also upregulated in ob/ob heart tissue. All things considered, these results indicate that there are several important changes that occur in the 20S and 26S proteasomes in the heart and gastrocnemius tissues of leptin-deficient mice of various ages.

Effects of Lentivirus on the Activation States of Microglia

Xiao Song
Sponsor: Stephen Noctor, Ph.D.
Psychiatry & Behavioral Sciences

Lentivirus is a genus of virus that is commonly used as a research tool in neuroscience to introduce reporter genes and gene products into the developing brain. It has recently been recognized that microglial cells, the major immune cell in the CNS, are present and play a prominent role in regulating cell production in the fetal brain. In the adult brain microglia respond to foreign pathogens by releasing cytotoxic cytokines, but little is known about how fetal microglia respond to foreign pathogens. Thus it is possible that fetal microglia detect the foreign lentivirus after it is introduced into the developing brain and initiate a cytotoxic immune response. This could be a complicating factor for studies that utilize lentivirus to induce gene transcription in the developing brain. To address the impact of lentivirus on fetal microglia, we are monitoring the activation status of fetal microglia after lentivirus injection into the fetal brain by examining key indicators of microglial status: morphology and expression of cytotoxic cytokines. We hypothesize that lentivirus alters microglial activation status. We are testing this hypothesis through in utero intracerebral injections of lentivirus, immunohistochemistry and confocal microscopy.

Investigating the Effects of Minocycline on Cognition and Neurodegeneration Following Bilateral, Concussive Brain Injuries

Anup N. Sonti
Sponsor: Bruce Lyeth, Ph.D.
Neurological Surgery

Recent human and animal studies suggest that repetitive, concussive brain injuries play a role in the development of neurodegenerative diseases. One of the hallmark pathologies of brain injury is chronic inflammation, caused in part by prolonged activation of microglia, the resident immune cells of the central nervous system. Studies indicate that minocycline, a tetracycline antibiotic with anti-apoptotic and anti-inflammatory properties, can suppress microglia activation and confer neuroprotection in various models of neurological diseases. This experiment investigated the effects of minocycline in a rodent model of repetitive concussive brain injuries. It was hypothesized that suppression of microglia activation would improve cognition and confer neuronal cell survival. Animals were subjected to bilateral mild injuries for two consecutive days, followed by injections of either minocycline (n=6/group) or saline (n=5/group) for seven days (60 mg/kg/day) beginning 24 hours after injuries. Outcome measures included daily measures of body weight, spatial memory performance in the Morris water maze (MWM) on days 11-15 post-injury, and histopathological assessment at 15 days post-injury. The minocycline group had significantly greater TBI-induced weight loss. There was no significant difference between the groups in MWM performance. Stereological quantification of neuronal cell survival and microglia morphology is in progress.

Evocation Through Facial Expression

Vincent M. Sosa
Sponsor: Gina Werfel, M.F.A.
Art Studio

The evocation of different emotions through facial expression remains at the forefront of my paintings. What can be communicated through a facial gesture, quick glance, or subtle look fosters my curiosity of the ways in which individuals express themselves outwardly. The subject matter of my paintings engages with the viewer through bold, dynamic, larger-than-life expressions, and confronts the viewer with direct eye contact. The vivid color combinations, smeared paint application, and increased scale of the paintings command the attention of the viewer. I deliberately depict the eyes of my subjects pointed straight at the audience, thereby making each person aware that they are not only viewers, but also recipients to another's gaze. This exchange of glances creates a visual dialogue that is inherent in the non-verbal communication that individuals encounter in their everyday lives. Expression and emotions are shared rather than words. I strive to create evocative paintings and to make my viewers cognizant of the tremendous role that facial expressions play in daily communication.

The Effect of Soil Organic Matter Enrichment on Fermentation During Solarization

Simon P. Staley
Sponsor: Jean VanderGheynst, Ph.D.
Biological Systems Engineering

Solarization is an agriculturally significant method of controlling weeds and pestilent microbes without application of pesticide. In solarization, a transparent polyethylene tarp is spread over a plot of soil, trapping solar radiation and raising soil temperature. This excessive heat deactivates seeds and pathogens, preparing soil for heightened productivity. Current research suggests that the volatile fatty acid (VFA) byproducts of soil fermentation may organically inactivate seeds, enhancing the solarization process and shortening the time required for solarization. The goal of this study was to investigate the efficacy of organic matter soil enrichments in promoting fermentation at various depths during solarization. Samples were taken from microcosms of solarized soil, each amended with different proportions of organic matter and containing replicates at varying depths. High Performance Liquid Chromatography (HPLC) was used to determine the VFA content of samples, with increased VFA content indicating increased fermentation. The most prevalent volatile compounds detected included butyric, iso-butyric, acetic, formic, and propionic acid. The results of this study indicate that soil amended with organic matter exhibits superior levels of fermentation, particularly with increasing soil depth. Further investigation may identify the most influential VFA compounds in seed deactivation, the effective VFA concentrations, and the corresponding soil amendment requirements.

The Middle East and Muslim Women in U.S. Media Representations

Nahira Stanackzai
Sponsor: Suad Joseph, Ph.D.
Anthropology

This essay seeks to explore photos and texts from archival newspaper articles in the *New York Times* from 1910 to 1919 that contain the word "Arab". From a pool of 71 *New York Times* articles for this period, there is a consistent pattern of a negative depiction of the Middle East and North Africa. While most readers and scholars expect the *New York Times* to be objective, my analysis reveals otherwise. The term "Arab" is often associated with "barbaric" imagery, which is also linked to the taming of the Arab by Western colonial powers. I am using the work of Edward Said's *Orientalism* as a paradigm to analyze why Western media outlets may illustrate Arabs in such a manner. The portrayal of Arabs as savage is significant because it appears to have developed in tandem with Western powers trying to justify their violent colonial presence in the region. I closely examined these articles through a key word search on *ProQuest*. This research is part of a larger project analyzing 150 years of the *New York Times* conducted in the lab of Professor Suad Joseph.

Controlling Parasitic Weeds Using RNAi Gene Silencing of Acetyl-CoA Carboxylase

Daniel B. Steele
Sponsor: John I. Yoder, Ph.D.
Plant Sciences

Parasitic plants are major agricultural pests causing huge economic loses. The root parasite family Orobanchaceae are particularly wide spread in developing nations; over two thirds of cereal crop farmland in Africa is infested with one or more species of the parasitic weed Striga. Conventional control methods have been unsuccessful as these parasites are underground and inaccessible and host genetic resistance has been ineffective as few resistance genes have been identified and incorporated into crops. An alternative method is the application of host produced RNA interference (RNAi) molecules which inhibits the parasite via the parasite-derived oligonucleotide toxin. The Yoder lab cloned acetyl-CoA carboxylase (ACCase) sequences from the parasitic plant Triphysaria in hairpin confirmation and introduced these into Medicagao truncatula roots by Agrobacterium rhizogenes transformation. Two of the most effective RNAi constructs were then transformed into Solanum lycopersicum. I am currently evaluating whether these tomato plants are resistant to a different genus of parasitic plant, Cuscuta. I am using quantitative RT-PCR to determine whether the expression of ACCase in S. lycopersicum is affected. The most promising transgenic lines will be challenged with Cuscuta and Triphysaria. This work will provide a novel approach for limiting the agricultural destructiveness of these pernicious weeds.

Endogenous Cocaine-Amphetamine-Regulated Transcript (CART) Mediates Glucagon-Like Peptide 1 (GLP-1) Inhibition of Gastric Emptying

Richard W. Stephens
Sponsor: Helen Raybould, Ph.D.
Anatomy, Physiology & Cell Biology

Gastric emptying (GE), the process of trafficking food through the stomach into the small intestine, is inhibited by vagal activation of gastrointestinal hormones (GLP-1) released from the small intestine. The aim of this study was to determine the mechanism by which GLP-1 inhibits GE via the release of the neuropeptide transmitter CART from vagal afferent neurons into the nucleus tract solitarius (NTS). Methods: GE was measured by appearance of orally-administered paracetamol in plasma. Fasted male Wistar rats had cannulas implanted into the NTS, and CART antibody (2ng) or saline (100nl) injected into the cannulas. After 10 minutes, injections of GLP-1 (100µg/kg) or saline (400ul) were given into the peritoneal space and subjects were fed pre-weighed chow containing 40mg paracetamol for 10 minutes. Blood was collected from the tail (0, 30, 60, 120, 180min) and paracetamol was measured by ELISA. Results: GLP-1 inhibited GE following NTS saline injection ($p<0.05$); however, injection of CART antibody into the NTS prevented GLP-1 induced inhibition of GE (at 60 min: 154.8 ± 11.9 µmol/L vs 163.2 ± 22.3 µmol/L paracetamol; $p>0.05$). Conclusion: Release of endogenous CART from vagal afferent terminals into the NTS is required for GLP-1 induced decrease in GE.

2D Interactive Surface

Michael Sticlaru
Sponsor: Andre Knoesen, Ph.D.
Electrical Engineering

The 2D Interactive Surface utilizes infrared proximity sensing to obtain user input and responds with RGB light from LEDs and sounds. This device demonstrates the practicality and capability of infrared sensors and its compatibility with microprocessors. A compact 30in x 30in x 6in box will be constructed, with a light diffusing acrylic glass surface on the top to cover the internal electronics. The device will be constructed of multiple modules, which can be thought of as "pixels". Each 3in x 3in pixel will be capable of emitting RGB light in response to user input. When an object is detected near the surface, infrared light is reflected back into the receiver, converted to a frequency, and fed directly to a microcontroller. The pixel responds by displaying color light that varies in intensity relative to the distance of the object to the surface. Full intensity is reached when the object is closest the surface and gradually decreases as the object is moved away. The modular design of the pixels allows the surface to be scaled up or down for various applications.

Echovirus 1 Entry Requires Binding of the Bent, Inactive Conformation of α2β1 Integrin

Michael J. Stout
Sponsor: R. Holland Cheng, Ph.D.
Molecular & Cellular Biology

Cell adhesion molecules (CAMs), membrane proteins used by cells for binding to other cells or to the extracellular matrix (ECM), may be hijacked by viruses to infect the cells. Integrins, a subset of CAMs which bind to the ECM, are involved in intracellular to extracellular communication. Echovirus 1 (EV1), a close relative of Coxsackievirus and the Poliovirus, infects cells displaying the α2β1 integrin on their surface, by binding to the α2I domain of the α2 subunit of the α2β1 integrin, and causing cell signaling, leading to EV1 internalization. α2β1 integrin's native ligand is collagen, whose binding induces integrin conformational activation, so that the collagen engaged integrin is in its extended, active form. EV1 has been previously shown to preferably bind to α2β1 integrin while it is in the bent, inactive form. In my presentation, EV1 bound integrin will be shown to remain in the bent, inactive form of α2β1 integrin. Through fluorescent microscopy, using Fluorescence Resonance Energy Transfer (FRET), it will be shown that EV1 only binds bent, inactive α2β1 integrin, by the emission of a distance dependent, unique wavelength of light. Higher resolution structure and analytics will be performed by using Cryo-Electron Microscopy (Cryo-EM).

Meaningful Predictors of Academic Performance, Depression, and Peer Competence for High and Low Risk Youth

Mac Strelioff
Sponsor: Keith Widaman, Ph.D.
Psychology

Risk factors have been shown to impair normative development for some, but not all, children. Resilience research has tried to uncover factors that protect children from the harms associated with exposure to high levels of risk. Frankl (1959/2006) has indicated a sense of meaningfulness as a source of resilience. In the present study, five sources of meaning were identified and predictor variables representing these sources of meaningfulness were selected from an ongoing longitudinal study of Mexican-American children. Measures of the predictor variables collected while participants were in fifth grade were used to predict, or explain changes in, measures of academic competence, attachment to school, depression, and peer competence collected when the participants were in seventh grade. Path diagrams for low risk and high risk groups were compared. Results supported findings of cross-domain sources of change between academic and social measures of competence. Furthermore, a specific component of parental conflict appeared to explain poor peer competence at a later time, consistent with previous research. Future research could test the model in different populations, or use resilient and maladaptive groups in place of the single high risk group used in the present study.

When Frames Stick: Exploring Moderators of Sequential Framing Effects

Chun M. Su
Sponsor: Alison Ledgerwood, Ph.D.
Psychology

Research across many domains has highlighted the current--and presumably temporary--effects of frames on people's attitudes and behaviors. Yet people often encounter information that has been framed in different ways across contexts, and there are reasons to predict that certain frames, once encountered, might tend to stick in the mind and resist subsequent reframing. We tested the prediction that loss-to-gain (vs. gain-to-loss) reframing would have a muted impact on people's evaluations of a surgical procedure, and explored potential individual differences that might moderate this effect. As hypothesized, participants who saw a gain frame first exhibited significantly greater change in response to reframing at Time 2, compared with those who saw a loss frame first, $F(1, 96) = 4.37$, $p < .039$. Interestingly, individual differences in Need for Closure (NFC), or the tendency to prefer certainty over ambiguity, also influenced frame stickiness. We found that NFC also predicted attitude change in response to the Time 2 frame in both reframing conditions independently from frame order, $B = 15.35$, $SE = 4.16$, $p < .0001$. Implications for how individuals high in NFC tend to "seize" on current frames more than to "freeze" on past frames are discussed.

Diffusion in Ethanol-Containing Carbopol Solutions and Gels

Yang-Denis Su
Sponsor: Ronald J. Phillips, Ph.D.
Chemical Engineering

Carbopol 940 (CP940) is a water-soluble polymer that is widely used in drug-delivery services to modify the consistency of gels and creams. Carbopol is a highly cross-linked polymer that forms "microsponges." At neutral pH values, electrostatic repulsion between the chains causes the microsponges to swell, and Carbopol to form a gel that only flows when subjected to a strong enough stress. Despite its importance in commercial and medical applications, little is known about diffusion in Carbopol gels. We measure rates of diffusion in ethanol-containing Carbopol gels by holographic interferometry (HI), in which changes in the refractive index in a test cell are monitored by means of interference fringes formed from laser light. Refractive index changes directly relate to concentration changes; hence, we can monitor changes in concentration that occur over time due to diffusion. We study diffusion between samples of 0.3 weight percent (wt%) CP940 that are put into contact with other samples with differing compositions of CP940 and ethanol. Thus far, evidence suggests that rates of interdiffusion between 0.3 wt% CP940 gels and the other materials is unaffected by the presence of ethanol. However, the data remain inconclusive due to lack of reproducibility and the need for more experiments.

Investigation of Precipitation Kinetics in Aluminum 2139 Alloy

Haruka Sugahara
Sponsor: Julie M. Schoenung, Ph.D.
Materials Science & Engineering

A recently developed high strength aluminum alloy used in the aircraft industry is the heat treatable AA 2139 with a composition of Al-Cu-Mg-Ag. It is known that strength and fracture toughness of heat treatable aluminum alloys depend on the grain size of the Al matrix, and the size, distribution and volume fraction of the precipitates, which are controlled by temperature and duration of aging (a low temperature annealing after solid solution treatment). In the present study, we focus on investigating the influence of aging time and temperature on the precipitation kinetics of AA 2139 produced by powder metallurgy. The AA 2139 samples were aged at several temperatures in the rage of 120°-160°C for times up to 24 hours. Effects of aging conditions on mechanical properties of the AA 2139 were determined based on Vickers microhardness measurements. It was found that the sample aged at 160°C for 16 hours had the maximum hardness. Microstructures of several selected samples were also analyzed by means of optical microscopy and transmission electron microscopy. We observed the formation of a metastable phase, Al_2Cu. After careful investigation, it was concluded that precipitation hardening is the main strengthening mechanism in AA 2139.

Characterizing Milk Peptides

Hawa Sultani
Sponsor: Emanuel Maverakis, M.D.
Dermatology

Formula fed infants are at increased risk for atopy compared to breastfeed infants. Human breast milk contains certain proteins that highly represented as enamel matrix protein (EMP). Our preliminary result demonstrates that two synthesized EMP sequences are able to inhibit the secretion of MCP-1 (an inflammatory cytokine) in response to anti-CD14 stimulation. CD14 is a pattern recognition receptor on monocytes that recognizes lipopolysaccharide (LPS) receptor, present on inflammatory bacteria. We want to determine the effects of specific EMP on the secretion of CD14-dependent cytokines by monocytes. Our hypothesis is that these peptides can modulate T-cell cytokine secretion in response to CD3 CD28 stimulation. Monocytes are purified through anti-CD14 positive selection kit, which will activate secretion of CD14 dependent cytokines. These activated monocytes are incubated with varying concentrations of the two synthesized milk peptides. The supernatant is harvested and released cytokines are measured via ELISA. In addition, the cells are harvested at different time points and extracted RNA is quantified by real-time PCR. Similar experimental procedures will be done for CD3 and CD28. This verifies the two EMP possess immunomodulatory properties. In the future, we hope to understand the mechanism between CD14 and cytokine secretion.

The First Demonstration That Avian Odor Profile is Linked to Mating Strategy: An Investigation of Tricolored and Red-Winged Blackbirds

Hong Sun
Sponsor: Gabrielle Nevitt, Ph.D.
Neurobiology, Physiology & Behavior

In spring, in the Central Valley of California, males of tricolored blackbirds (*Agelaius tricolor*) opportunistically breed in groups that can comprise tens of thousands of individuals. These birds are a rare endemic species to our area and have a mating strategy that is highly gregarious and nomadic. In contrast, red-winged blackbirds (*Agelaius phoeniceus*) are phylopatric and common throughout North America. Males are highly polygynous, and defend their territories fiercely during breeding seasons. The two blackbird species smell strikingly different. While tricolored blackbirds have fruity-smelling feathers, red-winged blackbirds lack this distinctive aroma. Whereas volatile compounds emitted from birds have rarely been investigated, examining odor profiles of two sister species may provide functional insights. I analyzed Gas Chromatographs of feather samples collected from 20 tricolored and 20 red-winged blackbirds during a breeding season. I found that more than 20 compounds differed in peak area between the two species ($p < 0.05$, ANOVA test); I then performed a principle component analysis to investigate which volatile compounds are important in differentiating the two species. My results confirm that tricolored and red-winged blackbirds have significantly different odor profiles. This is the first demonstration that mating strategy is linked to odor profile in an avian species.

An In-Depth Look at the Driving Forces Behind Illegal File-Sharing

Kyle Sun
Sponsor: Katrina K. Jessoe, Ph.D.
Managerial Economics

As internet access and computer ownership expand globally, software developers are increasingly aware of, and concerned about, illegal file-sharing. Using longitudinal data collected from 95 countries, this study seeks to understand the drivers behind illegal file-sharing. Results suggest that factors such as GDP, internet penetration, and age distribution of a country's population meaningfully affect the probability of piracy within a country. This study also attempts to reconcile its results with those of prior studies, many of which suggest that different factors are at play in the illegal file-sharing market. With respect to prior research, I find that failure to control for systematic differences across countries and time shocks can lead to incorrect conclusions about the driving forces behind piracy. In correcting these errors, this study hopes to produce more statistically robust results which may lead to a greater understanding of what piracy is and why much of the world population engages in illegal file-sharing. Understanding the true effects of these factors may help us develop approaches to dealing with piracy and illegal file-sharing so that software engineers may continue in the current trend of innovation and development.

The Quality and Impact of High School Counseling on Students of Color in Their Pursuit of Higher Education

Rasnapreet K. Suri
Sponsor: Natalia Deeb-Sossa, Ph.D.
Chicana/Chicano Studies

High school counselors provide the academic, psychosocial, and career preparation students need to access higher education. Through in-depth interview sessions with both high school counselors and a randomized cohort of twelfth grade high school students from diverse academic backgrounds, this research aims to discover what the expectations and motivations of both groups are of each other. These interviews focus on the current work that is being done by counselors and give them an opportunity to discuss how they see themselves doing their jobs and what they believe can be done to help make their vital work easier. Indeed, the initial step in establishing stronger school counseling programs is to determine the characteristics and circumstances that lead to effectiveness and where room for improvement can be made in current conditions. This study provides a discussion of the challenges students face during their journey through the educational pipeline and how influential the guidance of the school counselors has been in the process. The ultimate goal of this study is to help transform school counselors into powerful agents of change in order to close the gap between available resources and higher education for students of color.

Seed Thermoinhibition in Lettuce

Clarissa H. Tam
Sponsor: Kent J. Bradford, Ph.D.
Plant Sciences

Seed thermoinhibition is the inability of seeds to germinate at temperatures above 27°C. This leads to an increase in the cost of production since lettuce is mainly grown in hot environments such as Arizona, California, and Florida. A current solution for this problem includes seed prehydration and drying, or priming, which is quite expensive. An alternative solution to the seed thermoinhibition problem is to breed for lettuce that exhibits thermotolerance during germination. To find the gene(s) responsible for thermotolerance, we used a Recombinant Inbred Line (RIL) mapping population derived from an intraspecific cross between a thermotolerant accession PI251246 and a thermosensitive cultivar Salinas. Within this mapping population, a Quantitative Trait Locus (QTL) associated with the seed thermoinhibition trait has been identified. A fine-mapping population was generated to dissect the QTL to refine the QTL interval. RNA transcript sequencing of seeds of the parental lines in different germination conditions will be used to correlate with genes collocating under the QTL region. Some potential candidate genes exhibiting differential transcriptional responses have been identified.

Cobalt-Trimer: A Model for Catalytic Water-Splitting

Jesse Tamayo
Sponsor: William H. Casey, Ph.D.
Chemistry

In photosynthesis, water is split catalytically to produce O_2 and H_2 via absorption of sunlight. Artificial photosynthesis is a promising path towards the goal of achieving future energy demands. Current artificial catalysts, such as ruthenium and iridium complexes, can be used to reproduce this reaction, but the pathways differ profoundly from the natural process. The metals in these catalysts are also geologically rare, making their use unsustainable for a growing population. Recently, cobalt catalysts have been developed but many questions remain about their structure. To create a cheaper and more viable catalyst, a compound, Co-OEC, $[(py)_3Co_3O(OAc)_5OCH_3][PF_6]$, was synthesized. The model cobalt trimer was synthesized using cobalt (II) acetate-four hydrate, peracetic acid, acetic acid, then refluxed with NH_4PF_6 and pyridine to yield the final product. It is further purified in methylene chloride/pentane. The compound was then investigated by a combination of electrochemical and electron paramagnetic resonance methods to determine its electronic properties. Our hope is that by studying this model, we will gain insights into the chemistry of Co Pi, and using photo catalysts enhance our ability to obtain a clean, cheap, and renewable energy source.

2D Interactive Surface

Kent T. Tanita
Sponsor: Andre Knoesen, Ph.D.
Electrical Engineering

The 2D Interactive Surface utilizes infrared proximity sensing to obtain user input and responds with RGB light from LEDs and sounds. This device demonstrates the practicality and capability of infrared sensors and its compatibility with microprocessors. A compact 30in x 30in x 6in box will be constructed, with a light diffusing acrylic glass surface on the top to cover the internal electronics. The device will be constructed of multiple modules, which can be thought of as "pixels". Each 3in x 3in pixel will be capable of emitting RGB light in response to user input. When an object is detected near the surface, infrared light is reflected back into the receiver, converted to a frequency, and fed directly to a microcontroller. The pixel responds by displaying color light that varies in intensity relative to the distance of the object to the surface. Full intensity is reached when the object is closest the surface and gradually decreases as the object is moved away. The modular design of the pixels allows the surface to be scaled up or down for various applications.

The Last Man Standing: SIV Infected Paneth Cells and Their Effects on Defensin Expression

Keyon Taravati
Sponsor: Sumathi Sankaran, Ph.D.
Medical Microbiology & Immunology

Defensins (small antimicrobial peptides) are the innate component of the immune response and are essential in maintaining gut barrier function. Over 21 Rhesus Paneth cell alpha defensins were recently identified. We studied the effects of SIV infection on defensin function in the SIV loop model because during SIV infection Paneth cell functions are lost last. Rhesus macaques were inoculated with SIV and ileal loops were inoculated with lactobacillus, salmonella, or bifidobacteria for 5 hours. Defensin expression was studied by real-time PCR and immunohistochemistry (IHC). Different defensins were increased in transcription depending on the loop bacteria. Defensins function when secreted into the lumen; not while in Paneth cells, explaining the inverse relationship observed between the real-time PCR and IHC results. SIV disrupts the "normal defensin response" to bacteria early in infection (2 days post inoculation). Defensin expression was positively correlated with IL1Beta expression, which indicates tissue inflammation. General inflammation in the gut mucosa may stimulate defensin expression but not secretion (the case during SIV infection) which is needed to respond to increased luminal pathogen levels. These results provide a better understanding of gut protection from bacterial insult and how we may protect the gut from HIV induced enteropathy.

Fecundity Decrease in *Drosophila simulans* in the Absence of *Wolbachia*

Jack C. Taylor
Sponsor: Michael Turelli, Ph.D.
Evolution, Ecology & Biodiversity

Many species of arthropods host *Wolbachia*, maternally transmitted bacteria that often influence host reproduction. This manipulation of host reproduction has contributed to *Wolbachia* becoming a normally-present infection of many *Drosophila simulans*. The Y36 isofemale line, a population of *Drosophila simulans* created from a single female collected in 2010 in Yolo County, produces flies which have an unusual phenotype when reciprocally crossed with uninfected simulans populations denoted U. The cross between Y36 male and U female produces female offspring with significantly lower fecundity than the reciprocal cross (Y36 female with U male). It is possible that this effect is a result of a paternal defect gene that is masked by the *Wolbachia* infection. Ten separate sublines were created from the Y36 isofemale line. The goal of my experiment was to determine whether this phenotype is still present among each of the ten sublines and if there is any variation in the phenotype among the sublines. Analysis of the data indicates that the qualitative effect of the phenotype has been preserved across the sublines but suggests that there is quantitaive variation amongst them.

Investigation of Enhancement of X-Rays by Nanoparticles With Electron Paramagnetic Spectroscopy

Ryan Taylor
Sponsor: Ting Guo, Ph.D.
Chemistry

The ionizing effects of hard X-rays are shown to be significantly enhanced in the presence of gold nanoparticles as demonstrated by experimentation with electron paramagnetic spectroscopy (EPR). Enhancement of up to 175% was measured for 0.75 wt% AuNPs irradiated with 150-Gy X-rays. Here gold nanoparticles (AuNPs) and the spin trap 5-tert-butoxycarbonyl 5-methyl-1-pyrroline N-oxide (BMPO) and combined in solution, irradiated and tested with EPR. Results demonstrate the increased yield of radical generation, in particular hydroxyl and superoxide radicals, as identified by scavenging experiments which included dime-thyl sulfoxide (DMSO) and superoxide dismutase (SOD) respectively. Studies of the dependence of enhancement on X-ray dose and gold concentration provide insight into the mechanisms of radical generation. This enhancement, called "physical enhancement" to distinguish it from chemical and other types of enhancement, is a powerful concept that may be harnessed for use in X-ray irradiation, nanotechnology, radiotherapy, and myriad other applications. Associated presentations will discuss experimentation procedure, corresponding data and potential cause for deviation between theoretic and experimental results.

Multiple Pathways of Gene Duplication in *Salmonella enterica*

Oyang Teng
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Microbiology

Gene duplications are a common form of mutation in all organisms and represent an important target for selection. Multiple pathways exist for the formation of such chromosomal rearrangements, though their exact mechanisms remain uncertain. In *Salmonella enterica*, genetic duplications occur at a high frequency in the chromosomal region containing seven directly repeated *rrn* loci encoding ribosomal RNA. These long tandem repeats offer extensive sequence identity for homologous recombination. However, duplication rates between these loci remain high in mutants lacking strand invasion proteins RecA, RecB, and/or RecF. It has been proposed that an alternative single-strand annealing pathway is activated under such conditions because the high levels of transcription and secondary stem-loop structures of *rrn* sequences make them vulnerable to frequent nicks and breaks. In order to study the relation between transcription and duplication frequency, I am constructing recombination-deficient strains lacking promoters for specific *rrn* genes. The resulting duplication frequency between these loci is assayed by trapping duplications using a Red-mediated recombineering cross. In addition, I am constructing mutant strains deficient in other DNA-binding proteins in order to test their influence on the observed duplication frequencies. The goal is to understand how these duplications arise at high rates by multiple pathways.

Exploring the Interaction of NLR and Chaperon Protein Using Purified Proteins

Burinrutt Thanasuwat
Sponsor: Savithramma Dinesh-Kumar, Ph.D.
Plant Biology

There are a wide variety of plant and mammal pathogens which cause agricultural and health issues on a globally scale. Even though plants and mammals are separated by millions of years of evolution, they both recognize pathogen using similar strategies. Plants use nucleotide-binding domain and leucine-rich repeat (NLR) proteins while mammals use The nucleotide-binding oligomerization domain receptors (NOD-like receptors) as their primary defense shield. Both of these proteins are structurally homologous and hypothesized to use similar mechanism to recognize invading pathogen. However, the molecular mechanism of how these protein recognize pathogen is not completely known. The SGT1-HSP90 complex is a chaperone complex responsible for folding both proteins. Earlier studies have indicated a role of this chaperone protein complex in immunity. The exact relationship between chaperon proteins and immunity is not clear. The goal of this study is to explore the relationship between NLR proteins and chaperone complex using purified proteins. I have cloned both SGT1 and HSP90 in E.coli expression vector using isothermal assembly. In future I plan to express and purify these proteins, and map the domain responsible for interaction using protein-protein interaction experiments like gel filtration and pull downs.

Water Splitting Properties of Aluminum and Magnesium Alloys

Jackson Thomas
Sponsor: Jerry Woodall, Ph.D.
Electrical Engineering

Pure aluminum is one of the most energy dense materials on the planet. It can spontaneously react to split water molecules, forming gaseous hydrogen capable of powering fuel cells. But the aluminum we find in our bike frames and soda cans has an oxide layer that prevents this reaction. By dissolving the aluminum into liquid gallium, we can remove the oxide layer and easily react the alloy with water. Not only does this allow for the safe transport of a hydrogen fuel source, but it is also a completely reversible process, as the aluminum oxide formed can be reduced back to pure aluminum. We are looking into the effects of similar metals, such as magnesium, to both more effectively react with water and to aid in the removal of the aluminum oxide layer. I will be testing the water splitting properties of pure magnesium-gallium alloys as well as adding magnesium to aluminum-gallium mixtures to try and ease the aluminum-gallium alloy formation process.

Algae Cultivation for the Treatment of Winery Wastewater and Biofuel Production

Alex Thornton-Dunwoody
Sponsor: Jean VanderGheynst, Ph.D.
Biological Systems Engineering

Wastewater from many commercial food-processing facilities, such as wineries, must be treated before it can be reused or released into the municipal waste system. At Gallo Winery's main processing facility in Fresno, CA, wastewater is treated by an anaerobic digester, but this process alone does not meet California's new wastewater discharge standards for nitrogen and phosphorous which contribute to eutrophication and ecosystem damage in natural waterways. Microalgae provide an avenue for wastewater treatment that, in addition to anaerobic digestion, treats wastewater for reuse while providing a potential biofuel feedstock. This study compares the total biomass and lipid content of monocultures of *Chlorella sorokiniana* and *Chlorella minutissima* grown in Gallo wastewater from high wine production and low wine production seasons to control cultures grown on chemical media. Gravimetric analysis was used to assess biomass growth and a Nile red assay to assess lipid content. In addition, changes in nitrogen and phosphorus levels in the wastewater during microalgae growth were measured using Hach assay kits. Both strains of microalgae exhibit exceptionally high biomass concentrations and growth rates on both types of Gallo wastewater, and are a promising biofuel feedstock as well as a method for wastewater treatment.

Millipedes Modify Soil Chemical Properties and Microbial Community

Emily J. Tibbett
Sponsor: Richard Jeannotte, Ph.D.
Population Health & Reproduction

Soil biodiversity plays an essential role in the ecosystem processes that sustain life on earth. However, soil biota and its habitat remains one of the most neglected on earth. Macrofauna represent an important part of the soil biodiversity and are involved in important processes of nutrient cycling and organic matter decomposition. Alongside earthworms, the most studied groups of macrofauna, millipedes are known to play important roles in these processes as well. Moreover, the interactions between millipedes and microbial community are not well characterized and understood. A time-course experiment in microcosms was performed to study the effects of millipedes, isolated from grassland soil, on soil nutrients and microbial community. Soil levels of ammonium (NH_4^+), nitrate (NO_3^-), inorganic and organic phosphorus as well as microbial lipid biomarkers were determined. Overall, the study demonstrates that millipedes have a significant impact on soil nutrient cycling and microbial community. It lays the foundation for more research to advance the understanding of the ecological contributions of millipedes in tallgrass prairie ecosystems.

Divergent Trajectory Patterns of Systemic vs. Vascular Inflammation Over Age in Healthy Caucasian and African-American Families

Jason Tien
Sponsor: Byambaa Enkhmaa, M.D.
Internal Medicine

Cardiovascular disease (CVD) is the leading cause of mortality resulting in one death every 39 second. Age and inflammation both are risk factors for CVD. However, the association between these two risk factors across the lifespan and ethnicities in the general population is poorly understood. Inflammation, the body's immune response to injury and infection, can be measured by inflammatory markers. Some inflammatory markers reflect more general systemic whole body response, whereas some indicate more local injury such as vascular damage. We assessed eight different inflammatory markers in healthy Caucasian and African-American families with members aged 6 to 74 years (n=267). We observed a contrasting pattern in systemic vs. vascular inflammatory burden over age with an increase in systemic but a decrease in vascular inflammatory markers in both ethnic groups. These observations remained significant after taking the correlations of siblings and parents from the same family into account. The findings illustrate the complex relationship between age and inflammation, and suggest that a perceived elevation of vascular markers among the very young may be an indication of dynamic growth rather than a disease process.

Laser Harp

Angela Tobin
Sponsor: Andre Knoesen, Ph.D.
Electrical Engineering

Current trends show that the US is lagging behind in STEM education. Change needs to be made to remedy the situation, and research shows that the most effective way to increase interest in STEM fields is through hands-on engagement with science and technology. Music is a creative medium that can appeal to all audiences. This project aims to stimulate interest in students of all age groups to pursue degrees in the fields of Electrical and Computer Engineering. Our project infuses the musical qualities of a harp with laser and sensor technology. In our rendition of a laser harp, the user plays notes not by plucking a string, but by interrupting the path of laser beams. When the user interrupts a laser beam, the microcontroller detects this action and plays a corresponding note. Users can then play various tunes by simply placing their hand in the path of the laser beam. Additionally, a teaching mode exists in which the harp will guide a user through playing a pre-programmed song by indicating what notes should be played. The Laser Harp gives people of all ages a fun way to engage with technology and learn more about the field of engineering.

Planning a Holistic Strategy for Brownfield Remediation: Steel Mills of Pittsburgh, PA

Ryoma Tominaga
Sponsor: Michael Rios, M.A.
Landscape Architecture

Abandoned buildings and urban decay plague cities all over the country and the industrial revolution of the 19th century have left vast areas of underutilized properties. These derelict sites come from formerly used industrial and commercial properties stigmatized by real and perceived contamination. Communities with numerous brownfields are directly related to multiple public health issues and the consequences are often compounded in damage. These issues include increased potential for exposure to harmful chemicals, contaminated soil and/or water, lack of green space, reduced property values, increased crime rates and substance abuse, poor air quality, asthma prevalence, and overall reduced quality of life. The high financial cost of brownfields remediation is one of the top reasons why these neglected communities still remain. The approach to finding a solution to decaying industrial sites requires exploration of modern passive remediation and holistic adaptive reuse that will trump traditional measures of demolish and relocate methods. In essence, the steel mill industrial infrastructure located in Pittsburgh, PA can be recaptured to serve a sub-cultural function and provide an important historical aesthetic that will likely never be reproduced; an aesthetic that will make an invaluable economic, social, and environmental contribution to the surrounding community.

Assessment of the NSAID FLunixin Meglumine in Wound Healing After Hot-Iron Branding in Beef Cattle

Valeria Torres
Sponsor: Cassandra B. Tucker, Ph.D.
Animal Science

Branding is commonly used on cattle and is known to cause pain, inflammation and tissue damage. Although not common, a non-steroidal anti-inflammatory drug (NSAID; Flunixin meglumine is approved for use in cattle) could be used to reduce inflammation and possibly result in a faster healing process. My objective was to assess its effects on brand wound healing. Calves were assigned to one of four treatments: 1) branded/given flunixin IV(1.1 mg/kg), 2) branded/given saline IV(1.1 mg/kg), 3) sham branded/given flunixin and 4) sham branded/given saline. Healing scores were used to assess degree of scabbing and re-pigmentation. Wound temperatures were recorded with an infrared camera at 24, 48, and 72 h and every week for 10 weeks after branding. On average the wound temperature ($P< 0.0001$) of the calves branded (34.4°C ± 0.137) was higher than those not branded (33.3°C ± 0.138). After 71 days 67% of the calves were fully healed. Flunixin was administered once, as per label directions, has only a half-life of 3 to 8 h and, not surprisingly showed no significant effect on the rate of wound healing ($P=0.843$) and temperature ($P=0.498$). Therefore, future research may want to address repeated NSAID dosage throughout the wound healing process after branding.

Regulatory Mechanisms Underlying Stereotyped Axon Pruning in the Mammalian Visual System

Atrin Toussi
Sponsor: Hwai-Jong Cheng, M.D., Ph.D.
Neurobiology, Physiology & Behavior

Precise neuronal connections across regions of the brain constitute functional sensory system circuitry. In the mammalian visual network, information is relayed from the retina through the dorsal lateral geniculate nucleus, to the 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 the hindbrain through a process termed stereotyped axon pruning. Defects in pruning are known to cause neuropsychiatric disorders such as schizophrenia and autism. Recently, the Cheng Laboratory has shown that intrinsic spontaneous retinal waves, not extrinsic visual stimulation after eye opening, are necessary for mouse visual CST pruning. However, it remains unknown whether these findings apply to the visual development of higher-order mammalian species. To address this, we comparatively examine visual CST development of the ferret by injecting anterograde neuroanatomical tracer into V1 at different ages. Preliminary data shows that visual CST pruning occurs during stage III spontaneous retinal waves, prior to eye opening. This indicates that spontaneous retinal waves are necessary for both ferret and mouse visual CST pruning and are therefore likely an evolutionarily conserved mechanism.

Angelman's Syndrome Isoform Study

Andy A. Tran
Sponsor: David J. Segal, Ph.D.
Biochemistry & Molecular Medicine

Angelman's Syndrome (AS) is a neuro-genetic disorder caused by the loss of a gene on the maternally inherited chromosome 15. Intellectual disabilities, seizures, interrupted sleep cycles, jerky movements, frequent bursts of laughter and a seemingly happy temperament characterize this disorder, which affects one in every 15,000 live births. Amongst normal individuals, the gene that codes for UBE3A produces multiple size variants (isoforms) of this ubiquitin ligase via alternative splicing and posttranslational modifications. However, the maternal locus is mutated in individuals with the disease- resulting in the absence of some or all of the normally present protein isoforms and phenotypic presentations of AS that vary in severity. One of the challenges is to understand the different isoforms of this important protein and their alternative sizes, structures, locations, interactions and functions. We intend to use commercially-available antibodies against the mouse Ube3a, western blotting and mass spectrometry techniques to study the different isoforms of this protein and try to gain a deeper understanding of the disease.

Exploring Consortships Among Adult Male and Female Rhesus Macaques (*Macaca mulatta*)

Connie Tran
Sponsor: Erin L. Kinnally, Ph.D.
Psychology

Do external factors such as social hierarchy rank and female:male sex ratio predict consortships among adult male and female rhesus macaques (*Macaca mulatta*)? Elements that define a consortship include copulation, affiliation, and time spent in proximity. This study was conducted on eighty-one adult male macaques living in five separate multi-male, multi-female enclosures at the California National Primate Research Center, each housing between 100-120 rhesus macaques. Observational data was collected by five observers over the course of three months during the breeding season. Observers were trained to identify males and rate their social state with females: copulation, contact, arms reach, and 2 arms reach proximity. The research is in progress, however preliminary results from statistical analysis suggest that rank predicts some variation of a male's prosocial behavior with adult females. Males' higher social rank predicted more overall contact with females (Pearson's $r = .292$, $p = .01$). However, sex ratio did not predict affiliative behavior. Future research will probe additional factors that contribute to consortship behavior between male and female macaque dyads. Our research may be used to expand our understanding of social behavior and the factors that contribute to male-female affiliation during the breeding season.

Investigation of Defective Telomere Maintenance Caused by Dyskeratosis Congenita-Associated Heterozygous TIN2 Mutations

Duy C. Tran
Sponsor: Lifeng Xu, Ph.D.
Microbiology

The ends of eukaryotic chromosomes are composed of repetitive telomere sequences bound by the shelterin complex. Telomerase, a reverse transcriptase, is known to express in highly proliferative tissues and cells in humans to maintain a constant telomere length and to sustain their proliferative potential. Heterozygous missense mutations within one of the shelterin subunits, TIN2, have been identified in patients with Dyskeratosis Congenita (DC), a multiple stem-cell failure syndrome characterized by extremely short telomeres in affected patients. Our study aims to elucidate the mechanism by which TIN2 mutations shorten telomeres in human cells. We generated HCT116 colorectal cancer cell lines containing heterozygous TIN2 R282H mutation, one of the most common DC-related TIN2 mutations, by zinc-finger-nuclease facilitated gene-editing. Clones with heterozygous TIN2 mutation showed progressive telomere shortening, while wild-type clones showed no change in telomere length over extended cell proliferation. The progressive telomere shortening phenotype in TIN2 mutants can be rescued by exogenous expression of wild-type TIN2. However, TIN2 mutant clones do not contain elevated levels of deprotected telomeres, suggesting the TIN2 mutation does not lead to overall telomere deprotection. We are investigating whether the DC-related mutation induces telomere shortening by inhibiting telomerase or by accelerating telomere attrition through telomerase-independent mechanisms.

Conductive and Flexible Devices Based on Transparent Silver Nanowire Films

Jacqueline M. Tran
Sponsor: M. Saif Islam, Ph.D.
Electrical Engineering

Transparent silver nanowire films are fundamental components in the fabrication of electrically conductive and flexible devices. The purpose of this project was to create a simple pressure sensor from these materials. To start, a silver nanowire solution was spray-deposited onto a masked polyurethane film. The mask exposed parallel lines of polyurethane film, each 1 millimeter wide by 5 centimeters long. After thoroughly coating the substrate, a heat source welded the silver nanowires together to create a metallic mesh. This process was repeated to make a second patterned substrate. To construct the pressure sensor, the two films were oriented face-to-face perpendicularly, such that the parallel lines created distinct intersection points. In order to characterize the device, resistivity and capacitance measurements were recorded against varying pressures on the device. Due to the high conductivity of the silver nanowires and the elasticity of the transparent film, this introduces a versatile material that can be used in a variety of sensors and devices. This alternative material can be used in devices that require a flexible sensor, with little effect from stress or strain due to the characteristics of the material.

Investigating the Interaction Between the LEAFY COTYLEDON1 and bZIP67 Regulators in Embryogenesis of *Arabidopsis*

John D. Tran
Sponsor: John J. Harada, Ph.D.
Plant Biology

Seed development is an important period of angiosperm plant life cycle. Seeds have the capability to promote desiccation tolerance of the embryo and, in addition, store protein and nutrients, which are synthesized during the maturation phase of seed development. Hence, the maturation phase makes seeds an excellent food source for humans. This research investigates two transcription factors, LEAFY COTYLEDON1 (LEC1), which previously has been shown to be a vital regulator of embryo development, and bZIP67, which data from our lab and others suggest may interact with LEC1 to initiate maturation. LEC1 encodes an AHAP3 subunit for a DNA complex binding factor, which includes AHAP2 and AHAP5. Therefore, our goal is to determine whether or not bZIP67 physically interacts with LEC1 by conducting a series of yeast hybrid experiments. We have results that suggest a specific AHAP5 subunit can be used to test with LEC1 and bZIP67 in order to understand the entire transcription factor complex responsible for the initiation of seed maturation.

Staphylococcus aureus Is Inhibited by *Staphylococcus epidermidis Esp*

Michelle T. Tran
Sponsor: Charles L. Bevins, M.D., Ph.D.
Medical Microbiology & Immunology

Staphylococcus aureus, which can harmlessly colonize body surfaces, can cause disease with concurrent illnesses requiring hospitalization. Individuals, including infants, entering an ICU are especially at risk. *S. epidermidis* are commensal bacteria that also commonly colonize body surfaces. Recent studies suggest that a subset of *S. epidermidis* secrete an extracellular serine protease (Esp) that can influence whether *S. aureus* can co-colonize at mucosal sites. Our hypothesis is that colonization by Esp secreting *S. epidermidis* impedes co-colonization by *S. aureus* in infants admitted to a NICU. To begin testing our hypothesis, 587 bacterial samples were collected from infants admitted to the NICU at the UC Davis Medical Center. PCR and RFLP analyses were used to identify *S. epidermidis* samples and to determine whether those colonies had an intact *Esp* gene. All analyzed *S. epidermidis* samples had an intact coding region for *Esp*, although not all colonies secreted Esp, suggesting that presence of the intact *Esp* gene does not account for Esp secretion status. Our current experiments are examining the promoter region of the *Esp* gene in these specimens to elucidate if changes in *Esp* gene expression may account for variation in secretion status, and correlate with colonization with *S. aureus*.

Synthesis of Novel Pnictide-Halides for Thermoelectric Applications

Nhon Tran
Sponsor: Kirill Kovnir, Ph.D.
Chemistry

Much of the world's electricity is supplied by heat energy, but much of this heat energy is lost during its conversion from fuel to electricity. Thermoelectric materials have the potential to harness this wasted heat and convert it to useful electricity. Some applications of thermoelectric materials relate, but are not limited to: internal combustion engines in motor vehicles, solar thermal energy generation such as those of solar panels and Freon free refrigerators. Polyphosphides have been shown to be potentially useful as thermoelectric materials; being versatile to exist as isolated anions or larger anionic polyphosphide network allows it to form with almost all metals. This paves way to a wide array of chemical compositions, crystal structures and electrical properties. We previously discovered two new Ba_2P_7X (X = Br, I) phases of the known Ba_2P_7Cl. With this, we aim to discover more A_2Pn_7X phases with the alkaline earth metals (A = Ca, Sr, Ba), halogens (X = Cl, Br, I) and pnicogens (Pn = P, As, Sb).As of recent, we synthesized Ba_2As_7I compound with As_7^{3-} clusters. Determination of the crystal structure indicates that As clusters are arranged in a different manner compared to phosphorus compound.

Role of the DNA Damage Sensor, ATR in Meiotic Chromosome Segregation in *C. elegans*

Lisa Truong
Sponsor: JoAnne Engebrecht, Ph.D.
Molecular & Cellular Biology

The ataxia telangiectasia and Rad3 related (ATR) kinase is an essential DNA damage sensor in eukaryotes. While mutations in ATR in mammals are lethal, in *Caenorhabditis elegans*, ATR (ATL-1) mutants are viable but infertile, providing a unique opportunity to study the function of ATR in a multicellular organism. ATR is suspected to control the formation of chiasmata where genetic information is exchanged between homologous non-sister chromatids during meiosis. Defects in chiasmata formation lead to chromosome errors and the resulting gametes are aneuploid, which is fatal to the embryo. To study the function of ATL-1, gonads were dissected out of the worm, the DNA was stained with DAPI, and the number of chromosomes was counted in diakinesis-stage oocytes. In wild type, six DAPI-stained bodies corresponding to the six pairs of homologous chromosomes connected by chiasmata are observed. However, if ATL-1 functions in chiasma formation, more than six DAPI-stained bodies will be observed in *atl-1* mutants. After obtaining sufficient numbers, a statistical test will be used to compare the average number of bivalents in wild type and mutants to determine whether ATL-1 contributes to proper chromosome segregation. Hopefully, our findings will help to further understand how ATR functions in humans.

Traction Force Analysis of Epithelial Cell-Cell Junctions

Rose Hong Truong
Sponsor: Soichiro Yamada, Ph.D.
Biomedical Engineering

Mechanotransduction, a signaling pathway where external mechanical stimuli are converted into chemical reactions, plays an important role in cell physiology and ultimately tissue organization. It is generally thought that migrating cells exert traction force onto the extracellular matrix as they grab and pull the cell body forward, but we know little about how cells generate and transmit forces across cell-cell junctions. Using a soft substrate with embedded microsphere particles as a deformation tracer, we analyze how epithelial cells exert traction forces. Our unique approach is to plate epithetical cells onto surfaces coated with cadherin, cell-cell adhesion molecules, so that we can mimic and measure traction forces generated via cell-cell interactions. This approach will help us understand the role of cadherin-based cell-cell adhesion towards modulating activity of epithelial cells, and help us further understand how cells sense and adapt to their dynamic mechanical environment. This has implications towards the mechanical regulation of epithelial cell tissues during growth, repair, and disease.

Religious Policies During the *Kōminka* Movement in Colonial Taiwan, 1937-1945

Catherine Tsai
Sponsor: Kyu Hyun Kim, Ph.D.
History

Taiwan was a Japanese colony from 1895-1945. Between 1937 and 1945, the Japanese colonial government instituted a series of programs known as the *Kōminka* Movement that aimed to inculcate patriotism among its colonized subjects. These programs encompassed name-changing, Japanese language adoption, military enlistment, and Shinto shrine worship. My research focuses on the Shinto shrine worship aspect of the program. The religious component of the *kōminka* policies was responsible for the destruction of native temples between 1936 and 1939 as well as for encouraging the population to visit Shinto shrines and build Shinto altars in their own homes. Despite the efforts of the Japanese colonial government, Shinto shrines are hardly noticeable today and the amount of Shinto adherents in Taiwan are negligible compared to Buddhist, Daoist, and Christian populations. Using a variety of primary sources from Taiwan, Japan, and Presbyterian foreign missionaries, my research examines the colonial rationale for these policies, the effect that these policies had on different communities in Taiwan, and the reasons that led to its ultimate failure.

A Wall-Associated Kinase in Rice Confers Resistance to Bacterial Blight

Li Tsao
Sponsor: Pamela C. Ronald, Ph.D.
Plant Pathology

Rice, like any organism, is susceptible to disease. A genetic understanding of the defense mechanisms in rice is necessary to develop new strategies that will help sustain crop production and feed the world's population. When expressed in rice, a specific protein in the wall-associated kinase family, WAK25, increases the immune response and confers enhanced resistance against the bacterial pathogen, *Xanthomonas oryzae* pv. *oryzae (Xoo)*. The WAK25-overexpressed rice lines show decreased disease symptoms when infected with *Xoo* in comparison to the wild-type control; however, the specific pathway and mechanism remain unknown. The aim of my study is to characterize WAK25 and investigate its relationship to pathogenesis-related genes that are activated as part of the defense responses of rice plant. The main method used in my study is quantitative polymerase chain reaction (qPCR). QPCR is a well-established molecular biology technique that amplifies and quantifies targeted gene transcripts. The qPCR results show a general increase in expression of the pathogenesis-related genes in WAK25-overexpression lines. This research project will deepen our understanding of the function of WAK25 in regulating the rice immune response.

The Middle East and Muslim Women in U.S. Media Representations: Muslim Women in Contemporary U.S. Media

Lauren N. Turner
Sponsor: Suad Joseph, Ph.D.
Anthropology

In this paper I examine the current U.S. media representations of women in the Islamic world. In my capacity as an outreach materials writer for the Encyclopedia of Women and Islamic Cultures (EWIC), I have found that the media portrays Muslim women as oppressed, passive, and voiceless. My EWIC research analyzes contemporary media including online newspapers, UN reports, and academic journals. Though these sources are generally viewed as unbiased, I argue that they create a stereotypical and static view of Muslim women. My findings echo Edward Said's *Covering Islam*, in which Said argues that a biased Western media controls public perception of the Muslim world. My research builds upon the work conducted by the Media Team, demonstrating that their historical findings of a biased portrayal of Muslims and Arabs in the *New York Times* continue into present day. I have found a persistence of misrepresentation in the media, as pre-existing stereotypes are incorporated into the production of new knowledge(s) about the Muslim world. This research is part of a larger project analyzing 150 years of The *New York Times* conducted in the lab of Professor Suad Joseph.

Probing for Induction of Class-Switch Recombination in Mouse B Cells

Kenney K. Tuyen
Sponsor: Nicole Baumgarth, D.V.M., Ph.D.
Pathology, Microbiology & Immunology

B cells are white blood cells that produce immunoglobulins (Ig; antibody), which bind to and eliminate invading pathogens. The Ig-specificity determines the type of pathogen it binds, whereas the Ig-class (M, G, E, A) determines its precise function. All B cells first produce IgM, but can switch to other classes by a process called "class-switch recombination" (CSR). CSR is induced when B cells bind to antigen with their B cell receptors (BCR) and receive additional co-stimulatory signals from T cells. However, not all B cells undergo CSR. The differential signals that induce CSR in some but not all activated B cells are unclear. This project is to test my hypothesis, that weak signaling through the BCR causes CSR, but that strong signals induce differentiation without CSR. To test this, I isolated mouse splenic B cells and activated them in culture with different levels of BCR stimuli. I then measured expression of genes associated with activation and differentiation (BLIMP-1, AID, IRF4, PAX5, BCL6) by qRT-PCR, and analyzed cell phenotypes using flow cytometry. I will present data from these assays to demonstrate that this approach allows us to observe the impact of BCR-signaling strengths on changing gene expression in B cells.

Development of Novel Minichromosome Technologies in *A. thaliana*

Guillaume Urtecho
Sponsor: Connie Champagne, Ph.D.
Plant Biology

Advances in chromosome engineering have created the possibility of using minichromosomes to allow plant 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 method of creating minichromosomes using GFP-Tailswap, a transgenic strain of *A. Thaliana* that expresses a hypomorphic variant 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. To date, minichromosomes derived from four of the five chromosomes of *A. Thaliana* have been recovered. In addition, we use GFP-Tailswap plants carrying minichromosomes to demonstrate a method of transferring minichromosomes into naive strains without introgression of the mutant background, which can greatly accelerate minichromosome breeding programs.

Influence of Sexual Reproduction Mode on the Behavior of Sex Chromosomes During Meiosis in *Caenorhabditis* Species

Mike V. Van
Sponsor: JoAnne Engebrecht, Ph.D.
Biochemistry & Molecular Biology

In meiosis parent cells replicate and segregate genetic material into gametes for sexual reproduction. Double-strand breaks (DSBs) are induced during meiosis allowing for meiotic recombination and chromosome segregation to occur, but when repaired incorrectly could result in mutations. DSBs are favorably repaired through the process of homologous recombination (HR), which utilizes the homolog or sister chromatid as a template for repair. Previously, my lab demonstrated that meiotic DSBs that are induced on the hemizygous X chromosome of *Caenorhabditis elegans* males are repaired in the absence of HR, suggesting a surprising level of flexibility in the repair of breaks on sex chromosomes. Such flexibility in repair of X DSBs may be due to the hermaphroditic lifestyle of *C. elegans* or may be an inherent property of hemizygous sex chromosomes. To distinguish between these possibilities, I am examining the localization of RAD-51, as readout of DSB repair, on the X chromosome of *C. remanei*, a closely related species of *C. elegans* that are strictly obligate males (X0) and females (XX). I hypothesize that the properties of the X chromosome of *C. remanei* males will be similar to the X of *C. elegans* suggesting that hemizygousity influences DSB repair on sex chromosomes.

Synthesis of μ_3-Oxo-Centered Transition Metal Complexes

Ariel E. Vaughn
Sponsor: William H. Casey, Ph.D.
Chemistry

Transition metal μ_3-oxo-centered trimers were synthesized, purified, characterized, and spun into thin films of semiconducting materials for energy reactions. Such materials serve two purposes: (1) they can be utilized as catalysts for part of the splitting of water into hydrogen and oxygen, and (2) they can be made into hydrogen storage materials. The current catalysts used, including ruthenium and iridium complexes, are heavy, rare, and expensive. The iron formate complex, $[Fe_3O(OOCH)_6(OH_2)_3]$, is of particular interest because it is cost-efficient, light, and made out of common, earth-abundant metals. The synthesis of $[Fe_3O(OOCH)_6(OH_2)_3]$ was adapted from literature methods of other transition metal μ_3-oxo-centered trimers, including cobalt and chromium complexes. Characterization will shed light on the bonding, structure, and coordination of this complex. If the complex withstands spinning into thin films of semiconducting material, its efficiency as a water-oxidation catalyst will be determined with hopes of creating a cheaper, lighter hydrogen fuel cell.

Effects of Pore Size on Mechanical Properties and Osteoblast Behavior in Bioglass Composite Scaffolds

Caroline B. Vissers
Sponsor: J. Kent Leach, Ph.D.
Biomedical Engineering

Composite scaffolds, like those incorporating hydroxyapatite (HA), β-tricalcium phosphate (TCP), or bioactive glass (Bioglass 45S®) alongside a degradable polymer, are promising alternatives to autografts for treatment of bone defects. Unlike autografts, these scaffolds are tailorable, require only one surgery, and promote self-healing. Bioactive glass (BG) has an exceptional ability to improve physical properties of poly(lactide-co-glycolide) (PLG) scaffolds and stimulate differentiation of human mesenchymal stromal cells (MSC) into osteoblasts. In order to optimize BG composite scaffolds we investigated the effect of pore size on cellular growth and differentiation. I hypothesized that 500μm pores will be the approximate upper bound for cell-friendly pore size, and that 500-800μm pore scaffolds will inhibit cellular growth relative to the 125-300μm and 300-500μm conditions; larger pores may force the cells to adhere to pore walls and grow in two dimensions, as opposed to stretching across the pore and growing in three dimensions. Furthermore, the 300-500μm scaffolds may give more room for nutrient diffusion and cell expansion than smaller pores, making them most optimal for bone tissue engineering. To test MSC proliferation, DNA content was quantified at 7, 14, and 21 days, and osteogenic response was measured by alkaline phosphatase (ALP) activity and gene expression.

Depth of Interaction Detection in Positron Emission Tomography Scanners Using Spectral Information

Varsha Viswanath
Sponsor: Simon R. Cherry, Ph.D.
Biomedical Engineering

Positron emission tomography (PET) is a widely used imaging technique to detect cancer, study neurodegenerative diseases, and assess the efficacy of drug delivery. After the patient is injected with a positron-emitting, radioactive probe, two collinear gamma rays are emitted from the annihilation of a positron and an electron in the medium. PET uses scintillation detectors to detect gamma rays and reconstruct the biodistribution of the probe. However the geometry of PET systems degrades the spatial resolution at the edges of the scanner due to the detector thickness. Therefore, we aim to address this by determining the depth of interaction (DOI) of the gamma ray in the detector, with a 2-layer scintillator attached to a photodetector. A wavelength shifting sheet will be placed between the two crystal layers, shifting the crystal's natural blue light to yellow light, and making the two crystal layers discernible. Before the light is collected by the photodetector, a blue filter is placed on one half of the crystal face and a yellow filter is placed on the other half, causing a spatial shift in the light collected, and providing DOI information to enhance PET scanners.

Infant Cortisol Levels and Behavior Across Contexts

Chandrashekar Vittalbabu
Sponsor: Leah C. Hibel, Ph.D.
Human Development

The current study examined infant's biobehavioral relationships across two contexts. Salivary cortisol was assessed in six-month-old infants surrounding a benign mother-infant interaction and an infant-targeted stress task. Saliva sampling was designed specifically to capture biological responses to each task. The stress task included two episodes from a temperament assessment; a mask task meant to elicit fear responses, and an arm restraint task meant to elicit frustration. Infant's behavioral expression of mood during the mother-infant interaction, and behavioral response (i.e., crying intensity) to the stress task, were coded by trained undergraduates. A change score was calculated by subtracting post-task cortisol from pre-task cortisol levels to represent cortisol reactivity to each task, separately. Infant's cortisol reactivity to the mother-infant interaction was not associated with infant's behavioral expression of mood. Conversely, infant's cortisol was associated with infant's behavioral response to the stress inducing tasks. These findings suggest that the strength of the relationship among an infant's physiology, behavior, and mood, is dependent on the emotional valence of the context examined. Future studies are necessary in order to determine the specific aspects of an infant's context that serve to associate or dissociate behavior and biology.

Enhanced Thermoelectric Properties in Type I Clathrate $K_{8-x}Ba_xAl_8Si_{38}$

Mai O. Vue
Sponsor: Susan M. Kauzlarich, Ph.D.
Chemistry

With an increasing global demand for energy, high efficiency thermoelectric materials, which can save energy by generating electricity from waste heat, serve as an ideal solution to the energy crisis. Previous work showed $K_8Al_8Si_{38}$, with type I clathrate structure, to be an n-type semiconductor with moderate thermoelectric performance. Substitution of K with Ba can be an effective strategy in improving its thermoelectric properties, since Ba will introduce more electron carriers. Polycrystalline $K_{8-x}Ba_xAl_8Si_{38}$ ($x = 0.5, 1, 1.5, 2$) samples were synthesized and purified. Powder X-ray diffraction (PXRD) patterns of these samples were obtained and analyzed with whole profile fitting. The samples are revealed to be pure phases and possess type I clathrate structure (Space Group: P*m-3n*). Powder samples were consolidated with a spark plasma sintering system (SPSS) at 650°C into a 4mm diameter bar. The chemical compositions and Ba distribution were investigated with wavelength dispersive spectroscopy (WDS) on the cross section of the sintered samples. The power factor ($\alpha 2\sigma$) was characterized by four probe measurement system from room temperature to 650°C. The work shows Ba doping is successful and introducing Ba atoms allows for an enhancement of the power factor.

Function of Lettuce *DOG1* Gene in Thermotolerant and Thermosensitive Genotypes

Alex T. Wai
Sponsor: Kent J. Bradford, Ph.D.
Plant Sciences

In lettuce seeds, primary dormancy is associated with the inhibition of germination at warm temperatures (thermoinhibition). In *Arabidopsis*, the *DELAY OF GERMINATION1 (DOG1)* gene is involved with seed primary dormancy regulation. In *Arabidopsis dog1* mutant seeds, we found them able to germinate well at high temperatures, indicating that *AtDOG1* regulates seed thermoinhibition. We then examined the function of the lettuce homolog of *DOG1 (LsDOG1)* from four different lettuce genotypes: thermosensitive *Lactuca sativa* cv. Salinas and thermotolerant *L. sativa* accession PI251246, *L. serriola* accession UC96US23, and *L. saligna* accession PI261653. While the four *LsDOG1* genes share >90% protein amino acid sequence homology, they share only 35% identity to *AtDOG1*. Nonetheless, expression of L. saligna DOG1 in *Arabidopsis* wild type Columbia results in an increase in seed primary dormancy. Molecular complementation tests revealed that all four *LsDOG1* genes can rescue the *atdog1* mutant, which suggests the lettuce *DOG1* homolog genes have a similar function. To investigate whether *LsDOG1* regulates seed thermoinhibition in lettuce, silencing of *LsDOG1* in thermosensitive Salinas genotype is in progress. Expression analysis of the lettuce genotypes will be performed to test whether phenotypic differences are associated with differential *LsDOG1* expression.

Confidence Ratings Reflect Implicit Error Detection During a Time Judgement Task

Tiffany A. Wall
Sponsor: Eve A. Isham, Ph.D.
Psychology

Subjective temporal reports of intent and action have been used as a way to index consciousness. However, recent evidence suggests that action-related reports are inaccurate and may be distorted in the presence of unrelated cues (Banks & Isham, 2009). This implies that we may not have an accurate representation of temporal information, or may lack such a representation entirely. To test this hypothesis, we asked naïve participants to perform a task in which the participants pressed a button and received a brief tone, presented immediately or at some time delay (Experiment 1). The participants reported the moment of intent to act, the moment of action, and provided confidence scores of how accurate they felt their reports were. The results showed that while uninformed observers relied on the timing of the tone to formulate their temporal reports, thus implying the absence of temporal awareness, their confidence data nevertheless suggest that the same observers implicitly were conscious of the temporal mismatch between action and the delayed tone. Subsequently, the participants were informed of the tone manipulation (Experiment 2), which resulted in diminishing of the inference process. Overall, these findings provide evidence that temporal information is mentally represented and can be accessed implicitly.

Absolute Quantification of Amino Acids Using MTBSTFA Derivatization on GC/MS Platform

Benjamin Wancewicz
Sponsor: Oliver Fiehn, Ph.D.
Molecular & Cellular Biology

Metabolomics is a growing field interested in the identification and quantification of chemical compounds, including amino acids, present in biological samples. Amino acids play a key role in our metabolism and irregular levels of any one of them can indicate a diseased state. In order to identify and quantify a compound, a derivatization process is required to make them volatile enough to run on the gas chromatography/mass spectrometry (GC/MS) platform. The currently accepted protocol for amino acid derivatization calls for MSTFA to act as a trimethylsilyl donor, but MTBSTFA with its tert-buytldimethylsilyl donor group provides a more complete reaction and robust product which will lead to a better absolute quantification. Both methods call for methoximation to protect the carbonyl group before MSTFA or MTBSTFA is added. In order to test the accuracy of a MTBSTFA derivatization, a curve with known concentrations, ranging from 0.1ug/ml up to 10ug/ml, must be run. Then the concentration of each sample will be plotted against the molecular ion peak to determine the correlation between actual and observed count. After analyzing the curve, NIST (National Institute of Standards and Technology) plasma samples will undergo both derivatization methods to compare their absolute quantification.

The Alzheimer's Disease Neuroimaging Initiative: The Relationship Between Subjective Memory Complaints and Other Patterns of Cognitive Impairment

Cathy Wang
Sponsor: Laurel A. Beckett, Ph.D.
Public Health Sciences

Alzheimer's disease (AD) is a progressive brain disease with very gradual onset, and patients typically report having memory problems years before clinical diagnosis. Our focus is on whether these early signs of memory problems are related to other patterns of cognitive impairment that may distinguish them from normal aging. The Alzheimer's Disease Neuroimaging Initiative (ADNI) study has recently enrolled a cohort of people who are normal except for subjective complaints of memory problems. We examine baseline cognitive test profiles for 100 participants with subjective memory complaint (SMC) and compare them with 182 normal controls (NC). There is considerable heterogeneity in both groups and overlap between the two; there is, however, a significant difference in means for test scores, especially those related to memory. Clinically normal people display a fairly wide range of cognitive test performance, but those who have memory complaints perform worse across several closely related domains. We employ multivariate analyses to identify patterns that might distinguish the two groups. Furthermore, we examine biological markers and prospective clinical evaluation to determine whether these patterns are associated either with markers for concurrent brain damage or prognosis of onset of cognitive impairment.

Exploiting Natural Variation to Determine the Genetic Basis for Hypocotyl Length in Tomato

Deyu Wang
Sponsor: Julin N. Maloof, Ph.D.
Plant Biology

At the seedling stage, the domesticated tomato cultivar M82 is three times the length of its wild desert-adapted relative, *Solanum pennellii*. Controlling seedling elongation may be an adaptive strategy for *S. pennellii* to minimize water loss at a stage in its life prone to desiccation in the desert, whereas increased elongation in the domesticated species may be an adaptation for competition with weeds. In this project, we screened a tomato introgression line (IL) population derived from an interspecific cross of M82 and *S. pennellii* to determine which genomic regions contribute to these differences in seedling elongation. With this population, we found that loci on chromosome 1 may contribute to the short seedling length of *S. pennellii*. In order to find candidate genes associated with seedling length, we are taking a classical genetic mapping approach by backcrossing the IL on chromosome 1 to M82 and propagating an F2 population. We designed nine cleaved amplified polymorphic sequence (CAPS) markers spanning the introgressed region on chromosome 1 for the identification of the introgression line of interest and of the recombinants. Recombinants identified in the F2 will be allowed to propagate, and homozygous F3 individuals will be phenotyped for seedling elongation.

Study of Grower Practices and Its Relation to Postharvest Chilling Injury in Tomatoes

Jason Wang
Sponsor: Diane Beckles, Ph.D.
Plant Sciences

Postharvest Chilling Injury (PCI) is a phenomenon in which susceptible produce show disruptions in their metabolisms when exposed to temperatures below 12.5ºC. This may lead to noticeable and undesirable sensory attributes, which create dissatisfaction among consumers or worse, may lead to a loss of product. As such, growers often face this dilemma: storing produce at low temperatures will maximize shelf-life but will also simultaneously increase the risk of PCI. The aim of this study was to survey grower awareness of PCI and the practices that may contribute to the risk of encountering fruit with the condition. This study may find links between factors such as grower experience and temperatures used to store products. California's fresh market tomato industry has generated USD$222 million in 2012 alone*. This research may lead to new developments that reduce the occurrence of PCI, thereby increasing revenue for the industry by allowing growers to reach more consumers with higher quality tomatoes. *USDA Economic Research Service - North American Fresh-Tomato Market 2013

Controlled Surface Modification of Cotton Fabrics With Light-Active Anthraquinone Derivatives

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

Certain anthraquinone compounds have exhibited light-active properties in solutions and on materials under UVA or fluorescent light exposure. One photosensitive anthraquinone derivative, a vat dye Vat Yellow GCN, was incorporated onto cotton fabrics through a conventional vat dyeing process. The anthraquinone moieties on the cotton fabrics were able to serve as a radical initiator for controlled graft polymerization of other functional groups onto the surface of cellulose fibers. A wide range of monomers, both hydrophobic and hydrophilic, was successfully grafted on the surface of Vat Yellow GCN dyed cotton fabrics after a dip-pad-light exposure process. In this research, we tried to create double face materials through the controlled photo-initiated surface modification methods. Acrylamide serving as a model monomer was grafted onto one side of the GCN dyed cotton fabrics through a controlled and optimized process. F. Properties of the new double face fabrics were evaluated. This new technology could be advantageous as an environmentally friendly process of making multi-functional cotton and other fabrics with coloration and functional finishes achieved simultaneously.

Lipidomics of Neuronal Differentiation

Isabel Warner
Sponsor: Richard Jeannotte, Ph.D.
Population Health & Reproduction

Lipids are key components in membrane composition and cell signaling. The membrane lipid composition of a cell determines not only its properties and structure but how it interacts with other cells and its environment. Lipids are highly involved in the structure and function of neuronal cells, but we know relatively little about their dynamics during neuronal differentiation. Here we seek to apply a lipidomics approach - the comprehensive study of the lipid composition of any living organism such as a mammalian cell – to study the modulation of membrane lipid composition during neuronal differentiation. Using this method we hope to better understand the sequence of cell signaling events taking place during differentiation from embryonic cells. A preliminary analysis has shown changing concentrations of certain membrane lipid species during neuronal differentiation, which could indicate that these species are important in the cell signaling and that their biosynthesis is regulated during differentiation. From this, we will be able to delve deeper, and look at the role of specific enzymes in altering the membrane's lipid composition. Ultimately, we will be able to look at and try to understand the mechanisms regulating lipid biosynthesis during neuronal development and how neurotoxins could alter them.

Interactions Between Lymphoid Tissues and Antigenic Challenge in Cockatiels (*Nymphicus hollandicus*)

Matthew F. Warren
Sponsor: Kirk C. Klasing, Ph.D.
Animal Science

Cockatiels (*Nymphicus hollandicus*) are the model for studying birds in the order Psittaciformes. Cockatiels are altricial birds, born blind and naked, chicks require high parental care, and little is known about their lymphoid system development. This study explores development of the lymphoid system in cockatiels that undergo an antigenic challenge, providing researchers information on augmenting immunity of captive altricial birds. Thirty-two one day old cockatiels will be used for the study. Cockatiels will be assigned to two treatments in a completely randomized design (n=16). The treatment group will be immunized with dinitrophenyl keyhole limpet hemocyanin (DNP-KLH) vaccine on the seventh day of age by intravenous injection via the wing vein to elicit an immune response. On day 7, 14, 21, and one month post-immunization, four cockatiels from each treatment group will be humanely euthanized by CO_2 asphyxiation. The spleen, bursa of Fabricius, and thymus will be weighed and frozen by liquid nitrogen for immunohistochemistry to analyze the development of germinal centers. DNP-KLH challenged cockatiels are expected to have lymphoid organs of 20% - 50% greater volume compared to non-challenged cockatiels because the antigenic challenge caused by the immunization will increase the number of germinal centers detected in the tissue samples.

Weaning and Early Diet Reconstruction From an Ancient Archaeological Site in California

Eden Washburn
Sponsor: Jelmer Eerkens, Ph.D.
Anthropology

This study examines weaning practices and early childhood diet at a 3000-year-old archaeological site in the California Delta, CA-SJO-112, or the Bear Creek Site, located in the modern city of Stockton. Human permanent first molars form between the ages 0 and 9 years, and record dietary practices while the tooth is forming. Collagen is extracted from serial samples in first molars, and stable carbon and nitrogen isotopes measured to reconstruct diets across this window of time, which includes the weaning process. The data facilitate comparison of diets of boys vs. girls within the site, and potentially, measures of parental investment in offspring. Data from 8 individuals at CA-SJO-112 are compared to a previous study at a contemporary site 40 km to the east, CA-CCO-548, or the Marsh Creek site. Analyses at the latter site showed that most children were weaned between 3 and 4 years of age, that boys consumed greater amounts of higher trophic-level fish and meat protein than girls, and that girls were weaned at slightly later ages. Data from this study will indicate whether contemporary sites located in different geographic regions follow similar cultural patterns of early childhood diets.

Investigating Protein Isoforms of Ube3a, an Important Ubiquitin-Protein Ligase Implicated in Angelman's Syndrome

Joanna B. Watterson
Sponsor: David J. Segal, Ph.D.
Biochemistry & Molecular Medicine

Angelman's Syndrome (AS) is a neuro-genetic disorder caused by the loss of a gene on the maternally inherited chromosome 15. Intellectual disabilities, seizures, interrupted sleep cycles, jerky movements, frequent bursts of laughter and a seemingly happy temperament characterize this disorder, which affects one in every 15,000 live births. Amongst normal individuals, the gene that codes for UBE3A produces multiple size variants (isoforms) of this ubiquitin ligase via alternative splicing and posttranslational modifications. However, the maternal locus is mutated in individuals with the disease- resulting in the absence of some or all of the normally present protein isoforms and phenotypic presentations of AS that vary in severity. One of the challenges is to understand the different isoforms of this important protein and their alternative sizes, structures, locations, interactions and functions. We intend to use commercially-available antibodies against the mouse Ube3a, western blotting and mass spectrometry techniques to study the different isoforms of this protein and try to gain a deeper understanding of the disease.

Leftovers

Marina D. Weiner
Sponsor: Hearne Pardee, M.F.A.
Art Studio

The great painter Braque said, "At a certain temperature, iron becomes malleable, it loses its sense of iron. That's the kind of temperature I'm seeking." This quotation adequately describes the push towards abstraction that I am experiencing in my work. My current series examines discarded materials through medium- to-large- scale paintings of the contents of garbage cans and recycling bins. Using color and form, I am exploring the boundary between representational and abstract painting in an attempt to make work that transcends its contents. I wish to evoke recognition of the familiar by retaining the repetition of form that is expected in a garbage can while also providing enough visual interest for the viewer to escape the mundaneness of one of our most common practices. Additionally, I hope that my work will raise questions about the nature and necessity of discarding certain objects and about the prevalence of disposability in our everyday lives.

Do H-1B Visas Respond to Labor Demand in the United States?

Ilyssa M. Weinstein
Sponsor: Giovanni Peri, Ph.D.
Economics

The H-1B visa program is the largest provider of high-skilled foreign workers in the science, technology, engineering, and mathematic (STEM) occupations, accounting for over 90% of H-1B requests from 2001-2012. STEM workers are essential catalysts to US innovation and US global economic competitiveness. This working paper models the US labor market in order to answer the question if the H-1B visa responds to labor demand, contesting the argument that US employers abuse the H-1B program in order to bypass the labor market and hire cheap foreign skilled-labor. This paper examines the role that employers play in motivating skilled migration to the US. A statis short and long-run approach as well as a dynamic long-run approach are used aggregating data by occupation and Metropolitan Statistical Area (MSA) and is based on two data sets, the Labor Condition Application (LCA) for the years 2001-2012 and the 2001-2011 American Community Survey (ACS). The importance of labor demand in stimulating skilled migration is clearly demonstrated by the total demand for H-1Bs, represented by certified LCAs, far exceeding the annual visa cap since its creation in 1990.

Electronic Trading and Price Volatility in Corn Futures Markets

Cy Whitten
Sponsor: Katrina K. Jessoe, Ph.D.
Managerial Economics

In recent years, electronic trading platforms have become commonplace for many exchanges. This paper examines the effect of electronic trading on price volatility and trading behavior in the corn futures contracts on the Chicago Board of Trade during the year 2006. On August 1, 2006, electronic trading was allowed during floor trading hours whereas before it was restricted to 6:30 PM to 6:00 AM. Using 15 minute interval trading data, I use multiple regression models to analyze how time, volume, and trading platform affect price volatility. Comparing periods before and after August 1, 2006, results suggest electronic trading reduced price volatility in futures markets and encouraged efficient market pricing. These findings run contrary to common impressions.

Automated Spotlight Tracker

Amanda M. Williams
Sponsor: Andre Knoesen, Ph.D.
Electrical Engineering

The "Spot Project" is designed to produce interesting visual and audio feedback to a user's movements through the use of a spotlight and an audio speaker system. A person moves in a random pattern, triggering the spotlight to follow and musical notes to play corresponding to where they move. A camera takes multiple images per second that are processed by the BeagleBone Black electronic processor. The BeagleBone Black process the images to find the user's position and detect movement. Once a change in position is detected, the BeagleBone responds by adjusting the spotlight's coordinates using electrical motors mounted in a mechanical fixture. In this manner, the spotlight follows the person. Simultaneously, data is sent to an electronic sound system to produce audio tones in a loudspeaker. In this collaborative project between electrical, computer and mechanical engineers, we demonstrate how the skills of engineers can be applied in making a fun and interactive project.

Expression Levels of LBD4/LBD3

Clara Williams
Sponsor: Siobhan M. Brady, Ph.D.
Plant Biology

The fasicular cambium is responsible for secondary growth in plants, which can greatly increase the amount of vascular tissue. This vascular tissue is made up of xylem tracheary elements and the phloem sieve elements. LBD4 and LBD3 are transcription factors which are thought to work downstream of the tracheary element differentiation inhibitory factor TDIF, a peptide ligand which is known to control vascular development and is encoded by CLE41, CLE42 and CLE44 genes. Expression of LBD3 and LBD4 increases in CLE41 expression. TDIF has been shown to bind to PXY (PHLOEM INTERCALATED WITH XYLEM) a receptor like kinase that is required for properly orientated vascular cell divisions. A way to help support that LBD4 and LBD3 are downstream of CLE/PXY would be to make an inducible CLE41 plant. If CLE41 expression is induced the RNA expression levels of the transcription factors acting downstream of PXY including LBD4, LBD3 and potentially those found to bind to their promoters should increase compared to the wild type. Alternatively, if factors that bind LBD3 and LBD4 promoters are identified that are not induced by CLE41 induction, they may be indicative of factors other than TDIF/PXY signaling regulating LBD3/4 and vascular development.

Sharing Facilities: Guidelines to a Model Facility for Both Skateboarders and Other Users

David M. Williamson
Sponsor: David de la Peña, Ph.D.
Landscape Architecture

Skateboarders are often frowned upon for the practice of their art on urban furniture and city property. Often times, skateboarders are pushed into skate parks/facilities in unfavorable conditions with forced regulations and set on the outside of town where they are forgotten and neglected. I am proposing a set of design guidelines for the combination of a skate facility with other users. This project will be approached carefully, and address issues of safety, sustainability, and community. My research involves visiting nine existing parks in Northern California and taking notes on their physical relation to downtown urban centers, their lighting/parking/drainage/shading conditions, popular objects, and size of the facility. While visiting these nine facilities, I will be gathering information from the locals by asking both community members and skateboarders a series of design, use of space, and accessibility questions. I have also gathered a series of scholarly articles, books, videos, and ProQuest historical newspapers to assist with my research. My conclusion will include a final set of design guidelines and a written paper. Both the design and paper will focus on a shared model facility for skateboarders and other users based on my collected case studies and research.

Investigating Germ Line Nucleoporin Plaques in a *C. elegans* Torsin Mutant

Paige C. Wilson
Sponsor: Lesilee S. Rose, Ph.D.
Molecular & Cellular Biology

The Torsin family AAA+ ATPase OOC-5 is required for polarity and spindle rotation in *C. elegans* embryos. Torsins localize to the lumen of the endoplasmic reticulum and contiguous nuclear envelope, and mutations in the human homolog, TorsinA, lead to a neuromuscular disease. Recent work indicated that TorsinA interacts with several nuclear envelope proteins including SUN and KASH proteins, but the role of torsins at the nuclear envelope is not clear. Our lab previously found that nucleoporins are mislocalized into plaques in the germ-line nuclei of *ooc-5* mutants. Plaques are first observed in the transition zone, where cells enter meiosis, suggesting a transition-zone-specific mechanism for their origin. In the transition zone chromosomes are anchored to the nuclear envelope through SUN-1/ZYG-12 bridges that move through the nuclear envelope to facilitate homologous pairing. We hypothesized that these movements cause nucleoporin plaques in the absence of OOC-5. To test this, we depleted ZYG-12 via RNAi and found that nucleoporin plaques persisted. Interestingly, nucleoporin plaques appear to start earlier in ZYG-12 RNAi treated *ooc-5* germ lines than in controls, a result we are currently investigating.

Dissecting the Mode of Action of a Novel Pharmacological Inhibitor Using Cell Wall Mutants

McKenzie Winter
Sponsor: Georgia Drakakaki, Ph.D.
Plant Sciences

Plant chemical genomics is a useful technique for gaining insight into inner cellular mechanics by studying chemical targets and resulting growth abnormalities, contributing to our ever-expanding knowledge base of intercellular plant dynamics. We have identified a chemical that causes mislocalization of cellulose synthase, the protein responsible for making major polysaccharides in plant cell walls. To further investigate the mode of action of this novel pharmacological inhibitor (chemical 1) and learn more about cellulose synthase trafficking, we tested cell wall mutants under chemical treatment. *Arabidopsis thaliana* were screened under various conditions, concentrations, and media to assess the effect of the small molecule. Preliminary chemical treated mutant screens were conducted in light and dark conditions and photographed over a ten-day period. Comparing the mutant response to chemical 1 with oryzalin and isoxaben treatments, inhibitors of microtubule polymerization and cellulose biosynthesis respectively, will lead to a greater understanding of cellular plant mechanics relating to cellulose synthase.

The Global Order of Symbolic Capital: UNESCO and the Discourse of World Heritage

Mitchell A. Winter
Sponsor: Vaidehi Ramanathan, Ph.D.
Linguistics

For over fifty years, the United Nations Educational Scientific and Cultural Organization (UNESCO) has remained an authority in the international arena when it comes to the management and protection of natural and cultural heritage. UNESCO drafted a convention for the establishment of a World Heritage program in 1972 that would locate and offer protection to natural and architectural sites around the world that exhibit "outstanding universal value." This paper presents a discourse analysis of the 1972 UNESCO convention text focusing on the recurrent themes of value and protection that are co-referenced in the document. I examine the rhetoric employed in the convention text through methodologies of critical discourse analysis (CDA) furthered in the field of sociolinguistics by Norman Fairclough; additionally, I draw from Pierre Bourdieu's concept of symbolic capital to explain UNESCO's definition of 'value.' In doing so, my aim is to demonstrate the structural inequalities that UNESCO's world heritage system reproduces by privileging the maintenance of some heritage sites over others in their global program of protection. Finally, this project discusses how relations of power are connected to linguistic practices at the institutional level and how worth is constructed as a global category.

Mechano-Chemo-Transduction Through Nitric Oxide Synthase in Heart Cells

Rahwa Woldeyesus
Sponsor: Ye Chen-Izu, Ph.D.
Pharmacology & Toxicology

Heart failure is the leading cause of death in the United States. A large portion comes from heart arrhythmias, making understanding the molecules that play vital roles in the hearts function important. The research in our lab centers on how the mechanical stress affects the biochemical reactions in heart cells to alter the heart function and cause diseases, a process called mechano- chemo-transduction. My research focuses on two isoforms of Nitric Oxide Synthase (NOS): eNOS and nNOS. These two enzymes produce nitric oxide (NO) increasing the probability of ryanodine receptors opening. This causes an elevation of spontaneous Ca2+ release by the sarcoplasmic reticulum (SR). Ca2+ is the key mediator of heart muscle contraction. Thus eNOS and nNOS signaling will aid in understanding how the heart functions. Due to the short-lived nature of NO diffusion, we think the location of eNOS and nNOS will give information on which isoform affects the ryanodine receptor. Using super-resolution Structured Illumination Microscopy (SIM) and antibody labeling, we are able to measure the distance of these enzymes in reference to the ryanodine receptors. Our studies reveal that nNOS is structurally closer to the ryanodine receptors than eNOS, playing a larger role in regulating ryanodine receptor activities.

Identifying Relationships Between *Ixodes angustus* and Its Ecological Role as a Vector to Lyme Disease and Anaplasmosis

Johnny Wong
Sponsor: Janet Foley, D.V.M., Ph.D.
Medicine & Epidemiology

The tick, *Ixodes angustus*, is an endemic species to the Pacific Northwest and capable of transmitting pathogens such as *Anaplasma phagocytophilum* and *Borrelia burgdorferi* sensu stricto, the etiologic agents of Lyme disease and anaplasmosis, respectively. Despite what we know about the genus *Ixodes* geographical omnipresence, ecological roles, range of hosts, little is known about *I. angustus* and its role as a vector. All stages of *I. angustus* were collected from live-trapped small mammal hosts in the past decade, from study sites throughout northern California. Taqman PCR of ticks will test for the presence of *A. phagocytophilum* and *B. burgdorferi*, which can then be evaluated by the stage of development, sex and location of the tick. From this data, we can make inferences about the role of *I. angustus* as a vector in the transmission of *A. phagocytophilum* and *B. burgdorferi*, which are both reportable diseases and of public health concern.

Dynamic Bike Parks as Alternatives to Urban Landfills

Matthew G. Wong
Sponsor: Rob Thayer, Ph.D.
Landscape Architecture

As the popularity of biking continues to rise throughout urban communities, accommodating bicyclists is becoming more of a challenge for city planners. Concepts relating to complete streets are more prevalent in master plans as cities begin to realize the benefits that result from incorporating bikeable areas in communities. The lack of available space, however, can many times come as a constraint. Cities like San Francisco and Elk Grove have found ways of incorporating bike parks within city limits. With issues regarding the availability of space, looking at underutilized spaces that may otherwise be overlooked, could prove to be an answer to the problem. The purpose of this study is to explore an effective way for integrating a multi-use bike park at the Yolo County Central Landfill in north Davis. In an effort for further examination, this project will involve a mixed methods approach, utilizing both quantitative and qualitative research methodologies. Community surveys, case studies, and extensive analysis of the site will be integral components of research that will be conducted during early stages of the project.

Perceptions About Maternal Diets in Rural Bangladesh

Candace Wong-Sing
Sponsor: Christine Stewart, Ph.D.
Clinical Nutrition & Dietetics

Perceptions about acceptable, health-promoting diets for pregnant women vary among cultures. My research explored these perceptions among Bangladeshi women who gave birth within the last 6 months (n=15), their family members (n=10), and community health workers (CHWs) (n=8) through qualitative methods. Each interviewee was asked a set of questions probing for information about foods that should or should not be consumed during pregnancy and where women get information about diet during pregnancy. The results suggest that women listen to advice from elders and those with children regarding the types of foods to consume during pregnancy, such as meat, certain fruits, and vegetables. Women also reported that they received information about diet during pregnancy from books and television. Though there was less consistency in the responses, some women reported that pineapples, bananas, and duck meat should not be consumed while pregnant. The reasons provided for avoiding these foods were that they were thought to cause illnesses to the child and mother. The results also suggest that CHWs learn advice through trainings, while relatives receive their information through elders and neighbors. The results inform us about rural Bangladeshi women's' perceptions about diets during pregnancy and where women receive this information.

Testing the Janzen-Connell Hypothesis for Explaining High Biodiversity in a Tropical Rainforest

Katherine E. A. Wood
Sponsor: Marcel Rejmanek, Ph.D.
Evolution, Ecology & Biodiversity

The Janzen-Connell Hypothesis explains maintenance of tropical rainforest biodiversity through density- or distance-dependent seedling recruitment. Host-specific predators target mature trees and make the surrounding area inhospitable for conspecific seedling establishment. Damage from herbivores and pathogens decreases conspecific density, thus keeping within-species density low and increasing within-habitat species diversity. I investigated the Janzen-Connell Hypothesis in an observational field study at Barro Colorado Island in Panama. For two tree species, I measured seedling metrics of fitness, leaf damage from herbivores and pathogens, and distance from focal adult conspecifics. In concordance with the Janzen-Connell Hypothesis, I expected to see greater damage from herbivores and pathogens on seedlings establishing near these adult conspecifics, especially those establishing in high seedling densities. This would suggest negative density-dependence and low rates of relatedness among seedlings and mature tree neighbors. This project investigates several key community interactions in tropical forests: spatial and density-dependent scales, seedling recruitment, herbivore and pathogen damage, and phylogenetic relatedness. Understanding these community interactions provides insights into species co-existence in hyper diverse tropical forests, especially with recent scrutiny of the Janzen-Connell Hypothesis.

Montmorillonite Catalyzed Nucleophilic Addition of Allylsilanes to Isatins

Richard L. Wood
Sponsor: Annaliese K. Franz, Ph.D.
Chemistry

Over the last few decades, there has been increasing interest in utilizing acidic clays as catalysts for organic synthesis because they are recyclable, environmentally benign, sustainable, green catalysts. Previous research demonstrates that acidic clays can catalyze a variety of organic reactions with high yields. My research focuses on utilizing the acidic clay montmorillonite to catalyze nucleophilic additions to isatins to synthesize 3,3'-disubstituted oxindoles. I chose isatins because they are readily available starting materials for the synthesis of 3,3'-disubstituted oxindoles and spirooxindoles, which are medicinally and biologically relevant scaffolds. We have shown that montmorillonite clay will catalyze the allylation of isatins with high yields and product selectivity, and these products can be carried on to further synthetic steps to yield medicinally relevant compounds. We have also demonstrated that montmorillonite clay can be recycled and used in subsequent reactions, thus making it a more environmentally benign catalyst for the nucleophillic addition of allylsilanes to indoles.

The Perceived Time of Intent is Determined by the Belief in Free Will

Krystal A. Wulf
Sponsor: Eve A. Isham, Ph.D.
Psychology

Different perspectives on free will have been shown to elicit different behaviors (Schooler et al., 2008). In the current study, we asked whether the belief in free will would alter the perceived time of intention. The current research is motivated by the neural evidence that preparation for voluntary action begins earlier than an involuntary movement (Libet et al., 1983). Based on this finding, we anticipated that those who believe in free will would also perceive the time of intent to be earlier than those who believe in determinism. The current experiment manipulated the participant's philosophical belief about free will via a suggestive passage of whether free will existed. Subsequently, the participants were asked to perform a simple button press and to report the time of intent by reading the time from a computerized clock. Additionally, the participants indicated their confidence regarding the temporal reports. Preliminary data suggest that those who were led to believe in free will judged their time of intent to be earlier and felt more confident about their reports. These results suggest that the belief in free will influences the mental representation and memory for the timing of action.

Hazard Assessments of Titanium Dioxide Nanoparticle Coatings in Textile

Zhimin Xie
Sponsor: Julie Schoenung, Ph.D.
Materials Science & Engineering

Different methods have been developed to incorporate photocatalytic molecules like titanium dioxide onto cotton fabrics for its self-cleaning property when exposed to light. Despite its practical property, there is limited information on the toxicity of the coatings, so the hazard traits of the process chemicals used to fabricate different coatings were evaluated with three hazard assessment tools. The first chemical hazard assessment tool for the coatings was GreenScreen for Safer Chemicals® (GreenScreen), which is a tool that ranks chemicals based on 18 different environmental and human health endpoints (e.g., carcinogenicity, skin sensitization, chronic aquatic toxicity, etc). For the second hazard assessment, the NanoRiskCat (NRC) for nanomaterials was used. The NRC assesses the nanoparticles in five categories: exposure for professional end-users, exposure for consumers, exposure for the environment, human hazards, and environmental hazards. The five categories are then ranked low, medium, high, or unknown with the colors: green, yellow, red, and grey, respectively. The last tool used was a life-cycle assessment of the production process - which encompass all steps from raw material acquisition to coating of the fabric. Results show that the coatings had similar toxicity ratings.

Diagnostic PCR for *An. gambiae* Forest and Mopti Chromosomal Forms via SNPs in the 2La Inversion

Youki K. Yamasaki
Sponsor: Gregory Lanzaro, Ph.D.
Pathology, Microbiology & Immunology

With 207 million estimated cases of malaria in 2012 (World Malaria Report 2013), there is an urgent need to understand *Anopheles gambiae* sensu stricto (*An. gambiae*), the primary carrier of malaria in Africa. To understand this vector, it is necessary to research the genetic mechanisms underlying its versatility in surviving in diverse habitats. *An. gambiae* populations have been documented to have different concentrations and locations of inverted DNA in their chromosome which contributes to their versatility. Populations with a particular inversion profile of have been designated as a chromosomal form. The presence of the 2La inversion is indicative of the Mopti form, as the absence of 2La inversion is indicative of the Forest form. This research investigates informative Single Nucleotide Polymorphisms (SNPs) found within the 2La inversion region to distinguish between the Forest and Mopti chromosomal forms. Using Polymerase Chain Reaction (PCR), the presence or absence of unique SNPs may be applied as a diagnostic tool to identify the chromosomal forms. Future investigations will test the viability of this simple procedure as a mean to distinguish *An. gambiae* chromosomal identity.

Effects of pH on Microstructure and Porosity of Soy Protein Hydrogels as a CO_2 Absorbent

Jia J. Yao
Sponsor: Gang Sun, Ph.D.
Textiles & Clothing

Global warming resulted from the emission of greenhouse gases has received widespread attention. The burning of the diminishing fossil fuel reserves is accompanied by large anthropogenic CO_2 release, which is outpacing nature's CO_2 recycling capability, causing significant environmental harm. The removal and capture of CO_2 from gas streams can be achieved by a range of separation techniques. Soy protein is a natural polymer containing rich amino and amide (peptide) groups, which can interact with CO_2. The soy protein chemical structural features, as a vegetable protein, may have high potential in CO_2 adsorption. A recent preliminary study of using protein for capturing CO_2 was conducted, and it has been approved that proteins are feasible for capturing CO_2. Since soy protein as an abundant plant protein is renewable and biodegradable, utilization of pure protein as adsorbents with high efficiency is our optimal goal. Due to the biodegradability of soy proteins, the process has the advantages of environmentally friendly and resulted products are potentially biodegradable or become fertilizers. In this research the effects of pH on the structures of soy protein hydrogels are investigated in order to find the highest porous protein structures for increasing physical interaction between CO_2 and the bio-absorbent.

Detecting the Enhancement of X-Ray Energy Deposition by Nanomaterials Free of Side Effects

Zi Yao
Sponsor: Ting Guo, Ph.D.
Chemistry

Enhancement of X-ray energy deposition in presence of gold nanoparticles was investigated using a liposome-based probe. Upon absorbing photons in the X-ray regime, gold nanoparticles release electrons with a wide distribution of energy. Consequently, the energy deposited by X-ray in presence of gold is expected to be greater than the energy deposited in absence of gold. To quantify the enhancement effect, a system involving calcium phosphate coated liposomes encapsulating a fluorescent dye (CaP-L) was synthesized. Gold nanoparticles were added to the CaP-L to create a system with gold while a separate system with only CaP-L was prepared as a reference. Comparing the destruction of the dye by X-rays between the two systems revealed the role of gold in the energy deposition process. Our primary results suggest that an enhancement is achieved in presence of gold nanoparticle concentration of 1 wt. %. Further investigations are underway to quantify and characterize the contribution of gold in enhancing radiation energy. Ultimately, understanding the interaction between gold nanoparticles and X-rays can potentially improve the efficiency of X-rays and expand its applications.

Detecting Subsurface Damage in Structures Using Embedded Multilayered Thin Film Sensors

Jennifer A. Yasui
Sponsor: Kenneth J. Loh, Ph.D.
Civil Engineering

Structural damage is often not visible to the naked eye and can propagate rapidly to cause sudden failure. In this study, a carbon nanotube-based thin film sensor was employed for detecting spatially distributed damage in structures. Previous studies demonstrated that film resistivity/conductivity was linearly related to applied strains, thus validating its strain sensitivity or piezoresistivity. Furthermore, when an electrical impedance tomography (EIT) algorithm was employed for obtaining the spatial conductivity distribution of these thin films, it was shown that this technique could achieve spatial damage detection. Not only could the severity of damage be quantified, but the location of damage could also be identified. Investigation was continued by embedding multiple layers of thin film sensors within glass fiber-reinforced polymer (GFRP) composite panels since fiber-reinforced polymers are often used as main structural components. Three-point bending and impact tests were performed to inflict damage to the GFRP specimens. The spatial conductivity maps of the embedded films were obtained to track the formation and propagation of damage through the thickness of the composite structure. Correspondingly, structures succumb to very serious geo-hazards due to landslides. Inspection of thin film sensors utilized in landslide monitoring techniques is furthermore explored.

Long-Term Sequelae of Smoking Cessation in Rats

Tammy Yau
Sponsor: Kent E. Pinkerton, Ph.D.
Pediatrics

Long-term effects of tobacco smoke cessation were examined in senescent, spontaneously hypertensive rats with one year recovery from smoking. From a timeline perspective, these rats were comparable to a human who had smoked from early teenage to 40 years of age, prior to quitting for the remainder of their life. In this recovery study, we examined survival curves, changes in the central airway epithelium and the pulmonary vasculature, along with possible residual pulmonary inflammation in both former tobacco smoke (TS) and filtered air (FA) rats. We hypothesized persistent long-term effects due to exposure to tobacco smoke (TS). From our findings, we conclude cellular changes and inflammation in the lungs of rats due to tobacco smoke do not attenuate with long-term cessation of TS, resulting in lung diseases such as bronchitis and chronic obstructive pulmonary disease (COPD) and a shortened lifespan. Furthermore, an observed reduction in the pulmonary artery tunica adventitia could be a result remodeled vascular collagen and elastic fibers, making it more difficult for the artery to contract or dilate leading to pulmonary hypertension or resulting in heart disease, though this remains to be tested.

Asian and Asian American Women in Academia: Institutional Oppression and Its Effects on Health

Melody C. Yee
Sponsor: Caroline Kieu Linh Valverde, Ph.D.
Asian American Studies

Injustice does more than inspire negative feelings - it can inflict real mental and bodily harm. While seen as liberal havens of meritocracy, institutions in higher education are not necessarily dedicated racial and gender equality. The actions and words associated with institutional discrimination is difficult to retaliate against, because it exists in subtle ways. It becomes very difficult to pin down exactly what had caused the resulting feelings of injustice and hopelessness. Unable to report these phantom-like attacks, Asian American women quietly endure this constant barrage, leading to prolonged stress which, we believe, results in higher rates of health problems. This study looks at the intersections of race, gender, class, and sexual orientation of Asian and Asian American women and how these interact with both discriminatory policies and informal racism, classism, sexism, and homophobia within higher-level institutions to determine whether or not Asian and Asian American women in higher education develop higher rates of disease attributed to the chronic stress from these intersectional attacks.

The Role of Thrombospondin in the Extracellular Matrix of Regenerating Tissues of *N. vectensis*

Isabel Yin
Sponsor: Qizhi Gong, Ph.D.
Cell Biology & Human Anatomy

The extracellular matrix plays important roles in tissue development and regeneration. Thrombospondins are ligands in the extracellular matrix that bind to transmembrane receptors, called integrins. Integrin-mediated signaling in turn influences cell proliferation and differentiation. Thrombospondins appeared over 600 million years ago and is present in both invertebrates and vertebrates, performing similar functions related to wound healing. We are studying the cnidarian *Nematostella vectensis* in order to learn more about the earliest functions of extracellular matrix. Previously, it was confirmed that thrombospondin is expressed in regenerating tissue in *N. vectensis*. Here we have identified a second thrombospondin, and our objective is to localize the specific cells on which there is upregulation of the expression of this new thrombospondin in sections of normal and regenerating *N. vectensis*. Currently, I am using in situ hybridization, which involves the use of RNA probes on sectioned regenerating tissues of *N. vectensis* to directly visualize the transcript expression.

Use of Solid Phase Extraction and Mass Spectrometry to Determine a Novel DNA Modification in *Listeria monocytogenes*

Derek Yip
Sponsor: Bart C. Weimer, Ph.D.
Population Health & Reproduction

DNA modifications are an integral feature of bacterial genomes with methylation comprising the majority of known modifications. Changes in the bacterial methylome in response to environmental cues influence the regulation of cellular processes and gene expression, allowing for stress adaptation and host persistence. Increased knowledge of bacterial methylomes will aid in understanding bacterial bet-hedging during infection. We are just now beginning to appreciate the role of methylome dynamics in a single, "clonal" population in giving rise to multiple subpopulations. Recent advances in sequencing technology with Pacific Biosciences SMRT sequencing facilitated the detection of DNA modifications. The 100K Pathogen Genome Project aims to further our understanding of foodborne pathogens through next generation sequencing of bacterial genomes. As part of the 100K project, sixteen strains of the foodborne pathogen, *Listeria monocytogenes*, were sequenced using PacBio SMRT sequencing. While thirteen of the sixteen strains demonstrated the canonical methylation capabilities including m6A, three strains displayed a form of DNA modification unattributable to any known DNA modification signal recognized by PacBio technology. Thus far, solid phase extraction methods coupled with mass spectrometry enabled the enrichment and analysis of modified DNA with work ongoing to identify the biochemical structure of the unknown *Listeria monocytogenes* DNA modification.

Towards Characterization of *Arabidopsis thaliana* DUF642 Protein Family

Timothy S. Youngblood
Sponsor: Stacey L. Harmer, Ph.D.
Plant Biology

Proteins with a domain of unknown function (DUF) represent over 20% of all identified protein families. In *Arabidopsis thaliana*, AT5G25460 gene is annotated as a member of the DUF642 protein family. This gene is differentially regulated by different abiotic stresses suggesting possible role(s) in stress response. The DUF642 protein family comprises ten members in *A. thaliana*. This project aims at functional characterization of *A. thaliana* DUF642 proteins. T-DNA insertion mutants of individual DUF642 genes will be assayed under various environmental stresses and scored for altered phenotype(s) compared to wild-type plants. Based on phylogenetic analysis and expression pattern data, closely related and possibly redundant DUF642 genes will be identified. Accordingly, higher order mutants containing mutations in multiple DUF642 genes in a single plant will be created to increase the chances of obtaining mutant phenotype(s). Identification of mutant phenotype(s) will provide the first clues as to what biological processes the DUF642 proteins are involved in and provide a launch point for future in depth characterization studies. Homologs of *A. thaliana* DUF642 proteins have been identified in several economically important plants such as rice and soybean, and their functional characterization may provide new insights for increasing crop productivity.

Toward Dinitrogen Reduction With the Use of Ruthenium-Based Metal Complexes

Sokena B. Zaidi
Sponsor: Louise Berben, Ph.D.
Chemistry

Ammonia is an important industrial chemical used in the manufacturing of pharmaceuticals, fertilizers and more. The use of electrochemistry and transition metal complexes could potentially catalyze the reduction of dinitrogen to ammonia. Ligands are molecules coordinated around metal centers, and of particular interest to us is the I_2P ligand, which is a pyridine-based ligand. These ligands are interesting because they remain stable in many different oxidation states. This project aims to understand the catalytic ability of the I_2P ligand coordinated around ruthenium with respect to ammonia production. Previous uses of ruthenium complexes include the epoxidation of cycloalkenes and the activation of Si-Cl bonds to create reactive silyl and silylene complexes. I will describe the synthesis of a ruthenium complex of I_2P which was completed by modifying a procedure previously reported in the literature. I will also report the electrochemical behavior of the ruthenium complex using nitrogen and non-nitrogen atmospheres for the collection of data.

Towards Establishment of an Inducible System to Understand the Function of OEP80

Andrew R. Zareie
Sponsor: Kentaro Inoue, Ph.D.
Plant Sciences

The chloroplast is a semiautonomous organelle in photosynthetic eukaryotes and evolved from a cyanobacterium-like autonomous endosymbiont. The Omp85 family proteins are found in the outer membranes of Gram-negative bacteria, mitochondria and chloroplasts. Each member of this family comprises conserved structural features including an N-terminal soluble region consisting of 1-5 POTRA domains and a C-terminal transmembrane beta-barrel. Toc75 and OEP80 are the chloroplast Omp85 homologs and share the common ancestor with Omp85 homologs in extant cyanobacteria. Toc75 acts as a protein import channel. The gene duplication generating Toc75 and OEP80 is believed to be the critical step for the chloroplast evolution because it allowed the endosymbiont to lose its autonomy. *OEP80* knockout results in embryo lethality in the model plant *Arabidopsis* although the exact function of OEP80 is unknown. To circumvent this, we are attempting to establish pX7-based transgenic system with *Arabidopsis* in which *OEP80* cDNA expression can be induced chemically with β-estradiol. The role of the POTRA domains will be assessed by inducing expression of constructs containing POTRA deletions named ΔP1, ΔP2, and ΔP3. Use of this system will allow for understanding of how the structure of OEP80 affects its function.

Relationship Between Skin Carotenoid Levels, Feeding Patterns, and Gender Disparities Among Mexican Origin Children

Gloria Zavala
Sponsor: Lucia L. Kaiser, Ph.D.
Nutrition

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 children ages 2-8 who are at risk of obesity and other nutrition-related health problems. This paper uses a subsample (n=150), to explore the relationship between parenting feeding behavior, children's eating habits and carotenoid measurements. A food frequency questionnaire and medical history record is used to assess child's eating habits and parental feeding practices. Skin Carotenoid measurements to assess fruit and vegetable intake are measured using the Pharmanex® BioPhotonic scanner (s2). The present study aims to study the effect of feeding practices and behavior on carotenoids measurement. It is expected that more structured eating habits and feeding practices lead the children to present higher fruit and vegetable intake and higher carotenoid measurements. The data will be presented by comparing boys versus girls to assess the effect of differences in feeding styles. Taking gender into consideration allows us to observe if different feeding strategies might have different effects for boys and girls.

Effect of Children Entering the School System on Skin Carotenoid Levels and Fruit and Vegetable Intake in Mexican Origin Children in California

Rosio Zavala
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Nutrition

California's Central Valley is reported to have one of the poorest congressional districts, presenting both, lack of diverse nutritious food and high level of obesity amongst children. Niños Sanos, Familia Sana is a five-year multi-disciplinary study aimed at preventing childhood obesity. Following procedures from *Skin carotenoid status measured by resonance Raman spectroscopy as a biomarker of fruit and vegetable intake* along with *Noninvasive assessment of dermal carotenoids as a biomarker of fruit and vegetable intake*, measurements of skin carotenoids levels were obtained in children ages 2-8. Their carotenoids scores ranging from 10,000 to 50,000 correlating every 10,000 equivalent to 1 serving of a fruit or vegetable serving in the previous month is analyzed for two different groups Children ages 2-5 have not entered the school system and have a diet that consists mostly of home made food, while children 5-8 have school lunch incorporated in their diet. Using carotenoids level scan measurements, this paper presents the correlation and effect of entering the school system on fruit and vegetable intake. By using additional data on dietary surveys we analyze the influence of transitioning to school into fruit and vegetable intake for young children.

Parenting Feeding Practices With Differences Based on Child Gender

Cindy Zhang
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Human Development

Parents take on an important role in influencing children's dietary needs. With that said, my research will explore how parents differ in their practices during feeding based on the child's gender and behavior. The data source will come from a subsample of the Healthy Kids Project at UC Davis (N=60). Child behavior will be measured using the attentional focusing subscale of the Children Behavior Questionnaire (Rothbart et al., 2001), while the dimensions for parental feeding practices will use parental control as the subscale measured by the My Child at Mealtime Questionnaire (Ontai et al., 2010). The analysis will consist of a 2 (gender) X 2 (high versus low attention) ANOVA considering parental control during feeding as the outcome. The hypothesis will predict that more parental control will be used with boys as well as with children low in attentional focusing. So far, results from other studies conclude that restrictive practices may inflict negative outcomes in children, causing children to worsen their dietary habits(Gubbels et al. 2011). This is problematic if parents continue using inappropriate practices, thus increasing the trend in obesity for children.

MECP2 Regulates Olfactory Sensory Neuron Axon Terminal Arbor Morphology

Daoshun Zhou
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Cell Biology

MECP2 (methyl CpG binding protein 2) is a gene that encodes a protein essential for the normal function of nerve cells. Mutations in MECP2 cause Rett Syndrome, an X-linked neurodevelopment disorder. In adult MECP2 deficient mice, OSN (olfactory sensory neuron) axons fail to form precise axon convergence into their target loci in the olfactory bulb. My project studies whether MECP2 regulates the development and maintenance of OSN axon terminal branching using a viral mediated approach. By labeling and visualizing the OSN axon terminals within the olfactory bulb glomeruli of mice, I can compare the axon terminal characteristics between wild type and MECP2 knockouts. To determine the differentiation state of the viral labeled OSNs, I immunostained mature OSN with an olfactory marker protein, immature OSNs with GAP43 (Growth Associated Protein 43) antibody, and viral labeled neurons with GFP (Green Fluorescent Protein) antibody. Through triple immunocytochemistry, I will determine the percentage of the maturity of GFP cells in order to better determine the diversity of OSN axon morphology. This is imperative to understanding the role of MECP2 on the development and the maintenance of olfactory axon terminal arbor morphology.

Chemically Regulated Genetic Logic Gates Based on HDV Ribozyme

Linlin Zhou
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Biomedical Engineering

Using RNA devices to control gene expression is a promising direction for synthetic biologists. Aptazyme is a class of RNA regulatory devices that consist of the fusion of an RNA aptamer and a self-cleaving ribozyme. By inserting an aptazyme in the 3' untranslated region of mRNA, gene expression can be controlled by the aptamer ligand, resulting in a "riboswitch". We have recently shown that two RNA aptamers, theophylline and guanine aptamers, can regulate gene expression when separately incorporated into the P4 stem of the HDV ribozyme. This research focuses on next-generation RNA devices that will respond to two (chemical) inputs in a logical fashion to control gene expression, similar to electronic digital devices. We will design a small library in which several bases connecting the ribozyme and the aptamer are randomized. The library will allow us to test different connection stabilities. To further characterize the switching ability of the engineered ribozymes, we intend to sequence some good logic gates, and design some mutants to further investigate their switching mechanism. The resulting ligand-responsive riboswitches will be useful for controlling gene expression for applications in biology and medicine.

The Impact of Capital Inflows From China on the U.S. Housing Bubble

Kaishan Zhu
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Economics

Following the collapse of the U.S. housing bubble in 2007, the globe has experienced the greatest financial crisis since the Great Depression. A significant fact is that the increasing capital inflows from China and some other foreign countries to the U.S. have preceded the burst of the housing bubble in 2007. This paper is devoted to shedding light on the connection between these huge inflows from China and their effects on the housing bubble in U.S. by looking at why China chose U.S. as its capital outflow destination, the amount of capital invested in different years, the timing of the inflow, and why this continuing inflow coincided with the housing bubble formation in the U.S.. By better understanding the downward pressure on the U.S. interest rate and the larger tolerance of risk in the financial system, we hope to gain more insights on how global economy as a whole can maintain sustainable prosperity under the increasing pressures of globalization as well as the increasing dependence of individual economies upon each other.