# 95th Annual Meeting Program at a Glance

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<td>Microbrewery Science and Pub Tour</td>
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<td><strong>BUSINESS MEETING</strong></td>
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<td>California’s World’s Fairs</td>
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- **Noon Public Lecture 1**
  - "Ecological Restoration and Post Natural Aesthetics"
  - HUB 355
  - 12:15 PM – 1:15 PM

- **Noon Public Lecture 2**
  - "Currents Implicated in Cardiac Arrhythmia"
  - HUB 268
  - 12:15 PM – 1:15 PM

- **Noon Public Lecture 3**
  - "The Expanding Universe, Dark Matter, and Dark Energy: The Three Greatest Discoveries in Cosmology"
  - HUB 268
  - 12:15 PM – 1:15 PM

- **Noon Public Lecture 4**
  - "Higher Infinity and the Foundations of Mathematics"
  - HUB 269
  - 12:15 PM – 1:15 PM

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**WORKSHOP**

- DockiMatic Experiments for Science Curricula
  - SURGE 171
Guide To These Proceedings

Organization of these Proceedings
These Proceedings (this program book) are organized from front to rear as follows:

- Program at a Glance, which lists all programs by day according to their start times and is found on the inside of the front cover of the book
- Table of Contents, listing symposia and workshops by day and name, and contributed oral and poster presentations by day and section
- Policies and Governance, covering Pacific Division and AAAS policies and governance
- General Information about Riverside, the University of California at Riverside, and the meeting
- General Sessions, which include business meetings, plenary talks, receptions, panels, etc.
- Technical Sessions: Symposia, a listing of all symposia by day, in order of their starting times and listing each presentation by its start time
- Technical Sessions: Workshops and Panels, a listing of all workshops and panels by day, complete with descriptions
- Technical Sessions: Contributed Oral Papers, a listing of all contributed oral presentations by day, grouped into combined sessions
- Technical Sessions: Posters, a listing of all contributed poster presentations, grouped by session and, within each session, by Pacific Division section
- Abstracts, a listing of all abstracts submitted for the technical program of this meeting, organized as follows from front to rear:
  - Plenary public lectures
  - Symposia, by symposium, following the order in which they are found in the Technical Sessions: Symposia section of these Proceedings. If a symposium lasts for a full day, all of the abstracts for that symposium are grouped together. If a symposium extends for more than one day, all of the abstracts for each day are grouped together day-by-day rather than as a single group for all days.
  - Contributed Oral Presentations, organized in the same order as in the program listing earlier in the book
  - Poster Presentations, organized in the same order as in the program listing earlier in the book
- Index, listing of page numbers on which contributors’ names may be found in the Proceedings. Lower numbers (less than page 83) are references to names mentioned in the earlier pages of these Proceedings, including schedules for presentations, while higher numbers (page 83 and above) are references to names in abstracts.

Program and abstract numbers
Every presentation is assigned a number, which appears both in the presentation schedule and with the abstract for that presentation. This is an easy way to go back and forth between presentations and abstracts. The numbers start with the plenary talks and then follow in numerical sequence through the program, from symposia to contributed oral presentations to posters.

Student presentations
Student presentations are identified by either their presentation time or poster number (same as abstract number) being italicized and underlined (e.g., 9:30, or 283).

Program at a Glance
The Program at a Glance is provided on the inside front cover of these Proceedings to aid in quickly finding particular programs or programs of particular interest in order to see when and where they are being offered. Additional information for each program listed in the Program at a Glance is found in the General Information section (for field trips, plenary talks, receptions, etc.) or at the start of each symposium or workshop in the Technical Sessions sections of these Proceedings.

Maps
A map of the UCR campus, showing building locations and parking lots, is printed on the outside of the back cover of the Proceedings. A map of the meeting rooms in the Student Union (HUB) is printed on the inside of the back cover of the Proceedings. A map of the two floors in the Materials Science and Engineering (MS&E) Building on which some of our meeting rooms are located is printed on the last page of the program, facing the inside back cover of the book.
PROCEEDINGS of the Annual Meeting of the AAAS, PACIFIC DIVISION

Volume 33, Part I 17 June 2014

PROGRAM with ABSTRACTS

95th Annual Meeting of the Pacific Division of the American Association for the Advancement of Science

University of California
Riverside, California
17 – 20 June 2014

Contents accurate as of 24 May 2014.
Times and/or locations of events may change.
Please refer to the “Program Updates” flyer for updated information.
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Publication
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Standards of Conduct
On April 14, 1978, the AAAS Board of Directors adopted the following position statement regarding standards of conduct at AAAS meetings:

“The Board takes it for granted that all who attend the Annual Meetings of the Association will conduct themselves with consideration for others and with particular consideration for those who generously give their time and thought to the sessions. Differing opinions will continue to be heard and respected. We recognize that there are areas of science that are both controversial and troubling. The Annual Meeting can serve as an effective forum to consider such issues so long as procedures of orderly debate and fairness are followed. Discourtesy and abusive behavior have no place in the annual Meeting. When excesses occur they do great injury to the Association and to the process of discussion. They cannot be condoned.”

The AAAS, Pacific Division, as part of the larger organization, ascribes to this position and will, if necessary, take appropriate measures to assure adherence to it.

Meeting Development
The technical programs of AAAS, Pacific Division meetings are developed by proposals submitted by individuals and/or groups of individuals and overseen by the Executive Committee and Executive Director of the Division. Symposium planners are responsible for developing lists of presenters that represent fairly the topic at hand. Papers submitted separately from symposia, referred to as Contributed Papers and Contributed Posters, are reviewed by section chairs prior to their inclusion in the program.

All program review is based on scientific significance, timeliness, balance, and clarity of organization. In the case of symposia and workshops, this review is based on materials provided by planners or submitters and does not include a technical examination of individual presentations.

Student Awards of Excellence
The Council, Executive Committee and officers of the AAAS, Pacific Division are committed to encouraging the scientific development of students by offering them a friendly yet scientifically robust environment in which to present their research results. Part of that environment includes evaluating student presentations and rewarding students’ superior efforts. To that end, the Division has developed an extensive program of student Awards of Excellence that are given at both the sectional and divisional levels. More information about this program may be found on page 27 of these Proceedings.
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Alan E. Leviton, California Academy of Sciences (non-voting)
Carl A. Maida, University of California, Los Angeles
C. Mark Maupin, Colorado School of Mines
Owen M. McDougal, Boise State University
Donald J. McGraw, Ephraim, UT
Kristen A. Mitchell, Boise State University
George Quainoo, Southern Oregon University
Vilapanur Ravi, California Polytechnic University, Pomona
Kimberly D. Tanner, San Francisco State University
Richard W. Van Buskirk, Pacific University
The Pacific Division gratefully acknowledges the following donors for their generous support of this meeting:

up to $499

UCR Graduate Division, Joseph W. Childers, Dean
UCR School of Medicine, G. Richard Olds, Dean

$500 – $999

Babcock Laboratories
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Gordon and Jill Bourns
UCR Office of Undergraduate Education,
Steven Brint, Vice Provost

$1000 – $1999

UCR College of Engineering, Reza Abbaschian, Dean

$2000 – $4999

UCR College of Natural and Agricultural Sciences,
Marylynn V. Yates, Dean
UCR Office of Research and Economic Development,
Michael Pazzani, Vice Chancellor
Sigma Xi, The Scientific Research Society
Wiley (John Wiley & Sons, Inc.)
Dear AAAS PD Members,

I am delighted to send my greetings and best wishes to you on the occasion of your annual meeting. This is the first time in 13 years that it is being held in the Los Angeles area, and I am thrilled that the American Association for the Advancement of Science chose to hold this event in the heart of Riverside.

AAAS is the largest general scientific organization in the world and the Pacific Division is the oldest division in the organization. This year’s theme is “Innovation for a Changing World” and I think that a forum like this is a terrific place to increase engagement, strengthen support, and foster education in the fields of science and engineering.

I would like to send a special welcome to the sponsor of tonight’s reception, Chancellor Kim Wilcox. He has been at the helm UCR for almost a year now and his leadership been invaluable.

Again, I welcome all of this year’s conference participants. I thank them for all their hard work and dedication. Please accept my best wishes for a memorable evening and continued success.

Sincerely,

Mark Takano
Member of Congress
June 17, 2014

Welcome to Riverside — The City of Arts & Innovation!

We are pleased and honored to host The American Association for the Advancement of Science (AAAS) Pacific Division annual meeting. On behalf of the City of Riverside, we would like to thank and welcome all the guests, visitors, and attendees to this great event.

Riverside is a big city with small-town hospitality. With more than 300,000 people, our city has activities for everyone. Riverside contains 59 parks with 16 community centers, each with a range of sports and recreational options. Our Fox Performing Arts Center showcases top-name performers in its historic, yet intimate, setting. We are home to more than 50,000 higher education students at four college campuses including University of California, Riverside, La Sierra University, California Baptist University and Riverside City College. In addition, our dedication to sustainability resulted in Riverside being the first city in California to be named an "Emerald City" by the California Department of Conservation.

Riverside is a charming place with a great sense of history that you will never forget. The Mission Inn Hotel & Spa, a national historic landmark, offers exquisite dining and an adjoining "street mall" with unique shopping, coffee houses, and tasty eateries.

I know your experience in Riverside will be enjoyable.

As a participant of this AAAS annual meeting and a guest of Riverside, we would like to welcome you to our beautiful city.

Sincerely,

William "Rusty" Bailey III
Mayor
June 17, 2014

Dear Fellow Scientists, Engineers and Science Enthusiasts,

WELCOME to the 95th Annual Meeting of the American Association for the Advancement of Science (AAAS), Pacific Division. Sigma Xi, The Scientific Research Society, is, once again, a proud co-sponsor of the meeting and offers a special hello to members of the Northwest and Southwest Regions of Sigma Xi. The mission of Sigma Xi and the mission of AAAS are very much aligned. Both organizations work to support and enhance scientific research to improve the lives of all people.

Sigma Xi is the international honor society for all disciplines of science and engineering that recognizes achievement in research. With a 128-year history, the Society is one of the oldest scientific organizations in the world. More than 200 Nobel Prize winners have been members. Sigma Xi chapters are located around the world and hosted at universities and colleges, government laboratories, and commercial industry research centers.

Sigma Xi continues to support the next generation of researchers. In 2014, Sigma Xi launched an online journal for pre-collegiate research, Chronicle of The New Researcher. Additionally, the Society provides Grants-in-Aid of Research, which may be the first source of funding to young investigators. Sigma Xi hosts the Student Research Showcase and International Research Conference at which students garner valuable feedback on their research directly from professional researchers. Sigma Xi members serve as volunteer judges at student research competitions, including at this meeting. The Society also publishes American Scientist, a bimonthly magazine written by researchers.

We invite you to learn more about Sigma Xi during this conference. Please join us and other members of the Society for a continental breakfast on Wednesday, June 18. That evening, Sigma Xi Past President Dr. Francisco J. Ayala, will give a fascinating and informative keynote lecture. Sigma Xi student awards will be presented during the banquet on Thursday that will be preceded by a co-sponsored cocktail reception. Please visit the Sigma Xi booth near the registration area for more details about these events and for more information about Sigma Xi.

Enjoy the meeting!

Sincerely,

Dr. Linda H. Mantel
Northwest Regional Director

Dr. Paul M. Stein
Southwest Regional Director
Welcome to the University of California, Riverside!

We are delighted to have you here for the 95th meeting of the American Association for the Advancement of Science, Pacific Division, along with the Southwest and Northwest regions of Sigma Xi, and the annual symposium on Molecular Reproduction and Development. Our campus has experienced explosive growth over the past decade and especially in those areas that resonate with the membership of AAAS.

UC Riverside’s roots lie in the UC Citrus Experiment Station, which was established in 1907 and soon produced groundbreaking research to support the Southern California citrus industry. In 1954, the College of Letters and Science opened to undergraduates and in 1959, UC Riverside became a general campus of the UC system. The campus remained small through the 1980s but grew rapidly in the 1990s, from 8,000 to nearly 22,000 students today.

UCR’s College of Engineering was founded in 1989 and in 2012, the campus received approval to open the School of Medicine, the first new public medical school in California in 40 years. Today, researchers from both, along with the College of Natural and Agricultural Sciences, are engaged in cutting-edge basic and applied research in a number of areas, including agriculture, astrophysics, bioengineering, combinatorial chemistry, genomics, material science, and nanotechnology. In addition, UCR is addressing many of the problems that confront our planet, including declining habitats, climate change, and population growth.

While you’re here, I hope you will take time to enjoy our campus. Explore the Botanical Gardens and the Science Library on campus and travel to our beautiful downtown area to visit UCR’s Sweeney Art Gallery and the California Museum of Photography, which houses the Ansel Adams Fiat Lux collection.

Welcome to our campus. I hope you have a wonderful meeting.

Sincerely,

Kim A. Wilcox
Chancellor
June 2014

Dear Conference Attendees,

Welcome to UC Riverside and to the Bourns College of Engineering. We are pleased to serve as hosts for the 95th annual meeting of AAAS Pacific Division and hope your time on our campus is productive and enjoyable.

Our college is young (25 years old in 2014), but we are already recognized as a leader in engineering research and education. Our programs are ranked in the top quartile by the National Research Council, and UCR is tenth in the world for the impact of faculty publications in the fields of natural sciences and engineering, according to the Leiden University rankings. The college is ranked 38th among public universities by U.S. News & World Report and was recognized with the Claire Felbinger Award for Diversity from ABET in 2009.

We have grown to 92 faculty, 2,400 undergraduates and 600 graduate students. Bioengineering is the newest of five departments at the college, and in 2007 we began an interdepartmental Materials Science and Engineering Program that graduated its first students in 2010. The college offers nine B.S. and seven M.S. and Ph.D. degrees, and in 2013 we added an online M.S. degree.

Much of the college’s $37 million in annual research is done in seven innovative and interdisciplinary centers: the Center for Bioengineering Research, the Center for Environmental Research and Technology, the Center for Research in Intelligent Systems, the Center for Nanoscale Science and Engineering, the Center for Ubiquitous Communications by Light, the Winston Chung Global Energy Center, and the Center for Phonon-Optimized Engineered Materials.

We are proud that 24 of our faculty have earned the distinction of fellow of AAAS and that several of them are taking an active part in this year’s Pacific Division meeting. I invite you to meet with us while you are here and exchange ideas on ways we might collaborate in advancing new knowledge in science and engineering and develop “Innovation for a Changing World.”

With kind regards,

Reza Abbaschian
Dean and Distinguished Professor
William R. Johnson, Jr. Family Professor
June 17, 2014

Dear Conference Attendee,

On behalf of the College of Natural and Agricultural Sciences at UC Riverside, I am delighted to welcome you to the 95th annual meeting of the American Association for the Advancement of Science Pacific Division. With nearly one-third of its faculty holding Fellow status in AAAS, the college has long been a strong supporter of the association’s vision and goals, and is proud to be part of the Pacific Division. The AAASPD’s president this year is Professor Richard Cardullo, a member of our Department of Biology.

The College of Natural and Agricultural Sciences (CNAS) is home to world-renowned scholars pursuing research that deepens our knowledge of the universe in which we live and improves the quality of life for the people of the state, the nation, and the globe. CNAS’s thirteen departments encompass the life, physical, mathematical, and agricultural sciences. This administrative structure encourages an extraordinary degree of collaboration, reflected in numerous interdisciplinary research centers and institutes and the many interdepartmental graduate and undergraduate degree programs. Modern science is team-based, and CNAS embodies that principle in its research and teaching practices.

Our research and teaching programs are facilitated by access to some unique facilities, including several hundred acres of agricultural fields, both adjacent to the campus and in the Coachella Valley. CNAS also manages eight of the University of California’s Natural Reserves, encompassing more than 25,000 acres, which provide a broad representation of Southern California’s flora, fauna, and major ecosystems.

I hope that you have the opportunity to explore some of the many programs CNAS has to offer. Enjoy your time here at UC Riverside!

Sincerely,

Marylynn V. Yates
Dean, College of Natural and Agricultural Sciences
University of California, Riverside
17 June 2014

Dear conference attendees:

Welcome to the 95th annual meeting of the Pacific Division of the AAAS at the University of California, Riverside. This meeting was last held in Riverside in 1965 at a time when this was a small campus primarily known for its excellence in agricultural research and undergraduate liberal arts education. Today, UCR is a major research university with over 22,000 undergraduate and graduate students, offering programs in virtually all science, technology, engineering, and mathematics disciplines. This year’s theme, Innovation for a Changing World, reflects many of the emerging research programs around the nation as we confront enormous challenges related to population growth, climate change, and evolving social pressures that may alter the environment and our place in it. In Southern California we are confronting those challenges today as our region struggles to coexist with a growing and diverse population within one of the planet’s most fragile and threatened ecosystems.

This meeting offers you a large number of symposia, plenary talks, platform sessions, and posters in basic and applied sciences, social sciences, and humanities. I am particularly pleased that there are two symposia and one workshop devoted to the importance of educating the next generation to produce not only scientists and engineers, but also an informed electorate that must make critical decisions about our future. While here, I encourage you to participate in some of the fieldtrips and take time to explore this campus and the cultural offerings of this vibrant city. You will come away with a deep appreciation for all that Riverside and Southern California have to offer.

Sincerely,

Richard A. Cardullo, Ph.D.
President, AAAS, Pacific Division
95th Annual Meeting
of the
Pacific Division of AAAS
University of California
Riverside, California
17 – 20 June 2014

GENERAL INFORMATION

PACIFIC DIVISION SECTIONS and
OTHER SOCIETIES SPONSORING
SESSIONS at this MEETING

Molecular Reproduction and Development
Northwest and Southwest Regions of Sigma Xi, The Scientific Research Society
Agriculture, Food, and Renewable Resources
Atmospheric and Hydrospheric Sciences
Cell and Molecular Biology
Chemistry and Biochemistry
Computer and Information Sciences
Earth Sciences
Ecology, Environmental Sciences, and Sustainability
Education (Science and Technology)
Engineering, Technology and Applied Sciences
Evolution, Organismal Biology, and Biodiversity
General and Interdisciplinary Studies
History and Philosophy of Science
Mathematics
Physics and Materials Science

Psychology
Science and the Arts and Humanities
Social, Economic and Political Sciences

RIVERSIDE, CITRUS, and the UNIVERSITY of CALIFORNIA1

HISTORY of RIVERSIDE
The City of Riverside’s rich heritage begins with the original residents of the area, the Cahuilla and Serrano Indian tribes, who lived in the niches in the rocky hills and foraged for food. Their first known European contact occurred in 1774 when a

1Material for this section was assembled from information accumulated from the following sources:
the Riverside Convention and Visitors Bureau
http://en.wikipedia.org/wiki/Juan_Bandini
http://www.parks.ca.gov/?page_id=649
http://www.ucr.edu/about/facts.html
http://medschool.ucr.edu/about/mission_history.html

Entrance to the University of California, Riverside

Courtesy University of California, Riverside
Spanish expedition of 34 men led by Captain Juan Bautista de Anza, who were seeking to chart a colonization route from Arizona into California, entered the area. The natives continued to live relatively undisturbed for almost the next fifty years until 1821, when the lands of California became the property of Mexico and Mexican and Spanish settlers poured into the area to establish ranchos, presidios, and missions.

Shortly thereafter, Juan Bandini, a prominent political figure in California, was granted by the Mexican government a very large land grant, El Rancho Jurupa, that included parts of what were later to become both San Bernardino and Riverside Counties. He later presented part of this to Abel Stearns, the husband of one of his daughters. The Stearns later sold the land to Louis Rubidoux, a former fur trader, who started a cattle and grain ranch on the property. After Rubidoux’s death, part of the land was purchased by John North, who solicited investors to found the Southern California Colony Association, a community of people devoted to establishing good schools, churches, and libraries. The new town was initially called Jurupa, but shortly, in 1871, the name was changed to Riverside, honoring the fact that it stood next to the Santa Ana River. Riverside’s original square, called “Mile Square,” remains the heart of the city even today. Within a few years of its founding, railroad tracks were built connecting the city to far-off places.

By 1900, Riverside had become an incorporated city of 8,000. In 1907, by a vote of the people, it became a charter city instituting a Mayor-Council form of government.

During World War I, March Field, now March Air Reserve Base, was established for the training of army aviators. During World War II, March Field was expanded and another base, Camp Haan, was begun across from March Field. The site is now occupied by the National Veteran’s Cemetery. A third base was built, called Camp Anza, which later became a subdivision called Arlanza.

In 1920, Ernest Louis Yeager began the E. L. Yeager Construction Company, Inc., which, with the assistance of his three sons, completed over a half century of master construction projects. In the latter half of this century the Food Machinery Corporation was formed to produce machinery for packing citrus fruits both efficiently and rapidly.

A new Charter implementing the Council-Manager form of government was adopted in 1952 and ratified in 1953 by the State Legislature. The Charter has been updated several times since then, but still maintains the 1952 governmental framework.

**RIVERSIDE TODAY**

In recent years Riverside has given much attention to diversifying its economy and creating a sustainable community. In 2004 Partners for Livable Communities recognized Riverside as one of America’s “Most Livable Communities” in the mid-sized city category. The award—which is given out every decade—recognizes Riverside’s strides in preparing itself for a global economy through strategic business plans. However, it also acknowledges Riverside’s constant nurturing of its community—something the city has done since it blossomed in the late nineteenth century.

After an unprecedented investment into city infrastructure and renovation, Riverside has reinvented itself. However, though fully revitalized, the city celebrates and showcases timeless historic attractions that have attracted visitors for decades.

With a $1.6 billion transformation, just about every area of Riverside has been transformed. Here are the Top 5:

1. **Main Street Riverside** has transformed downtown into an upbeat, walkable favorite featuring places to dine, shop and entertain.
2. The new **Riverside Convention Center**, opening in 2014, will increase the indoor meetings facilities to over 65,000 square feet, including unprecedented technical advancements throughout the complex.
3. The multi-million dollar expansion and enhancements of convenient hotels, including the world famous Mission Inn, makes Riverside more accommodating than ever.
4. **Riverside Aquatics Complex** is one of the nation’s top facilities to make a splash for competitive swimming, synchronized swimming, diving, and water polo.
5. The **Fox Performing Arts Center**—including sophisticated venues, The Box and The Showcase—have elevated the star power of concerts, performances, and more.

Riverside prides itself on its background, and there is strong community support for the historic preservation of architectural structures. Riverside has 22 properties listed on the National Register of Historic Places.

**HISTORY OF CITRUS AGRICULTURE IN CALIFORNIA AND RIVERSIDE**

California’s citrus heritage began in 1769 when Father Junipero Serra, while building a trail of missions in California, planted some citrus seeds, currently thought to have originated from China and reflecting trees that had been cultivated there for thousands of years. In 1840 a frontiersman named William Wolfskill planted several hundred lemon and orange seedlings that he obtained from the San Gabriel Mission on land that is now in downtown Los Angeles, launching the California citrus industry. It was known by this time that eating oranges prevented scurvy, and oranges were in much demand, especially by the “49ers” of the California gold rush.

In 1873 the U.S. Department of Agriculture sent to Eliza Tibbits in Riverside two or three seedlings of a new mutant orange tree that was earlier discovered in a Brazilian monastery. The mutation caused the fruit to be seedless and also to develop a second much smaller fruit at the end opposite the stem but embedded in the same rind as the main fruit. Because of its appearance, this variety of orange was soon dubbed the “navel” orange (often referred to as the Washington navel orange). It was found to grow extremely well in the...
rich soil alongside the Santa Ana River and was well adapted to the climate of Riverside. The seedlings were soon producing large, sweet, seedless fruits, which were in high demand. Interestingly, since the fruits were seedless, new trees could not be established by planting, but could only be established by grafting from one tree to the rootstock of another, which opened an entirely new chapter of the citrus industry. It has been estimated that nearly all of the navel orange trees in California have come from stock from Eliza Tibbits’ first trees and may thus be considered clones of the original trees. Of additional interest is the fact that these clones are expected to be genetically identical (except for random mutations) to the original cultivars. This has helped to stabilize the quality of the fruit, as the fruit from Valencia (seeded) oranges comes from trees planted from seeds derived from sexual reproduction, thus leading to a continually changing genetic heritage and size, sweetness, etc. One of the original trees, now 141 years old, still thrives and bears fruit in Riverside.

By 1887 the navel orange had become the dominant crop in Riverside and other California cities. The completion of the transcontinental railroad in 1869 had opened the California citrus industry to markets across the country, insuring a booming market for citrus and especially these new navel oranges. The success of the crops prompted a steady flow of agriculturalists and investors into the area who hoped to profit from the new citrus industry. The citrus industry also attracted numerous communities of immigrants; Chinese, Japanese, and Mexican workers flooded into the area hoping to acquire their own fortunes. At the turn of the twentieth century, Riverside contained the most successful agricultural cooperative in the world, the California Fruit Growers Exchange (now known as Sunkist Growers), which was the home of a superior research institution, the University of California Citrus Experimentation Station, which would eventually become the University of California, Riverside.

The development of refrigerated railroad cars and innovative irrigation systems established Riverside as the state’s wealthiest city per capita by 1895.

HISTORY of the UNIVERSITY of CALIFORNIA at RIVERSIDE

John Henry Reed, a retired school superintendent and dry goods merchant from Ohio turned citrus grower, is credited with first proposing the establishment of a scientific experiment station designed specifically for citrus research in Southern California, and organized a vigorous lobbying effort of the local citrus industry towards that end. As founding member and chair of the Riverside Horticultural Club’s experimental committee, he also pioneered a collaborative approach to conducting experimental plantings, and published more than 150 semi-technical and popular papers on citrus and other subjects between 1895 and 1915.

On February 14, 1907, the University of California Board of Regents established the UC Citrus Experiment Station (CES) on 23 acres (93,000 m²) of land on the east slope of Mt. Rubidoux in Riverside. However, the University’s decision to concentrate on the development of the University Farm in Davis lead to only two initial staff being assigned to the CES, only one of whom, Ralph E. Smith, a plant pathologist from Berkeley, was a scientist. Dubbed the Rubidoux Laboratory, the initial purpose of the station was to concentrate on various soil management problems such as fertilization, irrigation, and improvement of crops.

In 1913, a record killing freeze in Southern California caused a panic throughout the 175 million dollar citrus industry, which demanded more state-funded agricultural research. After considerable lobbying by various groups in the San Fernando Valley, the UC Regents in late 1914 approved the relocation of the CES to its current site on 475 acres (1.92 km²) of land 2.5 miles (4.0 km) from downtown Riverside, adjacent to the Box Springs Mountains.

The new station was to be governed autonomously under Webber’s direction. He spent the next few years personally recruiting the founding research team, eleven scientists organized into six divisions of agricultural chemistry, plant physiology, plant pathology, entomology, plant breeding, and orchard management. Webber also initiated the development of the Citrus Variety Collection on 5 acres (20,000 m²) planted with approximately 500 species of citrus from around the world, which grew to become the greatest such variety collection internationally. In addition, he planted hundreds of other subtropical crops, including 70 varieties of avocado imported from Mexico that produced more than 45,000 hybrids through controlled pollination. He also helped in the founding of the California Avocado Association (Calavo) in 1914 and served as its president for two years, and organized the annual citrus institute of the National Orange Show in San Bernardino and the Date Growers Institute of Coachella Valley.

The original laboratory, farm, and residence buildings on the Box Springs site was designed by Lester H. Hibbard.
of Los Angeles, a graduate of the University of California School of Architecture, in association with a colleague, H.B. Cody. Built at a cost of $165,000, the architecture followed the Mission Revival style suggesting the Spanish colonial heritage of Southern California. The site, which became the early nucleus of the UCR campus, eventually opened in 1917, although the Division of Agricultural Chemistry continued to occupy lab space at the Rubidoux site.

After the 1945 passage of the GI Bill, a massive influx of former servicemen began to enter college and strained the capacities of many state public university systems. While this wave was expected to subside by the early 1950s, state and federal statistics released in the late forties all projected a massive demand for access to higher education in California in the near future. The UC system was then composed only of established campuses at Berkeley and Los Angeles, (Santa Barbara State had just entered the UC system in 1944) which were already operating near capacity. In 1947, the Strayer committee recommended that Riverside become the location for the fourth UC undergraduate campus. (It also recommended that the existing Agricultural College at Davis be expanded to serve undergraduates.) Governor Earl Warren signed the bill approving the establishment of the College of Letters and Science in Riverside in 1949.

That same year, UC President Robert G. Sproul requested Gordon S. Watkins, Dean of the College of Letters and Science at UCLA, to take on the task of overseeing the organization of the College of Letters and Science at Riverside. The onset of the Korean war, however, delayed construction. Anticipating an initial enrollment of 1000, Watkins ordered the initial campus built for a maximum capacity of 1500 students. Not anticipating the need for graduate work, Watkins focused on recruiting many young, new PhDs rather than already established researchers into junior faculty positions. Watkins became provost of the Riverside campus and presided at its opening with 65 faculty and 131 students in February 1954.

The Regents at the time of the 1947 Strayer Report did not believe California could afford multiple high quality public universities, so they initially sought to respectively specialize the various new campuses. Riverside was designed to provide a high quality liberal arts education, but not graduate-level research. However, continually increasing enrollment demands at Berkeley and Los Angeles required continual expansion at all levels, so the liberal arts college model, implemented by the Regents as a way of saving money, was ultimately deemed too small and costly in light of the growing needs of California.

By the mid-1950s, the University had established a teaching-focused liberal arts curriculum, in the spirit of a small liberal arts college, but California’s rapidly growing population made it necessary for the Riverside campus to become a full-fledged general campus of the UC system.

By the time Clark Kerr became president of the UC system in 1958, UCR was in its fifth year of operation and included 1087 students. Kerr articulated a vision of the UC as “one university, many campuses” and by 1959 Riverside, Santa Barbara, Davis and San Diego were all designated general campuses of the UC system. The Regents tasked biologist Herman Theodore Spieth, provost after Watkins’ retirement in 1956, with increasing UCR’s enrollment capacity to 5000 students and administering UCR’s development towards full university status. As UCR’s first chancellor, Spieth was to combine the College of Letters and Science and the Citrus Research Center under a single academic and administrative entity, as well as oversee the planning and development of UCR’s graduate division, in accordance with the provisions of the developing California Master Plan for Higher Education. UCR started accepting graduate students in 1961.

It fell to Ivan Hinderaker, UCR’s second Chancellor, to complete the task of turning UCR into a full fledged research university. In doing this, he had to confront the early faculty Watkins had recruited on the premise that UCR Letters and Science would be a small liberal arts institution dedicated to teaching undergraduates. Many of UCR’s early L&S faculty had achieved tenured positions without having to do extensive research, and saw themselves primarily as teachers. All Hinderaker could do was wait for this early faculty to retire in order to appoint new faculty on a research basis.

Through the 1960s, UCR’s enrollment rose to a plateau of approximately 5000 students. In 1973, Riverside’s Mayor Lewis requested Governor Ronald Reagan to declare the South Coast Air Basin a disaster area. This caused Riverside to become famous for its air pollution and had disastrous effects on student enrollment and faculty recruitment at UCR, with a twenty-five percent reduction in students by 1978-79 and the loss of forty-two faculty positions during the early seventies. Rumors circulated that the campus

Citrus Experiment Station, circa 1916
would close; Gov. Jerry Brown proposed a merger with Cal State San Bernardino. But through the development of UCR’s Biomedical and Business Administration programs, Hinderaker was able to stave off the dire predictions. During his tenure, Hinderaker also established UCR’s graduate schools of education and administration, streamlined UCR’s departmental structure, and presided over the establishment of the UCR/California Museum of Photography during this period.

The 1980s were a turbulent time for the University, with a series of several short-term chancellors and trying to deal with budget problems brought on by the passage of California Proposition 13, which severely reduced the state’s ability to fund higher education. However, enrollment slowly picked up and by 1991 had more than doubled. Due to these enrollment gains, the University was able to bring on 200 new faculty members.

With the improvement of the economy in 1994, the UC campuses began receiving more applications than anticipated. This surge became known as “Tidal Wave II” (the first “tidal wave” of students having been the Baby Boom generation born in the post-World War II era). To help the UC system accommodate this growth, planners targeted UCR for an annual growth rate of 6.3%, the fastest in the UC system, and anticipated 19,900 students enrolled at UCR by 2010.

With UCR scheduled for dramatic population growth, efforts were made to increase its popular and academic recognition. The students voted to increase fees to move UCR athletics into NCAA Division I standing in 1998. Proposals to establish a law school, a medical school, and a school of public policy at UCR have been in development since the 90s. In June 2006, UCR received its largest gift, 15.5 million dollars from two local couples, in trust towards building its medical school, which opened fall term, 2013.

In fall 2012, UCR enrolled 18,539 undergraduate and 2,466 graduate students in a range of 107 bachelor’s programs, 56 master’s programs, 47 PhD programs, 10 California teaching and administrative credential programs. The UCR School of Medicine welcomed its inaugural class of students in August 2013.

ANNUAL MEETING

TRAVEL to UCR
From Los Angeles County
*From the 91 Freeway:* Take CA-91 east to the CA-60 east. Exit at University Ave. and turn left. At the second light, take a right onto West Campus Drive.
*From the 10 Freeway:* Take the I-10 east to the I-15 south and then to CA-60 east. Exit at University Ave. and turn left. At the second light, take a right onto West Campus Drive.
*From the 60 Freeway:* Take the CA-60 east. Exit at University Ave. and turn left. At the second light, take a right onto West Campus Drive.

From Orange County
Take the CA-91 east to the CA-60 east. Exit at University Ave. and turn left. At the second light, take a right onto West Campus Drive.

From San Bernardino
Take the I-215 south to the CA-60 east. Exit at University Ave. and turn left. At the second light, take a right onto West Campus Drive.

From Palm Springs
Take the I-10 west to CA-60 west. Exit at University Ave. and turn left. At the second light, take a right onto West Campus Drive.

From San Diego County
Take the I-15 north to the I-215 north to the CA-60 west. Exit at University Ave. and turn left. At the second light, take a right onto West Campus Drive.

PARKING on the UCR CAMPUS
Thanks to the UCR Chancellor’s office, there is no charge for on-campus parking for meeting attendees. Parking for this meeting has been assigned to Lot P24. Entry to Lot P24 is from Canyon Crest Drive. To park on the UCR Campus, all guests must display in their automobiles a valid visitor temporary parking permit. A new permit must be picked up each day. Follow signs when coming onto campus to be directed to a kiosk or other location where you can pick up the visitor permit.

REGISTRATION CENTER
and REGISTRATION
The Registration Center will be situated on the third floor of the Highlander Union Building (HUB). Hours of operation are expected to be as follows:
*Tuesday:* 2:00 p.m. – 6:00 p.m.
*Wednesday:* 7:30 a.m. – 4:30 p.m.
*Thursday:* 7:30 a.m. – 4:00 p.m.
*Friday:* 7:30 a.m. – 3:00 p.m.

On-site registration fees are as follows: full-meeting professional, $130.00; full-meeting program planners, program presenters and field trip planners, $90.00; K–12 and community college teachers, students, post-docs, and retirees/emeritus, $65.00; participating spouses and/or family members, and unemployed persons, $50.00. One-day professional registration is $90.00. If you attend more than one day, you must pay the full registration fee. Note that for students the registration fee includes a one-year student membership in AAAS. Students must fill out the AAAS Membership...
Application form in order to receive this benefit.

Special stipends of $75 were offered to the first twenty K–12 and community college instructors that registered in advance for this meeting and requested the stipend on their registration forms. The stipend is not available to teachers who register on-site. We wish to especially thank Bourns, Inc., Riverside, and the Bourns Revocable Trust for making these funds available for this meeting.

Students were given the opportunity to apply for travel awards of up to $150 each to help defray their costs for coming to the meeting to present the results of their own research.

About field trips: Due to limited seating in vehicles and the need to inform some destinations of the number of people arriving, pre-registration was required for all field trips. If you didn’t pre-register for a particular field trip in which you are interested in participating, please inquire at the Division’s Registration Center to see if space is still available. At least one member of a family group requesting a field trip must be a paid meeting registrant. Participants who are not registered for the meeting will be charged a one-time $10 field trip registration fee in addition to the fee for the field trip.

About workshops: All workshops at this meeting are available without additional charge to meeting registrants. Some workshops have limited space and persons indicating their interest on the Advance Registration Form will have priority in attending should a workshop fill.

About refunds: Requests for refunds must have been made in writing and received in the Pacific Division office no later than 15 May 2014. Under extreme hardship conditions beyond a registrant’s control, requests for refunds may be honored beyond this date if presented in writing with an adequate explanation of the hardship that precipitated the request for the refund. A $15 handling fee is applied to all refunds. An additional 3.5% deduction is applied to the total amount for credit card refunds.

MESSAGES
To leave a message for a meeting registrant or to contact the AAAS, Pacific Division staff, call 541-292-1115. Please note that this line will be monitored only between the dates of 13 June and 23 June. Thereafter, please use the regular Pacific Division number, 541-552-6869, in order to contact Pacific Division staff.

BREAKS
Mid-morning and mid afternoon breaks are scheduled each day, as appropriate. Refreshments will be served outside of HUB 302, near the Registration center on the third floor of the Highlander Union Building and are available to all registered meeting attendees. We would like to express our deep gratitude to Dr. Michael Pazzani, Vice Chancellor for Research and Economic Development, for sponsoring the coffee breaks on Wednesday and to Babcock Laboratories, Inc., Riverside, for sponsoring the coffee breaks on Thursday.

ON CAMPUS MEETING HOUSING
A limited number of rooms in the Glen Mor Apartments campus housing were available for participants at this meeting. The Glen Mor Apartments are arranged in pods of four bedrooms, each pair of bedrooms sharing one bathroom. In the middle is a living room type seating area and a kitchen.

Each bedroom is designed to sleep one person, so there are a maximum of four persons in each apartment. Couples requesting a Glen Mor Apartment for their stay in Riverside will be assigned to two bedrooms on the same side and share the same bathroom. The package price of $200 per person includes overnight accommodations in a single room of a four bedroom apartment for three nights (Tuesday, Wednesday and Thursday), complimentary parking for one automobile, linen service that includes a pillow, pillow case, two flat sheets, a blanket, towel, hand towel, and wash cloth per person, and breakfast in the Highlander Union Building (HUB) (for location, please refer to the map on the back cover of this Proceedings) the morning following each night’s stay.

An extra night stay in the Glen Mor Apartments was available for Friday night only and only for those purchasing the three-night package. The cost for this was an additional $67 per person and included all of the above amenities. No other additional nights were available.

The University has these important housing regulations. Guests not honoring these will likely be asked to leave and be given no refund on their housing package.

- no pets
- no smoking in University buildings – smoking is allowed in designated smoking areas only
- no alcohol/substance abuse – use of these substances will result in removal from the housing unit and the University campus
- do not move or rearrange residence hall furniture or face the possibility of fines
- do not tamper with fire alarms or extinguishers – fines will be assessed for false alarms
- make sure all trash is placed in the proper receptacles and linen is stacked neatly for pick-up
- a $50 fee will be assessed for lost room keys or lost meal cards – report immediately if a loss occurs

Please remember that you will be required to agree to pay any additional fees that are assessed to the Pacific Division by UCR relating to your stay in the apartments, such as lost

Application form in order to receive this benefit.

Special stipends of $75 were offered to the first twenty K–12 and community college instructors that registered in advance for this meeting and requested the stipend on their registration forms. The stipend is not available to teachers who register on-site. We wish to especially thank Bourns, Inc., Riverside, and the Bourns Revocable Trust for making these funds available for this meeting.

Students were given the opportunity to apply for travel awards of up to $150 each to help defray their costs for coming to the meeting to present the results of their own research.

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- a $50 fee will be assessed for lost room keys or lost meal cards – report immediately if a loss occurs

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keys, lost meal cards, use of “additional charge” facilities, fines, etc. Should you incur any of these fees and you pay them directly to UCR, there should be no fee assessed to the Division.

Check-in for housing is in the Pentland Hills Q building-Resident Services Office (directly west of the Glen Mor Apartments Building on Pentland Way--please refer to map on the back cover of these Proceedings). If driving, park in lot 21 while checking in and once you have your parking permit be sure to place it in your vehicle per the instructions you will receive at check-in.

OFF CAMPUS MEETING HOUSING
The Division contracted with the Mission Inn, one of the premier hotels in Southern California, to provide off-campus housing for this meeting. The Mission Inn is truly “breathtaking” in its architecture, timeless beauty and old-world charm. Listed on the National Register of Historic Places, it is one of the must-see stops in Southern California. But one needn’t settle for a whirlwind tour through the facility, as The Mission Inn provided attendees to this meeting with a spectacular price on room rentals.

Mission Inn
Address: 3649 Mission Inn Ave., Riverside, CA 92501
Telephone: 951-784-0300
Website: www.missioninn.com
Additional information: http://www.missioninnmuseum.com/about/mission_inn.htm
Rate: $115 (1 or 2 persons in a Deluxe room) + 12% tax
• each additional adult in room – $15
• Other rooms were available at the following rates:
  - Raincross – $125
  - Glenwood – $135
  - Mission – $155
  - Junior Suite – $205
  - Presidential Suite – $500
  - Superior Presidential Suite – $700
  - Keeper of the Inn Suite – $1000
Dates Available: 14 June – 23 June (not all room types are available for all of these days)
Check-in time: 3:00 p.m.
Check-out time: noon
Complementary amenities:
• overnight self-parking
• high speed internet in rooms and lobby
• shuttle service to and from the Highlander Union Building (HUB) on the UCR campus
• use of fitness center and steam room
• swimming pool

FOOD SERVICES on CAMPUS
The UCR Highlander Union Building (the HUB) has a fairly extensive food court, which includes such establishments as
The Coffee Bean & Tea Leaf, Habanero’s, La Fiamma Italian Cuisine, Panda Express, Sushi by Panda Express, The Grill, and Subway. Alternatively, you can take a short walk over to Hinderaker Hall (west of the HUB) to pick up a coffee, pastry, espresso drink, Java City smoothie, grab’n’go salad, wrap, sandwich or snack at Ivan’s @ Hinderaker. Another campus option is The Barn, southwest of the HUB and kitty-corner to Sproul Hall. The Barn serves a variety of burgers, sandwiches, salads, and pastas. See next page for details.

MEETING ROOMS, COMPUTERS, and POWERPOINT PRESENTATIONS
Technical sessions will meet in rooms on the second and third levels of the Highlander Union Building (HUB) and also in rooms of adjacent buildings as needed. All meeting rooms will be equipped with computers running Windows and Microsoft PowerPoint, as well as computer projectors. Speakers requiring other specialized equipment such as slide or overhead projectors should have made their requests known when they submitted their abstracts. If available, specialized equipment will be provided. Any rental costs are the responsibility of the requestor.

Should a presenter wish to use their own laptop computer for their presentation, it is possible to connect the laptop directly to the LCD projector via a VGA port. It is the responsibility of the presenter doing this to supply any needed adapters to connect their computers to the VGA cable of the LCD projector.

STUDENT AWARDS for EXCELLENCE
The AAAS, Pacific Division offers each affiliated society and section participating in the annual meeting the opportunity to recognize outstanding student participants through the presentation of Awards of Excellence and cash prizes of $150 for first place and $100 for second place. All award winners at this year’s meeting will also be invited to join Sigma Xi, The Scientific Research Society.

For this meeting, seven division-wide awards are available: Laurence M. Klauber Award for Excellence (unrestricted); Geraldine K. Lindsay Award for Excellence in the Natural Sciences; J. Thomas Dutro, Jr. Award for Excellence in the Geosciences; Presidents Award for Excellence (unrestricted); Rita W. Peterson Award for Excellence in Science Education Research; Best Poster Award (for posters only but otherwise unrestricted); and the AAAS–Robert I. Larus Travel Award, which will provide reimbursement up to $1,000 for travel and other meeting related expenses for the awardee to attend the national meeting of AAAS in San José, California, 12 – 16 February 2015 for the purpose of presenting his/her winning presentation as a poster. The Klauber, Lindsay, Dutro, Peterson, Best Poster, and Larus awards are given to those students whose presentations are judged the most significant in the advancement or understanding of science.

To be eligible for a sectional award or one of the
# UCR Summer Dining Options

**Effective June 2014**

<table>
<thead>
<tr>
<th><strong>Habanero’s</strong></th>
<th><strong>SCOTTY’S</strong></th>
<th><strong>SUSHI</strong></th>
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<tbody>
<tr>
<td>Fresh &amp; healthy Mexican food, served up to order.</td>
<td>UCR’s very own convenience store, conveniently located at The HUB.</td>
<td>Enjoy fresh sushi rolls.</td>
</tr>
<tr>
<td>Monday—Friday 10:30am – 2pm</td>
<td>Monday—Friday 8am – 5pm</td>
<td>Monday—Friday 10:30am – 2:00pm</td>
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<tr>
<th><strong>La Fiamma</strong></th>
<th><strong>SUBWAY</strong></th>
<th><strong>PANDA EXPRESS</strong></th>
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<tbody>
<tr>
<td>Traditional hearth-baked style pizza, gourmet pasta and salads.</td>
<td>Hot and cold sandwiches, salads, wraps and more!</td>
<td>They’ve worked up a delicious menu with something for everyone.</td>
</tr>
<tr>
<td>Monday—Friday 10:30am – 2pm</td>
<td>Monday—Friday 7:30am – 5pm</td>
<td>Monday—Friday 10:30am – 2pm</td>
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<tr>
<th><strong>Ivan’s</strong></th>
<th><strong>BYTES</strong></th>
<th><strong>UCR DINING</strong></th>
</tr>
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<tbody>
<tr>
<td>Coffee, pastries, espresso drinks, salads, sandwiches and snacks.</td>
<td>Coffee, espresso drinks, flatbread sandwiches &amp; more.</td>
<td>UCR Dining</td>
</tr>
<tr>
<td>Monday—Friday 7:30am – 3pm</td>
<td>Monday—Friday 8am – 3pm</td>
<td>Monday—Friday 10:30am – 2:30pm</td>
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<th><strong>UCR Dining</strong></th>
<th><strong>UCR Housing, Dining &amp; Residential Services</strong></th>
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<td>UCR Housing, Dining &amp; Residential Services</td>
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division-wide awards, a student must be registered for the meeting prior to judging, must be the primary presenter of the paper or poster, and must be the principal research investigator. Student presentations, oral and poster, are judged on their abstracts, content, style of delivery or presentation, and audiovisual aids and/or handouts (if used). The evaluation forms for both oral and poster presentations are posted on the Division’s meeting web page.

Students who are competing for Awards of Excellence are invited to be guests of the Division at the annual banquet Thursday evening, 19 June 2014. Festivities that evening include the announcement of student awards. Students were asked to indicate on the Advance Registration Form if they were planning to attend the banquet. Those who responded affirmatively were provided a ticket with their registration materials. If you are a student who is in competition for an Award of Excellence and you do not have a ticket for the banquet, please inquire at the Registration Center to see whether any tickets are still available.

IMPORTANT NOTE: All judging for student awards ends no later than 3:00 p.m. on Tuesday, at which time the judges go into closed session to determine the winners. Students with oral presentations beyond this cut-off time were instructed to present their oral presentations also as a poster in order to be judged and in the pool of potential prize winners. Double presentations of this nature may only occur if a student’s presentation is part of a symposium. All oral contributed paper sessions are scheduled to ensure that student presenters are judged prior to the cut-off on Tuesday afternoon.

PUBLIC LECTURES and PROGRAMS

The following public lectures and programs are planned. All members of the public are invited to attend these lectures at no charge.

Tuesday Evening Public Plenary Talk: 6:30 p.m. – 7:30 p.m. in HUB 302 S. And Ever the Twain Shall Meet: An Exposé of Sexual Differences in the Animal Kingdom, presented by Dr. Daphne J. Fairbairn (Department of Biology, University of California, Riverside). Please refer to Abstract #1 for additional information about this talk.

Dr. Fairbairn received her B.S. (with honors) from Carleton University, Ottawa, and her Ph.D. from the University of British Columbia, Vancouver. She is currently a Professor of Biology and a member of the Graduate Program in Evolution, Ecology and Organismal Biology at the University of California, Riverside. She is also a fellow of AAAS, past editor-in-chief of the journal Evolution, and President-Elect of the Society for the Study of Evolution. She is the author of Odd Couples: Extraordinary Differences between the Sexes in the Animal Kingdom (Princeton University Press, 2013), co-editor of two previous books and author or co-author of more than 90 research articles and book chapters. Her research focuses on the evolution and adaptive significance of dimorphic trait variation in animals, with particular emphasis on morphological and behavioral differences between the sexes.

Dr. Fairbairn will be doing a book signing for her most recent book, mentioned above, at the reception following her talk.

Wednesday Noon Public Plenary Lecture: 12:15 p.m. – 1:15 p.m. in HUB 355. Ecological Restoration and Post Natural Aesthetics, presented by Dr. Robert Louis Chianese (Emeritus, Department of English, California State University, Northridge). Please refer to Abstract #2 for additional information about this talk.

Dr. Chianese received his Bachelor of Arts degree at Rutgers and his Ph.D. at Washington University, St. Louis. He is professor of English emeritus, California State University, Northridge, a 1979 Mitchell Prize Laureate in Sustainability, and past president of the Pacific Division of the American Association for the Advancement of Science, the only humanities professor selected in its 100-year history. The AAASPD recently published his monograph, Art Inspired by Science. As a Fulbright Senior Specialist, he teaches courses on literature and the environment in China and Bulgaria as part of his curricular reform efforts there. He is a poet, a playwright, and a columnist for American Scientist magazine. He also works to link the arts, humanities and sciences in collaborative efforts in environmental preservation both on and off campus.

Dr. Chianese’s talk will focus on the role of art in ecology and the artistry of eco-restoration.

Wednesday Evening Sigma Xi Distinguished Lecture: 7:00 p.m. in the HUB 302 S. Two Revolutions: Copernicus and Darwin, presented by Dr. Francisco J. Ayala (Departments of Biological Sciences and Philosophy, University of California, Irvine). Please refer to Abstract #3 for additional information about this talk.

Dr. Ayala is University Professor and Donald Bren Professor of Biological Sciences and Professor of Philosophy at the University of California, Irvine. Dr. Ayala is a member of the National Academy of Sciences (NAS), a recipient of the 2001 National Medal of Science, and served as Chair of the Authoring Committee of Science, Evolution,
and Creationism, jointly published in 2008 by the NAS and the Institute of Medicine. Dr. Ayala has received numerous awards, including the 2010 Templeton Prize for “exceptional contribution to affirming life’s spiritual dimension,” and 23 honorary degrees from universities in ten countries. He has been President and Chairman of the Board of AAAS and President of Sigma Xi, the Scientific Research Society of the United States. Dr. Ayala has written numerous books and articles about the intersection of science and religion, including Darwin’s Gift to Science and Religion (Joseph Henry Press, 2007) and Am I a Monkey? (Johns Hopkins University Press, 2010). He teaches classes in evolution, genetics, and the philosophy of biology, which are also the subjects of his research.

Thursday Noon Public Plenary Lecture 1: 12:15 p.m. in the HUB 269. The Expanding Universe, Dark Matter and Dark Energy: The Three Greatest Discoveries in Cosmology, presented by Dr. Gillian Wilson (Professor of Physics and Astronomy, University of California, Riverside). Please refer to Abstract #4 for additional information about this talk.

Dr. Wilson is an astronomer specializing in galaxy evolution and cosmology. She leads the SpARCS survey which has discovered hundreds of new distant clusters of galaxies using NASA’s infrared Spitzer Space Telescope. Originally from Scotland, Dr. Wilson has been a professor at UCR since 2007. She teaches a popular course for UCR undergraduates called “History of the Universe.”

Thursday Noon Public Plenary Lecture 2: 12:15 p.m. in HUB 268. Currents Implicated in Cardiac Arrhythmia, presented by Mr. David Blackman (affiliated faculty member, Southern Oregon University). Please refer to Abstract #5 for additional information about this talk.

Mr. Blackman received his bachelor’s degree in mathematics from University of Arizona, followed by an MS degree in Chemistry (emphasis Biochemistry) from San Francisco State University (SFSU). He taught as a lecturer at SFSU, where he became interested in spectroscopy. This interest lead to the design of the world’s first open architecture spectrometer in 1984, with the construction of twenty-five of the units subsequently funded by an NSF grant while he was working with undergraduate physics labs at the University of California, Berkeley. Mr. Blackman subsequently became interested in biophysical theories. His first such theory, started in 1999, is the subject of this talk. In it, he describes a solution to the arrhythmia problem in which he has simplified an extremely complicated model with 93 differential equations coupled to 101 initial conditions and constants by combining all of the passive potassium currents, reducing the complexity to a set of five theorems with practical consequences. Mr. Blackman is currently an affiliated faculty member in the Department of Mathematics at Southern Oregon University.

Friday Noon Public Plenary Lecture: 12:15 p.m. in HUB 260. Higher Infinity and the Foundations of Mathematics, presented by Dr. Joel David Hamkins (The City University of New York). Please refer to Abstract #6 for additional information about this talk.

Dr. Hamkins received his B.S. degree from the California Institute of Technology and his Ph.D. from the University of California at Berkeley. He is currently a Professor in the Department of Mathematics at the College of Staten Island of the City University of New York (CUNY). He is also on the doctoral faculty in Mathematics, in Philosophy, and in Computer Science at the CUNY Graduate Center in midtown Manhattan. He has held numerous faculty positions around the world, including ones at UC Berkeley, CUNY, Kobe University (Japan), Carnegie Mellon University, University of Muenster (Germany), University of Amsterdam (Netherlands), New York University, and elsewhere.

Professor Hamkins undertakes research in mathematical logic, particularly set theory, with a focus on the mathematics and philosophy of the infinite. A major theme of his work is the interaction of forcing, a set-theoretic method used to build alternative mathematical universes with large cardinals, the strongest-known hypotheses of infinity. He has been a central figure in the theory of infinitary computability, introducing (with A. Lewis and J. Kidder) the theory of infinite time Turing
machines. He has worked in the theory of infinitary utilitarianism, and more recently, infinite chess. Some of his current work concerns mathematical and philosophical issues surrounding the set-theoretic multiverse, including the debate on pluralism, the modal logic of forcing and set-theoretic geology.

**RECEPTIONS and AWARDS BANQUET**

**Tuesday Evening Welcome Reception:** 7:30 p.m. – 9:00 p.m. in HUB 355, immediately following the conclusion of the Tuesday Evening Public Plenary Lecture. All registrants and their guests are invited to enjoy the conviviality of this event. Light refreshments will be available. This event is sponsored through a donation by Michael Pazzani, Vice Chancellor for Research and Economic Development. Thank you!

**Wednesday Evening UCR Chancellor’s Reception:** 8:00 p.m. – 9:15 p.m. on the HUB PLAZA. Immediately following the Sigma Xi Distinguished Lecture, UCR Chancellor Kim A. Wilcox will host a reception for all meeting registrants and their guests. Non-registered guests are welcome, but must be accompanied by a registrant. Please wear your registration badge to this event.

**Thursday Evening Student Awards Banquet:** 6:00 p.m. – about 9:00 p.m. in the HUB 302. Thursday evening will be an exciting time for students as Division representatives will announce the names of student winners of sectional Awards of Excellence and also winners of the Division’s Laurence M. Klauber Award for Excellence (unrestricted), Geraldine K. Lindsay Award for Excellence in the Natural Sciences, J. Thomas Dutro, Jr. Award for Excellence in the Geosciences, Presidents Award for Excellence, Rita W. Peterson Award for Excellence in Science Education Research, the Best Poster Award (for poster presentations only but otherwise unrestricted), and the AAAS Robert I. Larus Travel Award.

The evening festivities will begin at 6:00 p.m. with a reception sponsored by Sigma Xi and which includes beer, wine, and soft drinks. Dinner service will begin about 6:45 p.m. After dinner will be the presentation of student awards, followed by a short program. The evening should end by about 9:00 p.m.

Banquet attendees had the choice of three entrées: Steak and salmon, which are sure to be of interest to meeting attendees. Attendees were requested to sign up in advance for these tours. Should more people show up for a tour than the capacity of the tour, preference will be given to those who signed up in advance. The following campus tours have are available during the meeting.

**BUSINESS MEETINGS**

**Executive Committee of the Pacific Division of AAAS.** Monday, 16 June, Noon – 5:00 p.m. at the Mission Inn.

**Council of the Pacific Division of AAAS.** Tuesday, 17 June, Noon – 5:00 p.m. in HUB 260. At this time the Council will hold its annual business meeting, including the elections of officers, Council and Executive Committee members, discussion of programs for the 2015 annual meetings, and the transaction of such other business as is required by the Division’s By-Laws. This is an open meeting and Pacific Division members with an interest in the governance of the Division are invited to attend.

**Molecular Reproduction and Development.** Thursday, 19 June, 8:00 a.m. – Noon in HUB 355.

**CAMPUS TOURS**

The UCR campus has a rich history dating back into the early 1900s. Because of this and its positioning in citrus and agricultural research, there are a number of locations on campus that are sure to be of interest to meeting attendees. Attendees were requested to sign up in advance for these tours. Should more people show up for a tour than the capacity of the tour, preference will be given to those who signed up in advance. The following campus tours have are available during the meeting.

(A) **UCR Botanic Gardens**

The UCR Botanic Gardens are nestled in the foothills of the Box Springs Mountains on the east side of the UCR campus and a short 8 to 10 minute uphill walk from the meeting location at the HUB. The Gardens cover 40 hilly acres and can be found in section G-H 6-7 of the campus map (see the back cover of these Proceedings).
Courses supported by the Botanic Gardens include anthropology, art, biology, botany, ecology, entomology, landscape plants, morphology, ornamental horticulture, plant pathology, photography, and taxonomy. The Gardens also provide plant materials for various research projects and serve to test and exhibit plant species introduced from all parts of the world. The variable terrain and Riverside’s subtropical climate create numerous “microclimates” which allow for the notable diversity of plantings. This wealth of vegetation creates a hospitable sanctuary for wildlife, where nearly 200 bird species have been officially observed.

This tour will be a research-based guided tour and briefing of the Botanic Gardens. Come enjoy the relaxing atmosphere of the Gardens! After the tour, explore over four miles of scenic trails or just relax on a bench and enjoy the beauty. Though maintained separately, the UCR campus grounds are also considered a part of the Botanic Gardens, and serve to demonstrate landscape plants that do well in Riverside’s climate.

Meet by 8:30 a.m. at the Registration Center on the third floor of the HUB to be escorted to the Botanical Garden.

There are currently three opportunities to take this tour:

- **Wednesday 8:30 a.m. – 10:30 a.m.**
- **Thursday 8:30 a.m. – 10:30 a.m.**
- **Friday 8:30 a.m. – 10:30 a.m.**

Note that this is a walking tour of the Botanic Gardens, so please come prepared wearing good quality walking shoes. It is also best to protect yourself from sun exposure by bringing a hat, sunglasses, and a good sunscreen. Bottles of water will be provided. The admission fee to the Gardens is a $4.00 donation, payable upon entry. This is the only cost for this tour. If you haven’t already signed up for this tour, inquire about availability at the Registration Center.

**(B) UCR Citrus Variety Collection**

The Citrus Experiment Station and its Citrus Variety Collection were established in Riverside in the early 1900s to support the needs of the developing citrus industry in Southern California. Over the years, the world-renowned Citrus Experiment Station became the foundation of the Riverside campus of the University of California and has remained at the forefront of agricultural research, and especially citrus research.

Today, UCR has expertise in many disciplines, yet the Citrus Variety Collection, consisting of four trees each of more than 1,000 different citrus types, remains one of the most diverse collections of citrus and related genera in the world.

This is a research-based guided tour and briefing, and includes transportation. Come prepared to see and taste your way through a tour of citrus diversity. Cost: $7.50.

Meet no later than 9:00 a.m. at the Registration Center on the third floor of the HUB to be escorted to the van for this tour.

There are currently two opportunities to take this tour:

- **Wednesday 9:00 a.m. – 11:00 a.m.**
- **Thursday 9:00 a.m. – 11:00 a.m.**

Maximum number for each tour is 18 participants. If you haven’t already signed up for this tour, inquire about availability at the Registration Center.

**(C) UCR Entomology Research Museum, Insectary, and Quarantine Facility**

On March 30, 1994 a new building for UCR’s large collection of insects and related arthropods was dedicated and given an official name – the Entomology Research Museum. The lower of two floors in the building houses the collection and provides offices, space for curating and research for its Director, Dr. Serguei V. Triapitsyn, its senior museum scientist, Dr. Doug Yanega, and visiting scientists as well as students. There is a preparations room, a small library/lab room, and a large room for teaching, special seminars, and other events sponsored by the Department of Entomology.

The Insectary and Quarantine Facility provides a restrictive environment for potentially invasive species that are currently under scientific research. The building offers two receiving rooms, six research laboratories, 12 greenhouses, 64 rearing rooms and provides a three stage level of quarantine. Each room is equipped with state of the art temperature, humidity, and light controls providing the perfect artificial environment for studies. The Insectary and Quarantine Facility is one of only four insectaries west of the Rocky Mountains.

This will be a research-guided tour. Meet by 2:00 p.m. at the Registration Center on the third floor of the HUB to be escorted to the Entomology Research Museum.

There are two opportunities to take this tour:

- **Wednesday 2:00 p.m. – 4:00 p.m.**
- **Thursday 2:00 p.m. – 4:00 p.m.**

There is no charge for this tour. Maximum number of participants for each tour is 10. If you haven’t already signed up for this tour, inquire about availability at the Registration Center.

**FIELD TRIPS**

All field trips are open to meeting registrants and their families. At least one member of a family group must be registered for the meeting. Unregistered family members will be charged an additional one-time-only $10 field trip registration fee. This fee is paid only once for this meeting, regardless of how many field trips a non-registered participant participates in.

Due to limited space, advance registration was required for all field trips. If you haven’t signed up for a trip you would like to go on, ask about availability at the Registration Center.

**TUESDAY, 17 JUNE**

**Field Trip #4 James San Jacinto Mountains Reserve. Tuesday, 8:00 a.m. – 5:00 p.m.**

The James San Jacinto Mountains Reserve is located on an alluvial bench situated at the lower end of Hall Canyon, a steep, western flank of Black Mountain. The reserve hosts a wide variety of plant communities: Sierra mixed conifer riparian forest, oak woodlands, montane chaparral, alder-willow-cedar riparian forest, and dry meadows. Habitats include mixed conifer and...
hardwood forest, montane chaparral, montane riparian forest, and a rapidly flowing mountain stream with man-made reservoir (Lake Fulmor) immediately downstream. The entire watershed is protected for research and study by the U.S. Forest Service. There are records of 259 species of vascular plants, 35 bryophytes, 6 amphibians, 18 reptiles, 125 birds (60 percent nesting), 35 mammals, and approximately 1,000 invertebrates.

Operating as a satellite to the James Reserve, the Oasis de los Osos Reserve is located at the west end of the Coachella Valley, north of Palm Springs, and encompasses 65 hectares (160 acres) situated on a steep elevational gradient near the base of the north-facing escarpment of Mount San Jacinto. A perennial stream, Lambs Creek, runs through the site, supporting one of the very few riparian woodlands in the Colorado Desert. Oasis de los Osos is protected by the Nature Conservancy.

There are numerous on-going research projects at the reserve covering long-horned beetles, lady beetles, southern mountain yellow-legged frogs, flying squirrels, phenology of the forest, carbon dioxide budgets from the atmosphere to deep into the soil, studies of the mycorrhizae and many others. In addition, extensive teaching use is made of the site by university-level courses in biology, botany, animal tracking, zoology, ecology, and others. The local community is also welcomed for science/ecologically focused tours, meetings and courses on site. K-12 students visit for day-long and overnight field trips and the Idyllwild community uses GIS for fire prevention and planning.

After an orientation to the reserve, participants in this trip will have the opportunity to either head out on an approximately 3 mile hike on a trail that is a bit steep in portions and best for intermediate hikers, or go off in a different direction with a different leader on a hike of the reserve more suitable for beginners or those who aren’t able to navigate the longer hike.

Elevation of the James Reserve is 1,623–1,692 m (5,325–5,550 ft.). Summertime highs are generally in the mid–70s to low 80s but can get into the low 90s. Suggested clothing includes sturdy, closed-toe shoes, shorts or long pants, short sleeved shirt and a jacket, just in case. Hats are good as well. Don’t forget sunscreen and your camera, etc.

Field Trip #2 Microbrewery Science and Pub Tour. Tuesday, 11:00 a.m. – 3:00 p.m.

Since early times, beer has played an important role in our society, but have you ever considered the SCIENCE behind it? As technology has progressed, brewing techniques have been developed and refined, in no small part due to our increased knowledge in the fields of biotechnology, microbiology, and chemistry. Our friends at Ritual Brewing Co. in Redlands will be sharing their passion and knowledge with those interested in this field trip. Hosting this excursion will be Mr. Owen Williams, Certified Cicerone®, and lecturer on Beer and Culture at the Collins College of Hospitality Management at California Polytechnic University, Pasadena.

We plan to leave Riverside at 11:00 a.m., and arrive in Redlands about 11:30 a.m. After eating our box lunches, we will join Mr. Williams for an approximately two hour tour of the microbrewery facility at Ritual Brewing Company, which will include background information on the processes and microorganisms involved in the brewing of beer. Following the tour will be a time to taste various microbrews. The cost for tasting, estimated at about $5 to $10, is not included in the cost for the excursion, and is on your own.

Includes transportation and box lunch. Cost of beer tasting is additional and on your own. Cost: $25 per person.

Friday, 20 June – Saturday, 21 June

Field Trip #3 Channel Islands Adventure.

Due to low advance enrollment by attendees, this field trip was cancelled.

Saturday, 21 June

Field Trip #5 Huntington Library, Art Collections and Botanical Gardens. Saturday, 9:30 a.m. – 5:30 p.m.

This trip is organized and led by Robert L. Chianese (Emeritus, Department of English, California State University Northridge, Northridge, California; rlcianese@gmail.com).

For the most part, this is a self-guided, walking tour of the Huntington Library and grounds, including the art collections and various botanical gardens. Prior to arrival at the “Huntington,” as it is called, participants will be given an overview of the art collection, which includes extensive collections of 18th and 19th century British works as well as American, French, and some Renaissance works. Once on the grounds, participants will be able to explore the 120 acres or so of facilities. It is recommended that participants in this field trip review the Huntington Library website, http://www.huntington.org/, to become oriented to the facility. A map showing the Huntington grounds and discussing accessibility may be downloaded at this link: http://www.huntington.org/WebAssets/Content.aspx?id=350. Please note that most of the grounds are accessible by wheelchair but a few trails are steep and/or have stairs. Refer to the Huntington map to distinguish between those types of trails.

Audio tours and other programs about the Huntington may be found by searching iTunesU for “The Huntington.”

No food is allowed on the premises. However, there are several places inside the Huntington grounds where food may be purchased, such as the Rose Garden Café, which offers a wide variety of sandwiches and grilled items such as hamburgers, hot dogs, grilled chicken sandwiches, fish tacos, and quesadillas, all made to order ($4.95-$8), entree salads with fruit or fresh mixed greens, homemade soups, chili, and freshly baked goods including muffins, scones, turnovers, brownies, and cookies. Another option is the Chinese Garden Tea Shop, as well as food carts. All food purchases are on your own, and may be purchased with cash or credit card.

Be sure to come prepared for our time at the Huntington with comfortable walking shoes, hat, sunscreen, and water. It can be hot, particularly in the Cactus Garden!

Includes transportation and fees. Food purchases are on your own. Cost: $50.00 per person.
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Special Issue: From Germ Cell to Implantation – The Epigenetic Story

When the sperm and egg come together at fertilization, the genomes of each cell must be restructured to support embryonic development. This Special Issue: From Germ Cell to Implantation – The Epigenetic Story, will position us to better understand the dynamic changes in the chromatin states of gametogenesis, after fertilization, and during the development of the resulting embryo, and provides insight to the special ways in which stem cells utilize epigenetic mechanisms to retain their characteristic potency.

Free to read online at http://bit.ly/1j0iwA3, or scan the QR code below:
Future Meetings

Pacific Division Annual Meetings
2015.....14–17 June in San Francisco, California
San Francisco State University
***100th Anniversary of the Division’s first meeting, held in San Francisco as part of the first AAAS meeting west of the Continental Divide and the Pan-Pacific Exposition of 1915.***

AAAS National Meetings
2015.....12 – 16 Feb. in San Jose, California
2016.....11 – 15 Feb. in Washington, D.C.
2017.....16 – 20 Feb. in Boston, Massachusetts
2018.....15 – 19 Feb. in Austin, Texas
Tuesday, 17 June 2014

Meeting of the Council of the Pacific Division
HUB 260
Tuesday
Noon – 4:00 p.m.

The Council of the AAAS, Pacific Division will hold its annual business meeting starting at noon in the HUB, room 260. The Council will elect officers, discuss programs for upcoming annual meetings, and transact other business as is required by the Division’s By-laws. This is an open meeting and members interested in the governance of the Division are invited to attend.

*Evening Public Plenary Presentation
HUB 302 S
Tuesday
6:30 p.m. – 7:30 p.m.

1 And Ever the Twain Shall Meet: An Exposé of Sexual Differences in the Animal Kingdom, presented by Dr. DAPHNE J. FAIRBAIRN (Department of Biology, University of California, Riverside). Please refer to page 29 in these Proceedings and abstract #1 for additional information about this talk.

Welcome Reception
HUB 355
Tuesday
7:30 p.m.

Sponsored by the UCR office of Research and Economic Development, this low key reception features beer, soft drinks and salty snacks. It begins immediately following the conclusion of the evening public plenary panel and continues until about 9:00 p.m. All registrants and their families are invited to enjoy the conviviality of this event. Please wear your registration badge.

Student Awards Judges Organizational Meeting
HUB 265
Tuesday
8:30 p.m.

*The public is invited to attend this program at no charge.

Wednesday, 18 June 2014

Sigma Xi Membership Breakfast
HUB 302 S
Wednesday
7:00 a.m. – 8:30 a.m.

This event is by invitation, for members of Sigma Xi only. If you are a Sigma Xi member and didn’t receive an invitation, please join us!

*Wednesday Noon Public Plenary Lecture
HUB 355
Wednesday
12:15 p.m. – 1:15 p.m.

2 Ecological Restoration and Post Natural Aesthetics, presented by Dr. ROBERT LOUIS CHIANESE (Emeritus, Department of English, California State University, Northridge). Please refer to page 29 in these Proceedings and abstract #2 for additional information about this talk.

*Sigma Xi Distinguished Lecture
HUB 302 S
Wednesday
7:00 p.m. – 8:00 p.m.

3 Two Revolutions: Copernicus and Darwin, presented by Dr. FRANCISCO J. AYALA (Departments of Biological Sciences and Philosophy, University of California, Irvine). Please refer to page 29 in these Proceedings and abstract #3 for additional information about this talk.

UCR Chancellor’s Reception
HUB PLAZA
Wednesday
8:00 p.m.

Sponsored by UCR Chancellor Kim A. Wilcox, this informal reception begins immediately following the conclusion of the Sigma Xi Distinguished Lecture. All meeting registrants and their guests are invited to attend. Non-registered guests are welcome, but must be accompanied by a registrant. Please wear your registration badge to this event.
Thursday, 19 June 2014

**Business Meeting**
Molecular Reproduction and Development
HUB 355
Thursday
8:00 a.m.

*Thursday Noon Plenary Lecture #1*
HUB 269
Thursday
12:15 p.m. – 1:15 p.m.

4 The Expanding Universe, Dark Matter and Dark Energy: The Three Greatest Discoveries in Cosmology, presented by Dr. Gillian Wilson (Professor of Physics and Astronomy, University of California, Riverside). Please refer to page 30 in these Proceedings and abstract #4 for additional information about this talk.

*Thursday Noon Plenary Lecture #2*
HUB 268
Thursday
12:15 p.m. – 1:15 p.m.

5 Currents Implicated in Cardiac Arrhythmia, presented by Mr. David Blackman (affiliated faculty member, Department of Mathematics, Southern Oregon University). Please refer to page 30 in these Proceedings and abstract #5 for additional information about this talk.

**Student Award Judges Meeting**
HUB 268
Thursday
3:00 p.m.

**Reception and Student Awards Banquet**
HUB 302
Thursday
6:00 p.m.

The evening will begin at 6:00 p.m. with a reception hosted by Sigma Xi and which features beer, wine, soft drinks, and hors d’oeuvres. Dinner service will begin about 6:45 p.m. Be sure to bring your dinner ticket with you, as it is needed not only to verify that you are on our dinner list but also to let the servers know your choice of entrée. Tickets to the banquet cost $40 and needed to be purchased in advance. Students in competition for Awards of Excellence were invited to attend the banquet as guests of the Division by requesting a ticket in advance (at no charge). Following dinner will be the announcement of the winners of the student Awards of Excellence as part of a short program. Student award winners are asked to stay until the end of the program so that photographs may be taken of the group. The evening is expected to end by about 9:00 p.m.

*The public is invited to attend this program at no charge.*
Friday, 20 June 2014

*Panel Discussion:
Does Nature Photography Distort Environmental Realities?*
CALIFORNIA MUSEUM OF PHOTOGRAPHY
3834 MAIN STREET, RIVERSIDE
Friday
8:30 a.m. – 11:30 a.m.

For information about this event, please refer to page 68 in these Proceedings.

*Friday Noon Plenary Lecture*
HUB 260
Friday
12:15 p.m. – 1:15 p.m.

6 Higher Infinity and the Foundations of Mathematics, presented by Dr. JOEL DAVID HAMKINS (The City University of New York). Please refer to page 30 in these Proceedings and abstract #6 for additional information about this talk.

*The public is invited to attend this program at no charge.
I. SYMPOSIA

Wednesday, 18 June 2014

Multi-Scale Bioengineering
MS&E 0103
Wednesday
8:35 a.m. – 5:00 p.m.

Program organizers: Dimitrios Morikis and Valentine Vullev (Department of Bioengineering, University of California, Riverside).

Program sponsor: Pacific Division Engineering, Technology, and Applied Sciences Section.

This symposium brings together experimental and theoretical bioengineering and biotechnology researchers, educators, students, and professionals with diverse research interests to promote intellectual exchanges across bioengineering research areas and scales. The symposium has the general theme of “Multi-Scale Bioengineering” and will cover selected topics of cutting edge research, spanning the bioengineering scales from molecular, cellular, tissue, organ, organismal, to human bioengineering, and including the development of innovative systems biology approaches, bioinformatics methods, biologicals, biomaterials, bioprocesses, implants, prosthetics, biomedical devices, and bioinstrumentation. The objective of the symposium is to bring together scientists with bioengineering and biotechnology interests in a setting that will provoke novel questions on how to cut across these diverse bioengineering topics and scales, and to develop new collaborations to address the common goals of understanding basic sciences and improving health.

Morning Session Chair: Dimitrios Morikis

8:35 Introductory Comments, DIMITRIOS MORIKIS

8:40 7 Controlled One-on-One Encounters between Immune Cells and Microbes Provide a New Window into the Mechanisms of the Innate Immune Response, VOLKMAR HEINRICH (Department of Biomedical Engineering, University of California Davis).

9:10 8 Scalable Drug Infusion Technologies, ELLIS MENG (Department of Biomedical Engineering and Ming Hsieh Department of Electrical Engineering, University of Southern California).

9:40 9 Biological Insights from Measuring the Physical Properties of Cells and Organisms, WILLIAM H. GROVER (Department of Bioengineering, University of California, Riverside).

10:10 BREAK

10:30 10 A Kinetic Model of Multivalent Nanoparticle Binding, JERED B. HAUN1,2,*, and MINGQIU WANG1 (*Department of Biomedical Engineering, University of California, Riverside; 2Department of Chemical Engineering and Materials Science, Chao Family Comprehensive Cancer Center, University of California Irvine).

11:00 11 In-situ Advanced Optical Spatiotemporal Analysis of Collagen Systems, JULIA LYUBOVITSKY1*, YU-JER HWANG2, XUYE LANG3, CASSANDRA TURGMAN3, and JOSEPH GRANELLI1 (*Department of Bioengineering, 2Cell, Molecular and Developmental Biology Program, 3Department of Biochemistry, University of California, Riverside).

11:30 12 Label-free Imaging of Neural Activity from Brain to Single Neurons, M. REZUANUL HAQUE, MICHAEL C. OLIVEIRA, MELISSA M. EBERLE, CARISSA L. RODRIGUEZ, CHRISTIAN M. OH, and B. HYLE PARK* (Department of Bioengineering, University of California, Riverside).

12:00 LUNCH

Afternoon Session Chair: Valentine Vullev

1:30 13 Mechanism of Bone Remodeling in Normal and DMP-1 Deficient Mice, MEGAN VELTEN1, JIAN Q. FENG2, and PRANESH B. ASWATH1* (1Materials Science and Engineering Department, Box 19031, University of Texas at Arlington; 2Department of Bio biomedical Sciences, Texas A&M Health Science Center, Baylor College of Dentistry).

2:00 14 Engineering Nutrient Derived Alloys for Medical Applications, HUINAN LIU (Department of
Bioengineering, Materials Science and Engineering Program, and Stem Cell Center, University of California, Riverside).

2:30 15 Multi-step Self-organization of Tissue-scale Tubules, CHIN-LIN GUO (Division of Engineering and Applied Science, Caltech).

3:00 BREAK

3:30 16 Modulation of Stem Cell Fate via Engineered Mechano-environment, MARICELA MALDONADO, LAUREN WONG, KAREN LOW, GERARDO ICO, and JIN NAM* (Department of Bioengineering, University of California, Riverside).

4:00 17 Engineering the Neural Microenvironment to Promote Spinal Cord Regeneration, STEPHANIE K. SEIDLITS1,2, RYAN M. BOEHLER2, ALINE M. THOMAS3, DOMINIQUE SMITH1, DANIEL J. MARGUL1, ASHLEY G. GOODMAN2, TODOR V. KUKUSHLIEV2, TING HE3, DYLAN A. MCCREEDY3, JAIME PALMA2, DONNA M. HASSANI1, BRIAN J. CUMMINGS, AILEEN J. ANDERSON, and LONNIE D. SHEA2 (1Department of Bioengineering, University of California Los Angeles; 2Department of Chemical and Biological Engineering, 3Department of Biomedical Engineering, 4Department of Psychology, Northwestern University; 5Department of Physical Medicine and Rehabilitation, Anatomy and Neurobiology, University of California Irvine).

4:30 18 Physical Determinants of Endothelial Inflammation, KAUSTABH GHOSH (Department of Bioengineering, University of California, Riverside).

Program organizers: Frank Jacobitz (Mechanical Engineering Department, Shiley-Marcos School of Engineering, University of San Diego) and Marko Princevac (Department of Mechanical Engineering, University of California, Riverside).


This symposium brings together researchers advancing our understanding of processes in turbulence and their applications in diverse fields, including modeling of atmospheric or oceanic turbulence, or air pollution problems. Application topics include urban dispersion, vehicular emissions, fire spread, multiphase flow, air lubrication, as well as smoke and visibility issues. Basic processes to be discussed include helical properties and acceleration statistics at multiple scales of turbulent motion.

Morning session chair: Marko Princevac

8:35 Introductory Comments, MARKO PRINCEVAC

8:40 19 Lagrangian and Eulerian Acceleration Properties in Homogeneous Turbulence with Shear and Rotation, FRANK G. JACOBITZ1*, KAI SCHNEIDER2, WOUTER J.T. BOS2, and MARIE FARGE4 (1Mechanical Engineering Department, Shirley-Marcos School of Engineering, University of San Diego; 2Laboratoire de Mécanique, Modélisation, et Procédés Propres du Centre National de la Recherche Scientifique, Aix-Marseille Université; 3Laboratoire de Mécanique des Fluides et d’Acoustique du Centre National de la Recherche Scientifique, Ecole Centrale de Lyon, Université de Lyon; 4Laboratoire de Météorologie Dynamique du Centre National de la Recherche Scientifique, Ecole Normale Supérieure).

9:10 20 Subtle Effects of Air Lubrication, CAMPBELL DINSMORE*, MARKO PRINCEVAC, RICHARD COPCA, JOSHUA HAUSER, WARNER TSE, PAUL LOU, JIT MALAY, and CHRISTOPHER MORALES (Department of Mechanical Engineering, University of California, Riverside).

9:40 21 New Superfog Screening Tool – Development and Validations through Laboratory Experiments, CHRISTIAN BARTOLOME1*, MARKO PRINCEVAC, AKULA VENKATRAM1, DAVID WEISE2, GARY ACHTEMEIER2, and SHANKAR MAHALINGAM1 (1Department of Mechanical Engineering, University of California, Riverside; 2USDA Forest Service Pacific Southwest Station, Riverside, CA; 3USDA Forest Service Southern Research Station, Athens, GA; 4College of Engineering, University of Alabama, Huntsville, AL).

10:10 BREAK
10:30  22  A Study of the Flow Field Surrounding Interacting Line Fires, TREVOR MAYNARD*¹, MARKO PRINCEVAC², and DAVID WEISE³ (USDA Forest Service Technology and Development Program, San Dimas, CA; ²University of California, Riverside; ³USDA Forest Service Pacific Southwest Research Station, Riverside, CA).

11:00  23  Ignition of Live Vegetation by Convection and/or Radiation – Preliminary Results, DAVID R. WEISE*⁴*, THOMAS H. FLETCHER², SARA McALLISTER¹, and JONATHAN GALLACHER³ (USDA Forest Service, Pacific Southwest Research Station, Riverside, CA; ²Brigham Young University; ³USDA Forest Service, Rocky Mountain Research Station, Missoula, MT).

11:30  24  Experiments on Surface Fire Transition to the Elevated Live Fuels, SUNDAY OMODAN*¹, CHRISTIAN BARTOLOME¹, RAUL-DELGA DELGADILLO¹, JOEY CHONG², GLORIA BURKE², MARKO PRINCEVAC¹, and DAVID WEISE² (Department of Mechanical Engineering, Bourns College of Engineering, University of California, Riverside; ²USDA Forest Service, Pacific Southwest Research Station, Riverside, CA).

12:00  LUNCH

Afternoon session chair: Frank Jacobitz

1:30  25  Characterizing Wicking for Development of Paper-based Analytical Devices, CARLOS CASTRO*⁴, CINDY ROSILLO, and HIDEAKI TSUTSU (Department of Mechanical Engineering, University of California, Riverside).

2:00  26  Recent Advances in Optical Thermocavitation, DARREN BANKS*, MOLLY DANIELS, and GUILLERMO AGUILAR (Department of Mechanical Engineering, University of California, Riverside).

2:30  27  Single Droplet and Train Impingement Pool Cooling, DARREN BANKS*, CYNTHIA AJAWARA, JIE LIU, and GUILLERMO AGUILAR (Department of Mechanical Engineering, University of California, Riverside).

3:00  BREAK

3:30  28  Magnification of Concentrations in Cities, NICO SHULTE*¹, SI TAN, and AKULA VENKATRAM (Mechanical Engineering, University of California, Riverside).

4:00  29  Understanding the Impact of Built Environment on Air Quality in Transit Oriented Developments, SI TAN*, NICO SCHULTE, and AKULA VENKATRAM (Mechanical Engineering, University of California, Riverside).

4:30  30  Near Road Impact of Sound Walls on Air Quality Mitigation, MARKO PRINCEVAC*, SAM POURNAZERI, and BRANDN GAZZOLO (Department of Mechanical Engineering, University of California, Riverside).

Please refer to poster 300 on page 79 of these Proceedings, which was submitted as part of this symposium.

**Boise Extravaganza in Set Theory (BEST)**

HUB 260

Wednesday, 8:50 a.m. – 5:20 p.m.
Thursday, 9:00 a.m. – 3:30 p.m.
Friday, 9:30 a.m. – 1:15 p.m.

Program organizers: Liljana Babinkostova, Andres Caicedo, Samuel Coskey and Marion Scheepers (Department of Mathematics, Boise State University, Boise, Idaho).

Program sponsored by the Pacific Division section on Mathematics and by the National Science Foundation under grant DMS1440263.

This program is a continuation of the well-known conference BEST (Boise Extravaganza in Set Theory). BEST focuses on the mathematical discipline called Set Theory and its applications in other disciplines in Mathematics. BEST was hosted in Idaho at Boise State University for its first nineteen years.

Set Theory is the mathematical foundation for the study of the infinitary objects that routinely arise in Mathematics and its applications, and in the mathematical sciences. Contemporary set theoretic research addresses basic questions about provability, consistency and independence, and the relative strength of postulates or hypotheses in mathematized scientific theories. The methods developed by set theory serve as powerful tools for applications in many other mathematical disciplines, including algebra, analysis, combinatorics, complexity, topology and more.

The invited speakers for this program are successful set theorists from different career stages and will present high level scientific talks in several areas of set theory and its applications. The BEST symposium will also host contributed talks in Set Theory and its applications by participants. Undergraduate and graduate students will also present research accomplishments in these areas.

**1100** (time italicized and underlined) identifies a student presentation

* identifies the speaker from among several authors listed

⁴ (bolded number) is the abstract number

abstracts contain complete contact information for authors
EDITOR’S NOTE: Due to the nature of this particular program and our printer’s deadline for printing these Proceedings, it was impossible to present this program here in its entirety. The planners have provided an outline for the program with as much detail as was known at press time. Exact details may change as the program develops. Meeting attendees will be given the detailed program for this symposium with their registration packets at registration in Riverside.

Session chair: Liljana Babinkostova

8:50 Opening comments

9:00 31 Boldface Resurrection and the Strongly Uplifting Cardinals, the Superstrongly Unfoldable Cardinals and the almost Hugely Unfoldable Cardinals, JOEL D. HAMKINS* and THOMAS A. JOHNSTONE (City University of New York).

10:00 BREAK

10:20 32 Student presentation. Information not available at press time. Please refer to updates sheet for information about this presentation.

10:55 33 Information not available at press time. Please refer to updates sheet for information about this presentation.

11:20 34 Information not available at press time. Please refer to updates sheet for information about this presentation.

11:45 35 Information not available at press time. Please refer to updates sheet for information about this presentation.

12:10 LUNCH

2:00 36 Singularizing and Square, MENACHEM MAG-IDOR† and DIMA SINAPOVA‡ (†Department of Mathematics, Hebrew University of Jerusalem, Israel; ‡Department of Mathematics, University of Illinois at Chicago).

3:00 BREAK

3:20 37 Weak Square and the Failure of SCH, SPENCER UNGER (Department of Mathematics, University of California, Los Angeles).

3:55 38 Information not available at press time. Please refer to updates sheet for information about this presentation.

4:20 39 Information not available at press time. Please refer to updates sheet for information about this presentation.

4:45 40 Information not available at press time. Please refer to updates sheet for information about this presentation.

Program continues at 9:00 a.m. on Thursday. Please refer to page 52 of these Proceedings.

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Advances and Challenges in Marine Cell Biology

MS&E 0003

Wednesday

9:05 a.m. – 5:00 p.m.

Program organizers: Amro Hamdoun (Scripps Institution of Oceanography, University of California, San Diego) and Anthony De Tomaso (Department of Molecular Cellular and Developmental Biology, University of California, Santa Barbara).

Program sponsor: Pacific Division section on Cell and Molecular Biology.

Marine model systems have long played central roles in understanding conserved features of cell function and organization, ranging from the mechanisms underlying generation of membrane potentials to the identification of molecules necessary for interaction of sperm and egg. Recent advances in genomics, microscopy and molecular biology have now greatly expanded the range of marine cell biological models accessible to researchers, and expanded the suite of questions accessible using established models. In this symposium we will present 8 examples of how marine cell biological models are being used to address modern problems in biology, and how unique aspects of the biology of marine organisms can potentially offer insights not available using classic laboratory organisms. One presentation will focus on the use of echinoderms to understand membrane transport systems involved in cellular signaling and efflux of xenobiotics. Another presentation will highlight the use of urochordates to understand mechanisms of allorecognition and tissue regeneration. Other examples of proposed presentations include one on the use of hemichordates to study evolution of developmental circuits necessary for formation of the nervous system, and one on the use of marine cells to understand function of acid/base sensing mechanisms. The presentations will provide insight into the utility of marine model organisms to address broad biological problems. These include problems in basic science, such as the understanding of animal developmental...
mechanisms, and those of relevance to applied science, as in the example of studying acid base sensing mechanisms to understand consequences of ocean acidification. The symposium is also likely to define novel questions that could be addressed by collaboration across these disparate models.

Morning session chair: Anthony De Tomaso

9:05 Introductory comments, ANTHONY DE TOMASO

9:10 41 Identification of Novel Egg Activation Circuits Revealed By Integrative Network Analysis of the Sea Urchin Egg Phosphoproteome, HONGBO GUO1, ANTHONY MORADA2, ANDREW LUGOWSKI1, ANA ELISA GARCIA-VEDRENNE1, RUTH ISSERLIN1, ANDREW EMILI1, and KATHY FOLTZ2* (1Donnelly Center for Cellular and Biomolecular Research, University of Toronto; 2Department of MCD Biology and Marine Science Institute, University of California, Santa Barbara; 3Department of EEM Biology, University of California, Santa Barbara).

9:40 42 Comparative Genomes Emphasizing Echinoderms, R. ANDREW CAMERON (Division of Biology, California Institute of Technology).

10:10 BREAK

10:30 43 Life’s Wonderful Solutions: Convergent Molecular Evolution Underlies Origins of Bioluminescence in Marine Animals, TODD OAKLEY (Department of Evolution Ecology and Marine Biology, University of California, Santa Barbara).

11:00 44 Dissecting Transporter Function in Sea Urchin Embryos, AMRO HAMDOUN*, TUFAN GOKIRMAY, JOSEPH CAMPNALE, and LAUREN SHIPP (Scripps Institution of Oceanography, University of California, San Diego).

11:30 LUNCH

Afternoon session chair: Amro Hamdoun

1:30 45 Predicting Pollutant Transfer from the Oceans to Humans Using Biochemistry and Structural Biology, SASCHA C. T. NICKLISCH1*, GEOFFREY CHANG2 and AMRO HAMDOUN1 (1Marine Biology Research Division, Scripps Institution of Oceanography, University of California, San Diego; 2Skaggs School of Pharmacy and Pharmaceutical Sciences, Department of Pharmacology, School of Medicine, University of California, San Diego).

2:00 46 Sensing Acid/Base Conditions via the cAMP Pathway, MARTIN TRESGUERRES (Scripps Institution of Oceanography, University of California San Diego, 9500 Gilman Drive (0202), La Jolla, California, 92093, mtresguerres@ucsd.edu).

2:30 BREAK

3:00 47 Diversity in Germ Line Determination, GARY WESSEL (Department of Molecular and Cellular Biology, Brown University).

3:30 48 Allorecognition in a Basal Chordate: A Simplified Model for Transplantation Tolerance, ANTHONY W. DE TOMASO (Department of MCD Biology and Marine Science Institute, University of California, Santa Barbara).

Forensic and Clinical Service Challenges in a Juvenile Arson Explosives and Research Center (JAERIC)

HUB 379  
Wednesday  
9:05 a.m. – NOON

Program organizer: Ronn Johnson (University of San Diego).

Program sponsor: Pacific Division Psychology Section.

Juvenile Fire Setting and Bomb Making (JFSB) is a growing public safety concern. In an effort to secure a more accurate forensic and clinical snapshot of the prevalence of JFSB, a national data base for JFSB is being crafted. This effort is being coordinated through the International Association of Fire Fighters (IAFF). Still, the comprehensive risk assessment factors for JFSB may not be completely captured by the anticipated national data set. A Juvenile Arson, Explosives and Research Center has coded 14 years of research data that includes roughly 1,600 cases of JFSBs. It is also very important to identify bomb-making and/or other explosive-making in forensic evaluation and treatment programming related to arson. Current peer reviewed research underrepresents the link between juvenile arson and juvenile bomb-making. Use of explosives was documented in 14.9% of the cases referred to a community juvenile arson intervention program in San Diego County. Of the 205 cases reported on in which use of explosives was documented, 37.1% of the juveniles had also committed arson apart from their use of explosives. Data from the JAERIC research project of the Burn Institute of San Diego County will be presented.

Session chair: Ronn Johnson
9:05  Introductory Comments, RONN JOHNSON

9:10  49  Geopsychological Profiling of Juvenile Fire Setters and Bomb Makers in San Diego County for Schools, ERIC JACOBS*, ADRIANA DEL VECCHIO*, and CHRISTINE COLLINS* (University of San Diego).

9:40  50  Use of a DSM-5 Quadrant with Juvenile Fire Setters and Bomb Makers, DERRICK YOUNG*, PATRICIA JONES, KORI RYAN*, and JESSICA MUELLER* (University of San Diego).

10:10 BREAK

10:30  51  Geopsychological Profiling of Juvenile Fire Setters and Bomb Makers in San Diego County, ANDI FESSLER*, PATRICIA JONES*, and YASMIN SAADATZADEH* (University of San Diego).

11:00  52  Clinical Decision Making in the Treatment of Juvenile Fire Setters during the Treatment Termination Phase: A Second Risk Assessment, DERRICK YOUNG*, ANDI FESSLER*, CHRISTINE COLLINS*, and ALEXIS WILSON* (University of San Diego).

11:30  53  The Forensic Psychological Patterns of “No Shows” in Juvenile Fire Setters and Bomb Makers, CINDY KIM*, YASMIN SAADATZADEH*, ANDI FESSLER*, and JESSICA MUELLER* (University of San Diego).

The Importance of Citizen Science in Forming Scientific Communities from the Local to the National Level

HUB 268
Wednesday
9:05 a.m. – NOON

Program organizer: Kimberly A. Hammond (Department of Biology, University of California, Riverside).

Program sponsors: Pacific Division sections of Education and General and Interdisciplinary Studies.

Involving the general public (Citizens) in the exploration of natural areas and the collection of scientific data results in more engaged and educated communities. In addition, the crowd-sourced data gathered in citizen science activities can be used to leverage scientific activities in a myriad of ways.

In an age when federal dollars are limited, this is a valuable way to continue to collect much needed information about the world around us. Despite all of the benefits of careful incorporation of citizen science into mainstream scientific activities, citizen science remains relatively unorganized and often lacks a coordinated direction. To some extent, the lack of organization is a good thing because activities arise from the grassroots efforts that allow for ingenious and fresh strategies. However, the cooperation and collaboration of groups organizing, supporting, and collecting data from citizen science activities can also help to further strengthen and improve the activities themselves and the results of those activities.

In this symposium, individuals, public non-profit organizations, and university groups will be brought together to explore the victories and current needs in citizen science. Specifically, however, we are aiming to sharpen the focus from the national level (Smithsonian Institution), to the Pacific Region, to the state of California, to the Southern California area and finally to one city (the city of Riverside) in a quest for an understanding of how the process works and how the different levels fit together to answer important questions and to inform a large and dynamic citizenry.

Session chairs: Kimberly A. Hammond and Jamie E. Dolan

9:10  54  Big Visions, Big Data … Big Problems, RUSTY RUSSELL (Department of Botany, Smithsonian Institution).

9:40  55  Rediscovering California: Engaging the Public in Biodiversity Research and Conservation, ALISON YOUNG*, REBECCA JOHNSON*, SCOTT LOARIE, TERRENCE GOSLINER, ELIZABETH BABCOCK, and JEAN FARRINGTON (California Academy of Sciences).

10:10 BREAK

10:30  56  Thinking about Knowledge and Power: Orienting Undergraduates to the Potential and Limits of Citizen Science/PPSR, DANIELA SOLERI (Geography Department, University of California Santa Barbara, Santa Barbara, CA 93106-4060; soleri@geog.ucsb.edu).

11:00  57  Urban Citizen Science and the Future of Cities, LILA M. HIGGINS*, GREGORY B. PAULY, and BRIAN V. BROWN (Natural History Museum, Los Angeles, CA).

11:30  58  Seeking Out Stink Bugs in Southern California: Using Citizen Scientists to Learn More About Stink
Bug Diversity, Behavior and Distribution, and Track the Spread of the Invasive Brown Marmorated Stink Bug (*Halyomorpha halys*), JAMES M. BRYANT* and MARK S. HODDLE² (*Museum Department, City of Riverside; ²Center for Invasive Species Research, University of California, Riverside).

Forensic and Clinical Psychological Research in Uganda: Challenges for Trauma on Top of Trauma Service Delivery
HUB 379
Wednesday
1:25 p.m. – 4:30 p.m.

Program organizer: Ronn Johnson (University of San Diego).

Program sponsor: Pacific Division Psychology Section.

Acts of terrorism and civil wars have resulted in multigenerational experiences with traumatic (PTSD) incidents that have no international border restrictions in Africa. The Republic of Uganda is a landlocked country in East Africa. Its size is comparable to the state of Oregon. Uganda has a high HIV prevalence in persons with severe mental illness (SMI) compared to the general population. The health problems stemming from HIV also coincide with disabling cognitive, behavioral, and motor dysfunction. The availability of competent and reliable mental health services is inadequate given the needs found in the remote regions of the country. Alternate approaches to mental health service delivery through collaborative partnerships as well as technology have garnered increasing interest, though there remains relatively limited research evaluating these forensic or clinical mental health approaches. In fact, there is some evidence that clinical mental health services have resulted in positive outcomes for many psychological disorders. This symposium examines issues that complicate and compliment mental health services research in Uganda.

The objective of this symposium is to review the efficacy of research-based clinical mental health interventions involved while delivering culturally responsive services in Uganda.

Session chair: Ronn Johnson

1:25 Introductory comments, RONN JOHNSON

1:30 59 Culturally-responsive Approaches for Addressing the Perceptions and Acceptability of Trauma Interventions in Uganda, ERIC JACOBS*, ELIZABETH GRACE*, MAGGIE WILHELM*, CINDY KIM*, ADRIANA DEL VECCHIO*, and KATHLEEN THOMAS* (University of San Diego).

2:00 60 Group Counseling Training and Supervision for Trauma Issues Faced in Uganda: Why a Counseling Theory is Important, DERRICK YOUNG*, MAGGIE WILHELM*, MONIQUE LITTLE*, and KATHLEEN THOMAS* (University of San Diego).

2:30 61 Culturally-Responsive Approaches for Addressing Severe Mental Health Issues Associated with HIV and AIDS, KATHLEEN THOMAS*, MELISSA KOENIGSBERG*, CHRISTINE COLLINS*, and MONICA GAMBILADO* (University of San Diego).

3:00 BREAK

3:30 62 An overview of East African Research and Trauma Hope (EARTH), ELIZABETH GRACE*, MAGGIE WILHELM*, MONICA GAMBILADO* and NICK BOYD* (University of San Diego).

4:00 63 Organization and Delivery of Clinical Mental Health Services in Uganda, ELIZABETH GRACE*, CINDY KIM*, YASMIN SAADATZADEH*, MONIQUE LITTLE*, and MELISSA KOENIGSBERG* (University of San Diego).

Should Science Reform the Humanities?
HUB 268
Wednesday
1:30 p.m. – 5:00 p.m.

Program organizer: Jesse James Thomas (Department of Religious Studies, San Diego State University) and Mark Wheeler (Department of Philosophy, San Diego State University).

Program sponsor: Pacific Division section of Science and the Arts and Humanities.

In a New Republic 8/6/2013 article titled “Science is not your enemy,” Steven Pinker argues that if the humanities were more scientific they could reverse the recent decline in the status of the humanities. Simon Weiseltier responds on 9/4/13 with “Crimes against the Humanities” in which he argues that the authority of the sciences belongs properly in the province of fact rather than value, which is the province of the humanities. Little discussion has followed these two articles. This symposium hopes to do that.

Professor Thomas will open the symposium with a brief summary of the two articles referenced above, as well as his
own answer to the question. He will then invite the presenters to provide and elaborate briefly on their own answers to the basic question.
Session chair: Jesse James Thomas

1:30  64  Parable of the Chicken House: The Importance of Metaphors in Science and Humanities, JESSE JAMES THOMAS (San Diego State University).

2:00  65  Should Science Reform the Humanities? NICOLE ASHLEY MEDA (San Diego State University).

2:30  66  Expanding Artistic Expression through Science? SHERIDON STOKES (Herb Alpert School of Music, University of California Los Angeles).

3:00  BREAK

3:30  67  Should Science Reform the Humanities? DARR-REN IAMMARINO (San Diego State University).

4:00  68  Problem-Posing: How Altering Our Educational Philosophy Can Bridge the Divide Between the Sciences and the Humanities, TREVOR AULD-RIDGE* and JEREMY JUYBARI (San Diego State University).

4:30  69  A House Divided: The Humanism of Science and the Scientific Nature of the Humanities, MARK RICHARD WHEELER (San Diego State University).
Thursday, 19 June 2014

**Theory, Experiment, and Computations: A Synergistic Approach to Research**

MS&E 0113

**Thursday**

8:05 a.m. – NOON

Program organizer: C. Mark Maupin (Colorado School of Mines).

Program sponsors: Pacific Division sections on Computer and Information Systems, and Chemistry and Biochemistry.

The utilization of theory and computations to complement and sometimes lead (i.e. theory driven research) experimental efforts is becoming increasingly common. The synergistic combination of experiment, theory, and computations has allowed for a greater understanding of many physical phenomena. The structural information obtained from various techniques such as X-ray and NMR is often critical to the creation of realistic models for computations, while theory and computations often reveal molecular level insights into catalytic mechanisms, binding phenomena, and system dynamics. This symposium is focused on the combination of experiment and theory/computations to expand our understanding of diverse systems ranging from gas phase reactions to complex condensed phase systems.

Session Chair: C. Mark Maupin

8:05 **Introductory comments, C. MARK MAUPIN**

8:10 **70 Acetylcholine Promotes Binding of α-Conotoxin MII at α,b, Nicotinic Acetylcholine Receptors**, SOMISETTI V. SAMBASIVARAO1, JESSICA ROBERTS2, VIVEK S. BHARADWAJ3, JASON G. SLINGSBY1, CONRAD ROHLEDER1, CHRIS MALLORY3, JAMES R. GROOME3, OWEN M. McDOUGAL3*, and C. MARK MAUPIN3* (1Chemical and Biological Engineering Department, Colorado School of Mines; 2Department of Biological Sciences, Idaho State University, Pocatello; 3Department of Chemistry and Biochemistry, Boise State University).

8:40 **71 Impact of Ionic Liquids on the Structure of Cellulose**, VIVEK BHARADWAJ*, TIMOTHY SCHUTT, COREY KINSINGER, TIMOTHY ASHURST, and C. MARK MAUPIN (Chemical and Biological Engineering Department, Colorado School of Mines).

9:10 **72 Using α-Conotoxin Molecular Scaffolds to Inform the Discovery of Potent and Selective Receptor Ligands toward the Treatment of Parkinson’s Disease**, OWEN M. McDOUGAL (Department of Chemistry and Biochemistry, Boise State University).

9:40 **73 Using Peptide Mutation and Structural Similarity to Aid in Drug Development**, THOMAS LONG (Departments of Computer Science and Chemistry and Biochemistry, Boise State University).

10:10 BREAK

10:30 **74 Comparison of the Microcirculation in the Human Conjunctiva in Healthy and Diabetic Patients**, WILLIAM L. DOW1*, FRANK G. JACOBITZ1, and PETER CHEN2 (1Shiley-Marcos School of Engineering, University of San Diego; 2Department of Bioengineering, University of California, San Diego).

11:00 **75 Augmenting NMR Crystallography through Fragment Methods**, JOSHUA D. HARTMAN (Department of Chemistry, University of California, Riverside).


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Ecology and Conservation in River Networks

HUB 379

**Thursday**

8:30 a.m. – NOON

Program organizer: Kurt E. Anderson (Department of Biology, University of California, Riverside).

Program sponsor: Pacific Division section on Ecology, Environmental Sciences, and Sustainability.

Freshwater scientists are increasingly demonstrating that the branching structure of river networks has substantial ecological consequences. Local dynamics in rivers have been profitably studied over small spatial scales, and modeled by idealizing rivers as a one-dimensional line. Yet river stretches belong to branching, tree-like networks, which adds complexity in several ways. For example, restriction of movement along branches may influence population dynamics, while fluxes of materials and organisms at river confluences can alter habitat

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**1100** (time italicized and underlined) identifies a student presentation

* identifies the speaker from among several authors listed

63 (bolded number) is the abstract number

abstracts contain complete contact information for authors
and species diversity. Superimposed on this river geometry is a large degree of temporal and spatial variation in ecological processes that is often arranged hierarchically. We still lack a coherent understanding of how river network structure constrains ecological processes, which hinders our ability to predict how other types of environmental variability, including human alterations, will affect freshwater ecosystems. However, there have recently been great strides made in our understanding of ecological dynamics in river networks, and this symposium will highlight recent exemplary research in this area. Each speaker has been suggested based on a broad expertise in river ecology, and will speak on one or more particular subthemes. These include: 1) how life history strategies and population dynamics reflect river network geometry, 2) patterns of abiotic and biotic diversity at different levels of hierarchical network organization, and 3) novel mathematical and statistical tools for studying the influence of network geometry on ecological processes.

Session Chair: Kurt E. Anderson

8:30  Introductory comments, KURT E. ANDERSON

8:40  77 Tectonic Controls over Ecological Transitions and Linkages Through River Drainage Networks, MARY E. POWER1*, WILLIAM E. DIETRICH2, and JACQUES C. FINLAY3 (1Department of Integrative Biology, University of California, Berkeley; 2Department of Earth and Planetary Science, University of California, Berkeley; 3Department of Ecology, Evolution, and Behavior, University of Minnesota, Minneapolis).

9:10  78 Mainstem-Tributary Food Web Interactions in River Networks Mediated by Migratory Mayflies and Anadromous Fish, HIROMI UNO* and MARY E. POWER (Department of Integrative Biology, University of California, Berkeley).

9:40  79 A Strategy for Aquatic Biodiversity Conservation in California, REBECCA M. QUIÑONES*, TED E. GRANTHAM, RYAN PEEK, ERIC HOLMES, NICK SANTOS, ANDY BELL, PETER B. MOYLE, and JOSHUA H. VIERS (Center for Watershed Sciences, University of California, Davis).

10:10 BREAK

10:30 80 Assessing the Performance of Geometric and Habitat-Based Indices of Population Persistence Using Continuous Space Models of River Networks, KURT E. ANDERSON*, JONATHAN SARHAD, and SCOTT MANIFOLD (Department of Biology, University of California, Riverside).

11:00 81 Spatial Sampling on Streams: Principles for Inference on Aquatic Networks, NICHOLAS A. SOM1*, PASCAL MONESTIEZ2, JAY M. VER HOEF3, DALE L. ZIMMERMAN4, and ERIN E. PETERSON5 (1Arcata Fish and Wildlife Office, US Fish and Wildlife Service, Arcata, CA; 2Biostatistique et Processus Spatiaux, INRA, Avignon, France; 3National Marine Mammal Laboratory, Alaska Fisheries Science Center, National Oceanographic and Atmospheric Administration, Seattle, WA; 4Department of Statistics and Actuarial Science, University of Iowa, Iowa City; 5CSIRO Computational Informatics, Dutton Park, QLD, Australia).

11:30 82 Stream Temperature Variability over Time and Space: Metrics and Models, E. ASHLEY STEEL (Pacific Northwest Research Station, USDA Forest Service, Seattle WA).

Accelerating Chemical and Biomedical Discovery with Molecular Simulation

Program organizers: Chia-en A. Chang (Department of Chemistry, University of California, Riverside) and Dong Xu (Department of Biomedical and Pharmaceutical Sciences, College of Pharmacy, Idaho State University, Meridian).

Program sponsors: Pacific Division sections of Cell and Molecular Biology, and Chemistry and Biochemistry.

This research symposium focuses on the advancements of state-of-the-art computational chemical and biological methods and their applications in addressing the most important and urgent biomedical questions. The objective of the symposium is to inform and engage elite computational scientists from around the globe in a discussion about the latest computational method development, the current applications in biomedical research, and the future outlook of the advanced simulation technologies.

Session chair: Dong Xu

8:35  Introductory comments, DONG XU

8:40  83 Dynamical Ensembles of Nucleic Acids and Their Importance for Binding, IOAN ANDRICIOAEI (Department of Chemistry, University of California, Irvine).
9:10 84 Effects of Spatial Organization and Molecular Scaffolds on the Diffusive Activity of Substrates in Enzyme Nanostructures, CHIA-EN A. CHANG* and CHRISTOPHER ROBERTS (Department of Chemistry, University of California, Riverside).

9:40 85 AMBER 14: Peer to Peer Molecular Dynamics FTW, SCOTT LE GRAND (Amazon and Scatology, Inc.).

10:10 BREAK

10:30 86 Protein Force Field Developments: Explicit and Implicit Strategies, RAY LUO (Department of Biochemistry, Molecular Biophysics and Biomedical Engineering, University of California, Irvine).

11:00 87 Making Sense of Transmembrane Voltage Sensing by Voltage-Sensitive Ion Channels: Concerted Simulation and Experimental Studies, DOUGLAS TOBIAS (Department of Chemistry, University of California, Irvine).

11:30 88 A Molecular Theory for High-throughput Prediction of Hydration Free Energies, YU LIU, JIA FU and JIANZHONG WU* (Departments of Chemical and Environmental Engineering and Mathematics, University of California, Riverside).

Two Dimensional Materials for Next Generation Devices
MS&E 0103
Thursday
8:35 a.m. – 4:10 p.m.

Program organizers: Jory Yarmoff (Department of Physics and Astronomy, University of California, Riverside) and Jeanie Lau (Department of Physics and Astronomy, University of California, Riverside).

Program sponsor: Pacific Division section on Physics and Materials Science.

The global challenge in electronic materials, driven by the impending end of Moore’s law, is to find effective materials that can replace silicon in device applications. Recently discovered two-dimensional materials, such as graphene and topological insulators, are the leading candidates. These materials are composed of layers that are weakly coupled to each other by van der Waals forces. They have been found to exhibit novel conductivity properties within the two-dimensional plane that is leading to an abundance of new physics and materials properties. This symposium will highlight recent advances in the science that underlies the fabrication, understanding and applications of two-dimensional materials.

Morning session chair: Jory Yarmoff

8:35 Introductory comments, JORY YARMOFF

8:45 89 Ripples, Strains and Quantum Transport in Few Layer Graphene Membranes, CHUN NING (JEANIE) LAU (Department of Physics and Astronomy, University of California, Riverside).

9:20 90 Optoelectronic and Thermal Transport Properties of Two-Dimensional Materials and Heterostructures, CHUN-CHUNG CHEN1, ZHEN LI1, SHUN-WEN CHANG2, and STEPHEN B. CRONIN1,2* (1Department of Electrical Engineering, 2Department of Physics, University of Southern California).

9:55 91 Indirect Excitons in van der Waals Heterostructures, M.M. FOLGER*, L.V. BUTOV, and K.S. NOVOSELOV (Department of Physics, University of California, San Diego).

10:30 BREAK

10:50 92 Manipulating Correlated Phases in Graphene, ALESSANDRA LANZARA (Department of Physics, University of California, Berkeley).

11:25 93 Electron-Hole Excitations in Two-Dimensional Atomic Layer Materials, NATHANIEL M. GABOR (Department of Physics and Astronomy, University of California, Riverside).

12:00 LUNCH

Afternoon session chair: Jeanie Lau

1:30 94 2D Transition Metal Dichalcogenide Films: Facile Single-Layer Film Growth on SiO2 and Bandgap Engineering through Alloying, LUDWIG BARTELS (Department of Chemistry, University of California, Riverside).

2:05 95 Engineering a Fault-tolerant Quantum Computer, JASON ALICEA (Department of Physics, and Institute for Quantum Information and Matter, California Institute of Technology).

2:40 BREAK
**3:00**  96  Magnetic Topological Insulator Hetero-Structures, KANG L. WANG (Device Research Laboratory, Department of Electrical Engineering, WIN Institute of Neurotronics Systems, KACST-UCLA Center on Green Nano Electronics, University of California, Los Angeles).

**3:35**  97  Topological Insulators and Beyond, DAVID HSIEH, (Institute for Quantum Information and Matter, California Institute of Technology).

Please refer to posters on page 75 of these Proceedings, which were submitted as part of this symposium.

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**Boise Extravaganza in Set Theory (BEST)**

HUB 260

Thursday, 9:00 a.m. – 3:30 p.m.

Friday, 9:30 a.m. – 1:15 p.m.

Continuing from Wednesday. Please refer to page 43 of these Proceedings for information about this program.

Session chair: Liljana Babinkostova

**9:00**  98  On a Class of Guessing Models, NAM TRANG (Department of Mathematics, Carnegie Mellon University).

**10:00** BREAK

**10:20**  99  Basic Tukey Reductions for Selective and Ramsey Filters on General Topological Ramsey Spaces, NATASHA DOBRINEN, JOSE G. MIJARES and TIMOTHY TRUJILLO*  (Department of Mathematics, The University of Denver).

**10:55**  100  Tychonoff’s Embedding into an H-closed Space, JOHN P. REYNOLDS (Department of Mathematics, University of Kansas).

**11:20**  101  Topological Ramsey spaces and Baire sets, NATASHA DOBRINEN and JOSE G. MIJARES* (Department of Mathematics, University of Denver).

**11:45**  102  Information not available at press time. Please refer to updates sheet for information about this presentation.

**12:10** LUNCH

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**2:00**  103  Generalized Choquet Spaces, SAMUEL COSKEY* and PHILIPP SCHLICHT², (¹Department of Mathematics, Boise State University; ²Rheinische Friedrich-Wilhelms-Universität, Bonn, Germany).

**2:30**  104  Information not available at press time. Please refer to updates sheet for information about this presentation.

**3:00**  105  Information not available at press time. Please refer to updates sheet for information about this presentation.

Program continues at 9:30 a.m. on Friday. Please refer to page 64 of these Proceedings.

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**Promoting Deeper Learning in Middle Adolescence: Critical Connections and Implications for STEM Education**

HUB 269

Thursday

9:00 a.m. – 4:00 p.m.

Program organized by Carl A. Maida (University of California, Los Angeles) and Paul Heckman (University of California, Davis).

Program sponsored by the Pacific Division section on Education.

Over the past few decades, research from the cognitive and learning sciences, education sciences, and developmental psychology has converged to yield a clear and compelling model of how high school-aged youth learn best. Research confirms observations that good learning involves direct experience, “deep immersion in a consequential activity,” according to psychologist Jerome Bruner. It confirms that learning works best when young people can focus in depth on a few things at a time, when they see a clear purpose in learning activities, and when they have an active role co-constructing, interpreting, applying, making sense of, and making connections. Deeper learning involves, in addition to mastering core academic content, the ability to think critically and solve complex problems, to work collaboratively, to communicate effectively, and to learn how to learn. This session will combine didactic, experiential, and reflective activities to engage audience members, including K-14 teachers and informal science educators, and presenters in a professional learning community experience. The intent is to provide an opportunity for collaborative inquiry and the learning related to the promotion of deeper learning approaches in...
STEM (Science, Technology, Engineering and Mathematics) in the classroom and beyond. This workshop will consider ways to increase students’ scientific literacy through involvement in deeper learning activities, including project-based learning in the classroom, after school programs, and in experiential, community-based learning activities, including mentored internships and apprenticeships. Panelists will discuss current issues and future trends in science education, including STEM after school programs, pre-college science enrichment and “pipeline” programs, STEM scientist mentoring activities, informal STEM education, and the role of the arts and design in STEM education initiatives.

Morning session chair: Carl A. Maida

9:00 Welcome, ROGER G. CHRISTIANSON (Executive Director, Pacific Division of AAAS, and Department of Biology, Southern Oregon University).

9:05 Introductory remarks, RICHARD A. CARDULLO (President, Pacific Division of AAAS, and Department of Biology, University of California, Riverside).

9:15 KEYNOTE ADDRESS: Realizing the Potential of Learning in Middle Adolescence, PAUL HECKMAN (University of California, Davis).

Comments, RICHARD ROBERTS (Los Angeles Unified School District, retired).

10:00 PANEL: Promoting Deeper Learning in Middle Adolescence.
Moderator: PAUL HECKMAN (University of California, Davis)
Panelists: STACEY CAILLIER (High Tech High School of Graduate Education, San Diego) KENNETH MAZEY (University of California, Los Angeles) RICHARD ROBERTS (Los Angeles Unified School District, ret.) JOHNNIE SA VOY (College Bound, Los Angeles) KIMBERLY TANNER (San Francisco State University)

10:45 WORKSHOP: Deeper Learning and STEM Activities (breakout sessions with panelists and audience)

11:45 Morning session wrap-up, PAUL HECKMAN

12:00 LUNCH

Afternoon session chair: Paul Heckman

1:30 KEYNOTE ADDRESS: Advancing Deeper Learning and Diversity in STEM Education, SHIRLEY MALCOM (AAAS, Washington, D.C.).

Comments, RICHARD CARDULLO (University of California, Riverside).

2:15 SYNTHESIS PANEL: Reflections on Deeper Learning Beyond the Classroom.
Moderator: CARL A. MAIDA (University of California, Los Angeles) Panels: MAITE ALVAREZ (J. Paul Getty Museum, Los Angeles) TERRY GOSLINER (California Academy of Sciences) MARVIN MARCUS (University of California, Los Angeles) EDWIN MEYER (University of California, Los Angeles) ICHIRO NISHIMURA (University of California, Los Angeles)

3:15 Afternoon session wrap-up, CARL A. MAIDA

Future Trends on the Past History of Life
HUB 268
Thursday
9:05 a.m. – 11:30 a.m.

Program organizer: Bahram Mobasher (Department of Physics and Astronomy, University of California, Riverside).

Program sponsored by the Pacific Division sections on Earth Sciences; Evolution, Organismal Biology, and Biodiversity; and Physics and Materials Science.

Session chair: Bahram Mobasher

9:05 Introductory comments, BAHRAM MOBASHER

9:10 106 Molecular Biomarker Evidence for the Earliest Animal Life from Unusual Fossil Steroids Produced by Sponges, GORDON D. LOVE (Department of Earth Sciences, University of California, Riverside).


10:10 BREAK

10:30 108 Transitioning Towards the Modern Animal Biota: Small Shelly Fossils from the Cambrian of the Himalaya, IAN R. GILBERT* and NIGEL C. HUGHES (Earth Sciences Department, University of California, Riverside).

11:00 109 Searches for Extrasolar Planets with the Next Generation of Ground-based Telescopes, BAHRAM MOBASHER (Department of Physics and Astronomy, University of California, Riverside).
**Computer Aided Drug Discovery and Development**  
MS&E 0003  
Thursday  
1:00 p.m. – 5:00 p.m.

Program organizers: Chia-en A. Chang (Department of Chemistry, University of California, Riverside) and Dong Xu (Department of Biomedical and Pharmaceutical Sciences, College of Pharmacy, Idaho State University, Meridian).

Program sponsors: Pacific Division sections of Cell and Molecular Biology, and Chemistry and Biochemistry.

This research symposium focuses on the advancements of state-of-the-art computational chemical and biological methods and their applications in addressing the most important and urgent biomedical questions. The objective of the symposium is to inform and engage elite computational scientists from around the globe in a discussion about the latest computational method development, the current applications in biomedical research, and the future outlook of the advanced simulation technologies.

Session chair: Chia-en A. Chang

1:00  110 Structure Based Drug Discovery Targeting the Complement System, **DIMITRIOS MORIKIS** (Department of Bioengineering, University of California, Riverside).

1:30  111 Bridging Calorimetry and Simulation through Precise Calculation of Binding Enthalpies in Host-Guest and Protein-Ligand Systems, **ANDREW FENLEY** and **MICHAEL GILSON** (Skaggs School of Pharmacy and Pharmaceutical Sciences, University of California, San Diego).

2:00  112 Activation Mechanisms of the M2 Muscarinic Receptor and Design of Allosteric Modulators, **YINGLONG MIAO** and **ANDY McCAMMON** (Howard Hughes Medical Institute, University of California, San Diego).

2:30  113 Using Model Systems to Improve Binding Free Energy Calculations for Drug Discovery, **DAVID MOBLEY** (Department of Pharmaceutical Sciences and Department of Chemistry, University of California, Irvine).

3:00  **BREAK**

3:30  114 Deciphering and Engineering Chromodomain-Methyllysine Peptide Recognition, **WEI HE**, **NAN LI**, **RICHARD STEIN**, **ELIZABETH KOMIVES** and **WEI WANG** (Department of Chemistry and Biochemistry, University of California, San Diego).

4:00  115 CADD and Translational Science: Interfacing Industry Practices with Academia, **VICTORIA A. FEHER** and **ROMMIE AMARO** (Department of Chemistry and Biochemistry, University of California, San Diego).

4:30  116 Drug Repurposing and Adverse Event Mitigation via an Integrated Molecular Modeling and Systems Pharmacology Approach, **DONG XU** (Department of Biomedical and Pharmaceutical Sciences, College of Pharmacy, Idaho State University).

**Molecular Reproduction and Development**  
HUB 355  
Thursday  
1:00 – 5:00 p.m.  
program continues on Friday  
8:10 a.m. – 5:00 p.m.

Program organizers: Gary M. Wessel (Editor-in-Chief, Molecular Reproduction and Development, and Department of Molecular Biology, Cell Biology, and Biochemistry, Brown University), Julian Wong (Managing editor, Molecular Reproduction and Development and Department of Molecular and Cellular Neuroscience, The Scripps Research Institute, La Jolla, CA), Mark Paalman (Senior Editor, Life Science Journals, Wiley), and Richard A. Cardullo (College of Natural and Agricultural Sciences, University of California, Riverside).

Program sponsors: the journal Molecular Reproduction and Development, and the Pacific Division sections of Cell and Molecular Biology; Chemistry and Biochemistry; and Evolution, Organismal Biology, and Biodiversity.

Reproduction is arguably the singular life goal of most organisms. Its study depends upon and impacts a broad cross-section of the sciences, is heavily influenced by evolutionary selection, and the application of research successes in the field are limited only by ethical considerations. It is therefore a lively centerpiece of intersecting interests.

This program will explore the biological mechanisms of reproduction in plants and animals. The topics will range from sperm and egg functions and fertilization, development of reproductive organs, environmental impact on reproductive success and selection, the clinical impacts of research progress in reproduction, and the stem cell technologies that influence our understanding of germ cell formation. The approaches used in this field are broad – cellular, molecular, biochemical,
computational, synthetic, and includes cells studied in vitro as well as whole organismal examination. The series of talks will be diverse and the discussions synthetic in nature. Members of the broader scientific community are urged to participate in this session to learn for the first time the rapidly moving field of reproduction and by contributing to the advancements made in the research and in their interpretations.

Session chair: Ekaterina Voronina (University of Montana).

1:00   Introductory comments, GARY WESSEL

1:10   117 How Sperm Learn to be Fertile, KEITH SUTTON, MELISSA JUNGNICKEL, and HARVEY FLORMAN* (Department of Cell and Developmental Biology, University of Massachusetts Medical Center).

1:40   118 Time to Make New Skin: Periodic Stem Cell Activation and Matrix Renovation in C. elegans, ALISON FRAND (Department of Biological Chemistry, School of Medicine, University of California, Los Angeles).

2:10   119 Adaptive Co-evolution of Interacting Sperm-Egg Reproductive Proteins, WILLIE J. SWANSON (Department of Genome Sciences, University of Washington, Seattle, WA).

2:40   120 Activation and Regulation of Insect Sperm Motility, CATHERINE D. THALER*, HARUHIKO MIYATA1,2, LEAH T. HAIMO1, and RICHARD A. CARDULLO1 (1Department of Biology, University of California, Riverside; 2Animal Resource Center for Infectious Diseases, Immunology Frontier Research Center, Osaka University, Osaka, Japan).

3:10   BREAK

3:30   121 Elucidating the Molecular Mechanisms behind Female Choice, KELLY KWAN, YIDING JIA, PETER CHANG, BRENT YOUNG and MATTHEW D. DEAN* (Molecular and Computational Biology, University of Southern California).

4:00   122 Human Stem Cells from Single Blastomeres Reveal Pathways of Embryonic or Trophoblast Fate Specification, TAMARA ZDRAVKOVIC1, OLGA GENBACEV1, LOUISE LAURENT2, JEANNE LORING2, and SUSAN FISHER* (1Department of Obstetrics, Gynecology, and Reproductive Sciences, University of California San Francisco; 2Department of Chemical Physiology, The Scripps Research Institute, La Jolla, CA).

4:30   123 Master Regulators of Early Lineage Formation in Mammalian Embryos, JASON KNOTT (Department of Animal Science, Michigan State University, East Lansing, MI).

Program continues on Friday. Please refer to page 60 of these Proceedings.

Please refer to oral presentations on page 71 of these Proceedings and posters on page 76 of these Proceedings, which were submitted as part of this program.

World War II Anthropology: Austrians and Germans in Poland; Japanese in Asia; Anthropological Research and the Search for Survivors

HUB 367
Thursday
1:20 p.m. – 5:00 p.m.

Program organizer: Alan L. Bain (Emeritus Certified Archivist; Research Collaborator, National Anthropological Archives; Retired Archivist, Smithsonian Institution Archives).

Program sponsor: Pacific Division sections on Anthropology and Archaeology, and General and Interdisciplinary Studies.

The Institut für Deutsche Osterbeit (IDO) was one of many ventures during the 19th and 20th centuries in which Germany attempted to examine the potential of using resources from the lands to its east to fulfill its own ambitions. The occupation of Poland from 1939 to the end of World War II, unlike previous attempts, allowed the German Nazi regime to organize the plunder of Poland from within the country. The IDO was headquartered in Krakow beginning in 1940 and quickly developed its organizational plan based on the ideology of race. Non-human resources were confiscated and exploited by the availability of an unending supply of slave labor. The IDO developed systems of hierarchical classification that led to clear-cut decision-making regarding the placement of individuals into slots. All Polish citizens were sentenced anywhere from immediate death to mindless labor for the Third Reich as determined by Nazi functionaries.

The IDO Section on Race and Ethnicity Research was supposed to form a scientific base for racial segregation of the Polish population under the General Government (GG), District of Occupied Poland. Anthropological, medical, and psychological tests were conducted. Systematic ethnographic field studies were organized. Library orders and bibliographic sources were created for subjects the Section was
most interested in, including materials about settlement patterns, art and scientific treasures, and laws and legal issues that had developed over the past several centuries. Genealogical records were created for specific groups. Several ethnic groups underwent precise anthropological and biological investigations. Among them were the Highlanders from the Podhale region and the population in the Lemko region (south-eastern Poland), discussed in this session. The Jewish community of the Tarnow ghetto was one of the first to be examined by the Section staff shortly before it was completely exterminated.

The Highlanders occupied a special place in Nazi plans and visions concerning a conquered population in the GG. Attention was drawn to their cultural attractiveness, trying to attribute it to German cultural influences, which in turn, attested to the strength and power of the cultural potential of German colonization of Poland. Unlike several of the other regions where the Section subjected adults to tests, children and youth were also tested. Fingerprints were taken, palm prints, head measurements and hair samples. Sets of photographs and slides supplementing the racial questionnaires were taken of individuals, as well as everyday life, churches and village architecture. From the anthropometrical data several townspeople were classified as cross-breed, noting that some were considered part Celtic. Within the larger body of records there were also photographs of Polish works of art in museums.

In the Lemko region, some of the documents left behind by the anthropologists were similar to those completed during the tests used on the population in the Podhale area. The subjects covered were aged 20 to 60. The anthropologists were searching for traces of Germanness as well as conducting a census of races that existed in the area of the GC. Unlike the Podhale area, only the anthropological and sociological survey data were available for research at a later time at Jagiellonian University. Ethnologists at the University found that the survivors agreed that the survey work was carried out in 1942, but felt that the participants were never informed what the real objective was. Within this discussion, the ethnologist will comment on how the remembering process works.

The records of the IDO Section on Race and Ethnicity Research were transferred from Krakow by Austrian and German anthropologists to Bavaria, where they continued to work on them. The records were captured by the Allied forces, and the wooden crates containing the records had British Military Intelligence stamped on them. In 1947, the Medical Intelligence Section of the United States War Department offered the Section records to the Smithsonian Institution on a long-term loan.

Sixty-years later the records were digitized and microfilmed and in 2008 were returned to Jagiellonian University in Krakow. Dr. Gretchen Schafft, who used the Section records at the Smithsonian to write a portion of her publica-

anthropologists at the University had gone through the documents, with one group focusing their research on the Podhale region, while a second research team went into the Lemko region. Through the use of the photographs staff found and met some of the survivors of the Section’s research. Interviews were conducted with more than twenty-five of them, and film was produced documenting the events. In addition, after the digitization of the records, the anthropometric data gathered by the German and Austrian anthropologists have been used to document variations in the Polish population.

Meanwhile, in Asia, Japanese anthropologists followed Japan’s empire and carried out ethnological studies in the annexed colonies. By 1942, Japan controlled a vast Asian-Pacific area from Indonesia to the Aleutian Islands. In 1926, Keijo Imperial University in Korea was established and an anatomy department was created by physical anthropologist Imamura Yutaka. Imamura attempted to collect the world’s best bone collection. He collected over 600 full-size skeletons from the Pacific Islands, Korea, Manchuria, and China. The United States prevented the skeletons from being transferred to Japan at the end of the war, but when the University was turned over to the Koreans, the skeletons could not be found. Chun Kyung-Soo has carried out research and fieldwork in Korea, Japan, China, Manchuria and Papua, New Guinea. Chun has tried to find survivors and interviewed some of them regarding their experiences under Japanese military rule. He will also discuss the set of skeletons collected at the University.

During this time, an ethnology (cultural anthropology) course was being taught at Taihoku Imperial University (located in modern-day Taipei). The course was taught by Dr. Utsurikawa, Nenozo, who was one of the first Japanese who took the PhD in cultural anthropology at Harvard University. The ethnology course, founded in 1928, was a landmark in the development of Japanese cultural anthropology because professional education was begun by professional anthropologists in a “Japanese” territory for the first time. Utsurikawa returned to Japan in December 1945. However, he was unable to establish his influence over the Japanese academic world. Why this occurred will be one of the topics that will be discussed at this session.

Session chair: Alan L. Bain

1:20 Introductory comments, ALAN L. BAIN

1:30 124 Continuity and Discontinuity seen in the Japanese Anthropological Tradition: A Case of Dr. Utsurikawa, Nenozo, YUKO MIO (Professor of Anthropology, Institute for Languages and Cultures of Asia and Africa, Tokyo University of Foreign Studies, Tokyo, Japan).

2:00 125 Anthropological Researches done by Japanese Scholars during WWII: A Case of Keijo Imperial
We will present six study systems in which the link between adaptation and the action of specific genes is being established. These presentations will include three experimental studies of evolution - one on laboratory populations of fruit flies, one on laboratory populations of mice and one on natural populations of guppies - in which we are identifying and characterizing candidate genes or scanning whole genomes for signatures of the role of genes in shaping complex adaptations. One presentation will focus on the remarkably diverse array of silks and the genetics of silk synthesis in spiders, revealing the evolutionary dynamics that have shaped these high-performance proteins. One presentation will consider the genetic basis of floral evolution and speciation in a genus of flowering plants. Finally, one presentation will characterize de-evolution, or what happens in the long term when a gene is no longer used. The resulting degradation represents the mirror image of the negative Darwinian selection that persists unseen in any study of positive Darwinian selection associated with adaptation. Collectively, these studies illustrate some of the diversity of technology that now makes it possible to associate genes with adaptations, but also illustrates the contribution of such endeavors to basic and applied science.

Session chair: David Reznick

1:20 Introductory comments, DAVID REZNICK

1:30 126 Born to Run: Genotype-Phenotype Mapping and the Evolution of Locomotor Activity, THEODORE GARLAND, JR. (Department of Biology, University of California, Riverside).

2:00 131 How Fast Is Mendelian Adaptation? MICHAEL R. ROSE1, LARRY G. CABRAL1, THOMAS T. BARTER1, GRANT A. RUTLEDGE1, JAMES N. KEZOS1, MARK A. PHILLIPS2, LAURENCE D. MUELLER1, LEE F. GREER1, and JOSEPH L. GRAVES, JR2 (1Department of Ecology and Evolutionary Biology, University of California, Irvine; 2Joint School of Nanoscience and Nanoengineering, Greensboro, NC).

2:30 132 Molecular Evolution of Spider Silk: Genetics of Functional Repetitive DNA, CHERYL Y. HAYASHI (Department of Biology, University of California, Riverside).

3:00 BREAK

3:30 133 Molecular Evolution of Tooth Genes in Toothless Vertebrates: Deciphering Evolutionary History from Pseudogenes, MARK SPRINGER (Department of Biology, University of California, Riverside).

4:00 134 Genomics of Convergently and Experimentally Evolving Populations of Guppies (Poecilia reticulata).
BONNIE A. FRASER*, AXEL KUNSTER¹, DAVID N. REZNICK², CHRISTINE DREYER³, and DETLEF WEIGEL⁴ (*Department of Molecular Biology, Max Planck Institute for Developmental Biology, Tübingen, Germany; ¹Department of Biology, University of California, Riverside).

4:30 135 The Genetics of Floral Adaptation: Flower Color, Shape and Organ Identity, SCOTT A. HODGES*, NATHAN J. DERIEG, and EVANGELINE S. BALLERINI (Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara).

Mechanisms of Tumor Progression and Cancer Therapy
MS&E 0113
Thursday
1:25 p.m. – 4:30 p.m.

Program organizer: Cheryl Jorcyk (Department of Biological Sciences, Boise State University).

Program sponsor: Pacific Division section of Cell and Molecular Biology.

Cancer is a large group of different diseases, all involving uncontrolled growth of cells in the body. During tumor progression, cells proliferate, form malignant tumors, invade to nearby parts of the body and metastasize, or spread, to more distant parts of the body through the lymphatic system or bloodstream. This program will provide scientific presentations addressing different mechanisms of tumor progression and metastasis, as well as mechanistic discussions on established and emerging cancer therapeutics. This symposium is designed for all types of biomedical researchers, undergraduate and graduate students, physicians and oncologists, nurses, pharmacists, and others who research or manage patients with cancer.

Session chair: Cheryl Jorcyk

1:25 Introductory comments, CHERYL JORCYK

1:30 136 Bone Metastatic Microenvironment: Oncostatin M Promotes Osteolytic Bone Degradation and Breast Cancer Metastasis, KEN TAWARA*, CELESTE BOLIN, CALEB SUTHERLAND, JEFF REDSHAW, PATRICK ARANDA, JIM MOSELY, ROBIN ANDERSON, and CHERYL L. JORCYK (Department of Biological Sciences, Boise State University).

2:00 137 Antitumor Activity of a Polypryidyl Chelating Ligand: In Vitro and In Vivo Inhibition of Glioblastoma, CLEMENT N. DAVID⁵, ELMA S. FRIAS⁶, CATHERINE C. ELIX⁷, AMEAE M. WALKER⁸, JACK F. EICHLER⁹, and EMMA H. WILSON¹⁰* (*Department of Biomedical Sciences, School of Medicine, University of California, Riverside; ¹Department of Chemistry, College of Natural and Agricultural Sciences, University of California, Riverside).

2:30 138 Antimaia Inhibits Breast Cancer Metastasis through Effects on Both Tumor and Immune Cells, KUAN-HUI E. CHEN, TOMOHIRO YONEZAWA, MRINAL K. GHOSH, and AMEAE M. WALKER* (Division of Biomedical Sciences, University of California, Riverside).

3:00 BREAK

3:30 139 Immune Responses and Racial Disparities in Colon Cancer, KATHLEEN L. McGUIRE¹, MOHAMMAD W. KHAN²*, and JOHN M. CARETHERS² (¹Department of Biology, Molecular Biology Institute, San Diego State University; ²Division of Gastroenterology, Department of Internal Medicine, University of Michigan, Ann Arbor).

4:00 140 Promoting Breast Cancer Metastasis: A Role for the Inflammatory Cytokine Oncostatin M, CHERYL L. JORCYK (Department of Biological Sciences, Biomolecular Sciences Program, Boise State University).

Small RNA-Mediated Gene Regulation
HUB 265
Thursday
1:25 p.m. – 5:00 p.m.

Program organizers: Hailing Jin and Katherine Borkovich (Department of Plant Pathology and Microbiology, University of California, Riverside, CA).

Program sponsors: Pacific Division sections of Agriculture, Food and Renewable Resources, and Cell and Molecular Biology.

Small non-coding RNAs have emerged as important gene expression regulators in eukaryotic organisms. They are involved in regulating almost multiple cellular processes, including development and growth, stress responses, immunity and genome integrity. Our symposium will invite experts in the small RNA field from both animal and plant systems.

(I100) (time italicized and underlined) identifies a student presentation
* identifies the speaker from among several authors listed
63 (bolded number) is the abstract number
abstracts contain complete contact information for authors
to present their recent findings on the function and regulation of small RNAs in various organisms. This symposium will include experimental studies on how small RNAs regulate gene expression, as well as computational modeling and practical applications.

Session chair: Hailing Jin

1:25  Introductory comments, HAILING JIN

1:30  141 Connecting RNA Directed-DNA Methylation and Histone Methylation in Arabidopsis thaliana, JULIE A. LAW1,5, JIAMU DU2*, CHRISTOPHER J. HALE1*, SUHUA FENG1, ANA MARIE S. PALANCA3, KRZYSZTOF KRAJEWSKI1, BRIAN D. STRAHL3, DINSHAW J. PATEL2, and STEVEN E. JACOBSEN1,4 (*Department of Molecular Cell and Developmental Biology, University of California, Los Angeles; 2Structural Biology Program, Memorial Sloan-Kettering Cancer Center; 3Department of Biochemistry and Biophysics, University of North Carolina at Chapel Hill; 4Howard Hughes Medical Institute, University of California, Los Angeles; 5Plant Molecular and Cellular Biology, Salk Institute).

2:00  142 Remodeling of Ago2-mRNA Interactions Upon Cellular Stress Reflects miRNA Complementarity and Correlates with Altered Translation Rates, FEDOR V. KARGINOV1* and GREGORY J. HANNON2 (*Department of Cell Biology and Neuroscience, University of California, Riverside; 2Watson School of Biological Sciences, Howard Hughes Medical Institute, Cold Spring Harbor Laboratory).

2:30  143 Fungal Small RNAs Suppress Plant Host Immunity by Hijacking Host RNAi Machinery, ARNE WEIBERG1, MING WANG1, FENG-MAO LIN2, HONGWEI ZHAO1, ZHIHONG ZHANG1, ISGOUHI KALOSHIAN1, HSEIN-DA HUANG2, and HAILING JIN1* (*University of California, Riverside; 2National Chiao Tung University, Taiwan; hailingj@ucr.edu).

3:00  BREAK

3:30  144 A Highly Conserved Protein PIR-1 Is Required for Silencing Orsay Virus in C. elegans, WEIFENG GU (Department of Cell Biology and Neuroscience, University of California, Riverside).

4:00  145 The Arabidopsis PHD-Finger Protein EDM2 Controls Plant Innate Immunity by Modulating Levels of the Epigenetic Transposon-Silencing Mark H3K9me2, THOMAS EUGLEM*, TOKUJI TSUCHIYA, and YAN LAI (Center for Plant Cell Biology, Institute for Integrative Genome Biology, Department of Botany and Plant Sciences, University of California, Riverside).
SYMPOSIA – Friday

Friday, 20 June 2014

Molecular Reproduction and Development
HUB 355
Friday
8:10 a.m. – 5:00 p.m.

This program continues from Thursday afternoon.
Please refer to page 54 of these Proceedings for details.

Morning session chair: Sara K. Olson

8:10 147 Developmental Regulation of Heparan Sulfate Proteoglycan Synthesis, LINE HOFMANN, DOUGLAS BORNEMANN and RAHUL WARRIOR* (Department of Developmental and Cell Biology, University of California, Irvine).

8:40 148 A Role for Dynein in Germline Stem Cell Maintenance in C. elegans, XIAOBO WANG1, EKATERINA VORONINA1*, DOMINIQUE RASOLON2, and MARIAH MALEY1 (1Division of Biological Sciences, University of Montana; 2Department of Molecular Biology and Genetics, Johns Hopkins University School of Medicine/HHMI).

9:10 149 Developmental Robustness in the C. elegans Embryo, MORRIS MADURO1*, HAILEY CHOI2, CASSANDRA BENNETT1, FRANCISCO CARRANZA1, FARHAD GHAMSARI1, GINA BROITMAN-MADURO1, and GURJOT WALIA1 (1Department of Biology and 2Graduate Program in Cell, Molecular and Developmental Biology, University of California, Riverside).

9:40 150 Deciphering the Role of EMP2 in Trophoblast Invasion and Placental Vascular Remodeling, MADHURI WADHERA1*, CARMEN J. WILLIAMS2, WENDY N. JEFFERSON2, DEEPTHI SUDHAKAR2, ELIZABETH PADILLA-BANKS1, and NEVIL KHURANA1 (1Department of Pathology and Laboratory Medicine, Geffen School of Medicine at UCLA; 2Reproductive Medicine Group, Laboratory of Reproductive and Developmental Toxicology, National Institute of Environmental Health Sciences, National Institutes of Health).

10:10 BREAK

10:30 151 Germline Development in the Colonial Ascidian, Botryllus schlosseri, ADAM LANGENBACHER, ALESSANDRO DE MAIO, DELANY RODRIGUEZ, SUSANNAH KASSMER, and ANTHONY W. DE TOMASO* (Department of MCD Biology and Marine Science Institute, University of California Santa Barbara).

11:00 152 Neonatal Estrogen Exposure Alters Global Epigenetic Marks in the Female Reproductive Tract, CARMEN J WILLIAMS*, WENDY N. JEFFERSON, ELIZABETH PADILLA-BANKS, H. KARIMI KINYAMU, TIANYUAN WANG, and WEICHUN HUANG (National Institute of Environmental Health Sciences).

11:30 153 Molecular Determinants of Oocyte Competence, GEORGE W. SMITH (Laboratory of Mammalian Reproductive Biology and Genomics, Departments of Animal Science and Physiology, Michigan State University).

12:00 LUNCH

Afternoon session chair: Catherine D. Thaler

1:30 154 The Terra Incognita of Male Fertility: Flagellar Ion Channels and Their Function, POLINA V. LISHKO*, MELISSA MILLER, STEVEN MANSELL, and SARA S. A. CHOO (Department of Molecular and Cell Biology, University of California, Berkeley).

2:00 155 Molecular Pathways Involved in Oocyte Developmental Competence, MARCO CONTI*, FEDERICA FRANCIOSI, HAKAN CAKMAK, and SHILA MANANDHAR (Center for Reproductive Sciences, University of California, San Francisco).

2:30 156 Cracking the Eggshell: Assembly of Protective Barriers Following Fertilization of the C. elegans Embryo, SARA K. OLSON (Department of Biology, Pomona College).

3:00 BREAK

3:30 157 How Attractive is the Fish Egg’s Micropyle? GARY N. CHER* and RYUZO YANAGIMACHI12 (1University of California Davis Bodega Marine Laboratory; 2Institute for Biogenesis Research, Department of Anatomy, Physiology, and Biochemistry, University of Hawaii Medical School).

4:00 158 Converging Calcium Waves Occur as Drosophila Oocytes Activate, TARO KANEUCHI1, CAROLINE V. SARTAIN2, SATOMI TAKEO2, VANESSA L. HORNERS2, TOSHIRO AIKAKI1, and MARIANA F. WOLFNER* (1Department of Biological Sciences, Tokyo Metropolitan University, Tokyo, Japan; 2Department of Biological Sciences, National Institute of Environmental Health Sciences).
4:30  159 Sugar Coated Genomes – Sperm Sialome and Sexual Selection, PASCAL GAGNEUX (Department of Cellular and Molecular Medicine, and Glycobiology Research and Training Center, University of California, San Diego).

California’s World’s Fairs: Panama Pacific International Exposition, San Francisco, 1915; Panama-California Exposition, San Diego, 1915–1916
HUB 367
Friday
8:30 a.m. – NOON

Program organizer: Alan L. Bain (Emeritus Certified Archivist; Research Collaborator, National Anthropological Archives; Retired Archivist, Smithsonian Institution Archives).

Program sponsors: Pacific Division sections on Anthropology and Archaeology, and General and Interdisciplinary Studies.

The Panama Pacific International Exposition (PPIE) held in San Francisco, 1915, was first conceptualized in 1904 by San Francisco businessmen. Later, San Francisco leaders and businessmen wanted to use the fair as a vehicle to show the city’s recovery from the 1906 earthquake and fire and rid its reputation as an uncouth frontier town. With the completion of the Panama Canal in 1913, the fair was designed to commemorate that amazing engineering feat. In 1909, business leaders of the small city of San Diego announced their intentions to celebrate the opening of the Canal with their own fair (Panama-California Exposition, 1915-1916). With the completion of the Canal, San Diego would be the first American port north of the waterway on the Pacific Coast. The exposition would help bolster an economy shaken by the Wall Street panic of 1907. San Francisco’s leaders became very upset. Thus began a competition of cities (which later included New Orleans) between businessmen, community leaders, and politicians for federal recognition and support. San Francisco received the prize. Later, San Diego was also given recognition and received federal support. It became the smallest of any city, with a population a little over 39,000, to attempt to hold an international exposition. Open for only nine months, San Francisco attracted over 19 million visitors, while San Diego, open for one year, received over 3.5 million to its regional displays.

Behind the expositions, which were cities within cities, the beautiful buildings, exhibitions on science, art, and literature, and the midways (amusement and concession stands), called the “Joy Zone” in San Francisco, and the Isthmus in San Diego, lay the concept of natural selection, survival of the fittest, and the Darwinian struggle between the races. Eugenics was revealed, using science to improve the human stock, with discussions at PPIE congresses held on the prevention of the ill-fit and improper intermarriages. The Federal government supported these concepts. At PPIE, the United States Department of Labor had exhibitions on immigration statistics between 1820 and 1914 that described the races that arrived, their occupations, arrests, deportations and conclusions that the composition of the white ethnic population was changing for the worse. At the Panama-California Exposition, the president for the fair utilized the services of the anthropologists from the Smithsonian Institution to develop exhibitions showing the physical evolution of man, evolution of culture, and the Native races of America. Led by Ales Hrdlicka, anthropologists carried out research. Expeditions were undertaken to gather and photograph skeletal remains in Europe, Africa, the United States, Siberia, Mongolia, and Peru; studies were made of the Eskimo and Sioux Indians; and graves were desecrated in the Philippines for cranial and skeletal material. The collections were displayed so that the classification of mankind along racial lines was easily understood and demonstrated man’s progress towards future perfection. The displays linked race to biology, even though anthropologist Franz Boas had earlier shown this linkage to be false, making racial attitudes untenable. Combined, the exhibitions helped to provide public support for the restrictive immigration laws of the 1920s, beginning with fixed racial quotas for European immigration and culminating in the exclusion of Asians altogether, in 1927.

The panelists at this session on the California expositions will discuss varied themes, demonstrating how the exhibitions represented reality to advance the aims of exposition organizers, and in some instances, how ethnic groups were able to participate at the fair under their own agency and agenda. Included are presentations regarding the ethnic communities around San Francisco, how Chinese American and Chinese American women participated at the fair, the exhibition of the Chinese Pagoda, how Native Americans were presented and the reality of their condition, mining exhibitions and the reality of mining conditions, and the creation of the Museum of Man.

Session chair: Alan L. Bain

8:30  Introductory comments, ALAN L. BAIN

8:40  160 Claiming Citizenship and Heritage: Bay Area Ethnic Communities at the Panama-Pacific International Exposition, ABIGAIL MARKWYN (Carroll University, Waukesha, WI).

9:40  162 Chinese Pagoda, WILLIAM H. MA (History of Art Department, University of California, Berkeley).

10:10  BREAK

10:30  163 Chinese Women and the Panama Pacific International Exposition, CHUIMEI HO (Chinese in Northwest America Research Committee, Bainbridge Island, WA).

11:00  164 Ethnographic Showcases at the California Fairs of 1915, MATTHEW BOKOVOY (Senior Acquisitions Editor, Native American and Indigenous Studies and Southwestern Borderlands, University of Nebraska Press).

11:30  165 Hrdlicka and the Museum of Man, TORI D. RANDALL (Department of Physical Anthropology, San Diego Museum of Man).

Challenges for Implementing Vision and Change in Science Classrooms
HUB 269
Friday
8:35 a.m. – NOON

Program organizers: Richard Cardullo (Department of Biology, University of California) and William B. Davis (Associate Dean for Undergraduate Education, School of Molecular Biosciences, College of Veterinary Medicine, Washington State University, Pullman, WA).

Program sponsor: Pacific Division section on Science and Technology Education.

Transformation in the life sciences on a large scale will only occur when institutions support change at the departmental level that is then shared with, and adopted by, other institutions. Over the past two decades, various initiatives have promoted changes in pedagogical strategies that focus on process over content while acknowledging the inherent power that diversity brings to science classrooms. A number of national efforts, including the AAAS-sponsored Vision and Change recommendations and the recent establishment of the National Academies Scientific Teaching Alliance (NASTA), seek to inform the scientific and science education communities about effective, evidence-based teaching practices that improve student learning. Significant challenges exist for transforming faculty members, departments, and institutions that reflect the growing need for delivering a relevant curriculum that serves all students in the sciences. This symposium will focus on these challenges and will present evidence of practices that improve student engagement and success using state-of-the-art assessments, technology, and strategies for empowering departments to fundamentally improve the quality of science education.

Session chairs: William B. Davis and Richard A. Cardullo

8:35  Introductory comments

8:40  166 Colored Cards to Coursera: The Role of In-house Education Research in Supporting Instructional Innovation, DIANE K. O’DOWD* and ADRIENNE E. WILLIAMS (Department of Developmental and Cell Biology, University of California, Irvine).


9:40  168 Providing First-year Undergraduate Scientific Research Experiences in the Teaching Laboratory, JAMES M. BURNETTE III (Neil A. Campbell Science Learning Laboratory and Dynamic Genome Program, University of California, Riverside).

10:30  169 Strategies for Implementation of Vision and Change at Community Colleges, PAMELA PAPE-LINDSTROM (Everett Community College, Everett, WA).

11:00  170 The Change in Demographics and STEM: How PULSE Strategies Can Increase URM participation in STEM Careers, EDWIN J. BAREA-RODRIGUEZ* and DANIELLE GORDON (Department of Biology, University of Texas at San Antonio).

11:30  171 A Partnership for Undergraduate Life Science Education (PULSE): An Initiative to Promote Vision and Change, GARY REINESS (Department of Biology, Lewis and Clark College).
Libraries and Learning  
HUB 265  
Friday  
8:35 a.m. – 4:00 p.m.

Program organizers: Crystal Goldman (Dr. Martin Luther King, Jr. Library, San Jose State University), Frank Jacobitz (Mechanical Engineering Department, University of San Diego), Amy Besnoy (Copley Library, University of San Diego), and Michele Potter (Orbach Science Library, University of California, Riverside).

Program sponsor: Pacific Division section on General and Interdisciplinary Studies.

Libraries and librarians play a key role in student learning. This can happen in one-shot instruction sessions, embedded librarianship, credit-bearing courses, co-teaching, at the reference desk, and in extended reference consultations. During such interactions, librarians teach students about access to information, gauging and evaluating information sources, and information literacy, all of which depend upon and develop critical thinking skills. The development of critical thinking skills in students, which remains relevant far beyond the walls of academia, relies on locating information and determining its appropriateness and validity within the specific application.

In the university classroom—be it online or on the ground—librarians work with teaching faculty to embed research and critical thinking skills into classroom pedagogy, with consideration going toward suitable projects, methods, timing, and frequency and length of interactions. This symposium will feature an all-inclusive consideration of libraries in the learning environment, from instruction to reference, synchronous to asynchronous services, and in the digital and in-person environments.

Session chairs: Crystal Goldman, Frank G. Jacobitz, Amy Besnoy, and Michele Potter.

8:35 Introductory comments

8:40 172 Technology Impact on New Adult Behavior about Health Information, LESLEY S. J. FARMER (Department of Advanced Studies in Education and Counseling, California State University, Long Beach).


9:40 174 It Takes a Village: A Collaborative Model for Cultivating and Diversifying Librarianship, PATRICIA SMITH-HUNT*, JESSICA DAVILA GREENE*, and TIFA N K. CHOW* (1Preservation Department, Orbach Science Library, University of California, Riverside; 2Special Collections and University Archives, University of California, Riverside; 3Alliant International University, Alhambra, CA).

10:10 BREAK

10:30 175 How Hard Can I Snuggle My King Penguin Without Waking Him? And Other Fun, Engaging, and Hands-on Ways of Bringing Information Literacy Skills Into a First Year Science Class, AMY BESNOY (Copley Library, University of San Diego).

11:00 176 Field of Dreams: Employing Special Collections in the Classroom, MATTHEW COOK (John Spoor Broome Library, California State University Channel Islands).

11:30 177 Information Literacy at the Freshman Level: Observations and Experiences from Three First-Semester Engineering Courses, FRANK JACOBITZ* and AMY BESNOY* (1Mechanical Engineering Department, Shiley-Marcos School of Engineering, University of San Diego; 2Copley Library, University of San Diego).

12:00 LUNCH

1:30 178 Critical Thinking and Information Literacy in Teaching Research: Embedded Librarian Model, CAROLE HUSTON*, HUGH BURKHART*, and PAULA KRIST* (1College of Arts and Sciences, Dean’s Office, University of San Diego; 2Copley Library, University of San Diego; 3Office of Institutional Research and Planning, University of San Diego).

2:00 179 Using Open Educational Resources to Develop Adaptable Online Library Instruction Modules for a Learning Management System, CHRISTINA MUNE, CRYSTAL GOLDMAN*, SILKE HIGGINS, LAUREL EBY, EMILY K. CHAN, and LINDA CROTTH (King Library, San Jose State University).

2:30 180 Analyzing Results from an Online Learning Assessment to Improve Information Literacy Teaching and Learning, TRISH STUMPF GARCIA* and MICHELE POTTER (Science Library, University of California, Riverside).

3:00 BREAK

11:00 (time italicized and underlined) identifies a student presentation  
* identifies the speaker from among several authors listed  
63 (bolded number) is the abstract number  
abstracts contain complete contact information for authors
3:30  181 Panel Discussion: Faculty and Librarian Perspectives on Embedded Librarianship, Assessment, Information Literacy, and the New ACRL Framework, AMY BESNOY*, CRYSTAL GOLDMAN*, CAROLE HUSTON3*, FRANK G. JACOBITZ4*, MICHELE POTTER* (*Copley Library, University of San Diego; 3Dr. Martin Luther King, Jr. Library, San Jose State University; 4College of Arts and Sciences, University of San Diego; 5Mechanical Engineering Department, Shiley-Marcos School of Engineering, University of San Diego; 5Orbach Science Library, University of California, Riverside).

Please refer to poster 258 on page 76 of these Proceedings, which was submitted as part of this symposium.

Biotic Invasions: Impacts on Natural and Urban Communities and Ecosystems
HUB 379
Friday
8:35 a.m. – NOON

Program organizers: Erin Wilson Rankin and Richard Redak (Department of Entomology, University of California, Riverside).

Program sponsor: Pacific Division section on Ecology, Environmental Sciences, and Sustainability.

Biological invasions, one of the main drivers of global environmental change, disrupt species interactions and can contribute to the collapse of trophic systems. Consequently, there is growing interest in how invaders alter community and ecosystem processes. We will present six different contexts in which non-native taxa change their invaded communities that include agricultural, urban and natural systems. This symposium will include experimental studies examining how invaders of large effect can alter local trophic interactions and how invasions may lead to the decoupling of ecosystem services. Two presentations will focus on invasion at several levels of disease transmission and describe efforts to minimize the threats posed by invasive pathogens and disease vectors. Using a combination of ecological and ever-evolving molecular genetic techniques, these studies delve into the mechanisms underlying the ecological impacts of invasion and provide insight into the best strategies to maintain ecosystem health and function.

Session chair: Erin Wilson Rankin

8:35  Introductory comments, ERIN WILSON RANKIN

8:40  182 Impacts of Plant Invasions: Pervasive Examples, Elusive Generality, JEFFREY M. DIEZ (Department of Botany and Plant Sciences, University of California, Riverside).

9:10  183 Human-mediated Movement of the Bacterium Xylella fastidiosa has Resulted in a Range of Plant Diseases that Affects the Urban, Agricultural, and Native Environment, LEONARD NUNNEY (Department of Biology, University of California, Riverside).

9:40  184 Invasive Beetles as Vectors of Invasive Diseases: Threats to Urban and Native Forests, T. D. PAINE (Department of Entomology, University of California, Riverside).

10:10 BREAK

10:30  185 Usurpation of Plant - Pollinator Mutualisms by Introduced Ants, DAVID A. HOLWAY (Division of Biological Sciences, University of California, San Diego).

11:00  186 Multi-trophic Effects of an Invasive Generalist on Endemic Arthropod Communities, ERIN W. RANKIN*, DAVID J. FLASPOHLER2, TADASHI FUKAMI3, CHRISTIAN GIARDINA4, JESSIE L. KNOWLTON2, and DANIEL S. GRUNER5 (1Department of Entomology, University of California, Riverside; 2School of Forest Resources and Environmental Science, Michigan Technological University; 3Department of Biology, Stanford University; 4US Forest Service, Hilo, HI; 5Department of Entomology, University of Maryland).

11:30  187 Sahara Mustard, Brassica tournefortii: Trophic Impacts on a Desert Sand Dune Community, CAMERON W. BARROWS (Center for Conservation Biology, University of California, Riverside).

Boise Extravaganza in Set Theory (BEST)
HUB 260
Friday
9:30 a.m. – 1:15 p.m.

Continuing from Thursday. Please refer to page 43 of these Proceedings for information about this program.

Session chair: Liljana Babinkostova

9:30  188 Descriptive Graph Combinatorics and Countable Borel Equivalence Relations, ANDREW MARKS
11:00 (time italicized and underlined) identifies a student presentation
* identifies the speaker from among several authors listed
63 (bolded number) is the abstract number
abstracts contain complete contact information for authors
uses of 3D printing as an aspect of “learning by making” in high school, community college, and informal education settings. The second part will cover the use of 3D printing in scientific visualization, equipment fabrication and laboratory biological tissue printing.

Session chair: Joan Horvath

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:30</td>
<td>Introduction to Part I: Learning with 3D Printing, JOAN HORVATH</td>
</tr>
<tr>
<td>1:35</td>
<td>196 The Design Technology Pathway at Pasadena City College, SALOMÓN DÁVILA (Career and Technical Education, Pasadena City College).</td>
</tr>
<tr>
<td>1:55</td>
<td>197 3D Printing as a Curricular Tool in Design and Engineering for the Secondary Curriculum, SIMON P. HUSS*, REGINA RUBIO, and JOAN HORVATH2 (1Science Department, Windward School, Los Angeles; 2Deezmaker 3D Printers, Pasadena).</td>
</tr>
<tr>
<td>2:15</td>
<td>198 Open-Source 3D Printing Projects as Multidisciplinary Learning Tools, KRISTIAN WITTMAN (Mechanical Engineering Department, Shiley-Marcos School of Engineering, University of San Diego).</td>
</tr>
<tr>
<td>2:35</td>
<td>199 3D Printing Nautical History at the MIT Museum, JOAN HORVATH1*, DIEGO PORQUERAS1, KURT HASSELBALCH3 (1Deezmaker 3D Printers, Pasadena; 2MIT Museum, Cambridge, MA).</td>
</tr>
<tr>
<td>2:55</td>
<td>Panel/Audience Discussion I with Part I Presenters</td>
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<tr>
<td>3:15</td>
<td>BREAK</td>
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<tr>
<td>3:45</td>
<td>Introduction to Part II: Science with 3D Printing, JOAN HORVATH</td>
</tr>
<tr>
<td>4:30</td>
<td>202 Development and Initial Porcine and Cadaver Experience with Three-Dimensional Printing of Endoscopic and Laparoscopic Equipment, MICHAEL DEL JUNCO1, RENAI YOON1, ZHAMSHID OKHUNOV1, RAMTIN KHANIPOUR3, SAMUEL JUNCAL1, GAREN ABEDI1, ACHIM LUSCH1, JAIME LANDMAN1, and BENJAMIN DOLAN2* (1Department of Urology, University of California, Irvine; 2RapidTech, Irvine, CA).</td>
</tr>
<tr>
<td>4:50</td>
<td>Panel/Audience Discussion II, with Part II Presenters</td>
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<tr>
<td>5:10</td>
<td>Wrap up</td>
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</tbody>
</table>

* identifies the speaker from among several authors listed

1Bolded number is the abstract number

Abstracts contain complete contact information for authors.
## II. WORKSHOPS and PANEL DISCUSSIONS

### Wednesday, 18 June 2014

**WORKSHOP**

**PULSE-ating with Vision and Change: Promoting the Role of Faculty as STEM Education Change Agents**

**HUB 269**

**Wednesday**

1:30 p.m – 4:30 p.m.

Organized by David J. Marcey (Biology Department, California Lutheran University; marcey@callutheran.edu) and Rick Gonzalez, Biology Department, University of San Diego; gonzalez@sandiego.edu.

This workshop is intended to advance faculty expertise in promoting department-level STEM education reform at their home institutions. Although the workshop staff are PULSE Vision and Change Leadership Fellows (PULSE = Partnership for Undergraduate Life Sciences Education), the topics covered will be relevant to all STEM fields. Workshop attendees will be active participants in developing skills and approaches that can be used to effect significant department-level educational change. Participants will employ self-assessment rubrics in order to determine their home department’s progress relative to the educational recommendations found in the AAAS/NSF Vision and Change (V&C) document. Attendee-led discussions of barriers to significant STEM education reform will be followed by activities designed to develop student-centered pedagogical “mindsets.” Participants will receive resources for Vision and Change implementation and each will develop a specific action plan to enhance their roles as change agents in their departments.

### Friday, 20 June 2014

**WORKSHOP**

**DockoMatic Experiments for the Science Curriculum**

**SURGE 171**

**Friday**

9:00 a.m. – Noon

Organizers: C. Mark Maupin (Department of Chemical and Biological Engineering, Colorado School of Mines; cmmaupin@mines.edu) and Owen McDougal (Department of Chemistry and Biochemistry, Boise State University; owenmcdougal@boisestate.edu).

This workshop will focus on the use of the computer program, DockoMatic. This program, created at Boise State University, is a wrapper that links several different codes, including AutoDock4 and Modeller, into a single user-friendly graphical user interface (GUI). During this workshop the participants will be guided through the use of DockoMatic to create a homology model of a macromolecule. After the successful creation of the 3D structure for the macromolecule, DockoMatic will then be used to automate docking calculations between the macromolecule and a ligand. The workshop will finish with an analysis of the calculations and a question and answer phase to help participants formulate ways in which to use DockoMatic for their own research or teaching needs.

**WORKSHOP**

**Open Source 3D Printing – How Does It Really Work?**

**HUB 268**

**Friday**

9:00 a.m. – Noon

Organizer: Joan Horvath (Deezmaker 3D Printers, Pasadena; joan@deezmaker.com).

What is 3-D printing, and how can it be used in scientific visualization and to make one-off objects you might need around the lab? What tools are available open source, and what is the workflow like if you are a user that needs maximal flexibility? Use a 3-D printer “in person” to learn what is and what is not possible with one of these machines. Attendees will learn the state-of-the-art in low-cost open-source 3D printing, the workflow involved in this type of printing, capabilities and limitations of low-cost printers, and some suggested applications. As time permits, some objects will
be developed and printed to show the end-to-end process. People who are already conversant with 3D modeling can prepare a model ahead of time and skip the second hour. One particular 3D printer will be used, but the open source software suite works on many printer brands with some variation on input parameters.

Workshop agenda:
• First hour: Review of open source 3D printer technology, what it is good for and what it isn’t ready for yet, and how the consumer printers have evolved.
• Second hour: Introduce two free or open source 3D modeling programs (Tinkercad, if adequate wifi is available, and OpenSCAD) and let people make a simple object. For people who already are advanced 3D modelers, we will start printing out a file they have prepared ahead of time if it doesn’t require extensive fixes.
• Third hour: Introduce the open source slicing and hosting programs Slic3r/Repetier Host. Discuss the considerations for printing something on a printer and then actually print out as many objects as we have time for. (We can leave the printers we bring printing for the duration of the 3-D printing symposium, which follows this workshop in the afternoon.)

Participants will be sent a list of software to download ahead of time (compatible with PC, Mac, Linux). The software is all open-source and free, except for Tinkercad which is a free cloud-based program that requires registration. Participants with extensive 3D modeling experience can prepare a .stl file for printing ahead of time if they wish, but should keep the item small – a few inches on a side at most – so that printing completes quickly.

WORKSHOP
Gas Diffusion Simulations for Chemical Engineering Curriculum
SURGE 171
Friday
1:30 p.m. – 3:30 p.m.

Organizers: C. Mark Maupin (Department of Chemical and Biological Engineering, Colorado School of Mines; cmmaupin@mines.edu) and Owen McDougal (Department of Chemistry and Biochemistry, Boise State University; owenmcdougal@boisestate.edu).

This workshop will focus on the analysis of molecular dynamics simulations of various flue gases passing through semi-permeable polymer membranes. The workshop will outline the use of computational techniques that will assist in the learning experience for undergraduate students. This module is appropriate for facilitating a molecular-level understanding of various topics including molecular interactions, diffusion, adsorption, and membrane separation phenomena.

PANEL DISCUSSION
Does Nature Photography Distort Environmental Realities?
CALIFORNIA MUSEUM of PHOTOGRAPHY (CMP)
3834 MAIN STREET, RIVERSIDE
(about 1 block from the Mission Inn)
Friday
8:30 a.m. – 11:30 a.m.

Organizer: Robert Louis Chianese (Emeritus, California State University Northridge; richianese@gmail.com).

The morning will begin with a coffee reception in the Atrium of the CMP, followed at 9:00 a.m. with the panel presentations and discussion in the CMP Screening Room. Please note that there is limited seating in the Screening Room and no food or beverages are allowed into that room.

The panel will discuss the impact of Nature Photography on public perceptions of the state of the environment. For instance, do stunning photos of the natural world serve to enhance appreciation and potential conservation of it, or do they provide a dishonest reassurance that the natural world continues to thrive in beauty and grandeur? Or, is photography an adequate medium to convey an objective view of the natural world?

Each panelist will present a short exploration of various kinds of Nature Photography and then the group will discuss and debate the topic, along with questions from the audience.

An essay by the organizer, “Is Nature Photography Too Beautiful?” published in the Jan/Feb American Scientist magazine, can serve as a catalyst for discussion. It can be found online at: http://www.americanscientist.org/issues/pub/2014/1/is-nature-photography-too-beautiful.

Panelists:
Patrick Nichelson (Professor Emeritus, CSU Northridge, Religious Studies/ Ethics)
Mark Chappell (Professor, UC Riverside, Biology/ Ecology)
Steve Kaye (Professional Nature Photographer—Birds; Placentia, CA)
Jason Weems (Assistant Professor, UC Riverside, History of Art/ Photography)
Robert Louis Chianese (Professor Emeritus, CSU Northridge, English/Humanities; Panel Organizer and AAASPD past president).
III. CONTRIBUTED ORAL PRESENTATIONS

1100 (time italicized and underlined) indicates a student presentation
* indicates the speaker from among several authors listed
63 (bolded number) indicates abstract number

Quick Directory of Sponsoring Sections
for these Oral Presentations

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Cell and Molecular Biology ................................ page 71
Chemistry and Biochemistry ............................ page 72
Earth Sciences ............................................. page 72
Ecology, Environmental Sciences, and
  Sustainability ........................................... page 70
Education .................................................. page 69
Engineering, Technology, and Applied Sciences ...... page 71
Evolution, Organismal Biology, and Biodiversity .... page 70
History and Philosophy of Science ....................... page 70
Molecular Reproduction and Development ............. page 72
Physics and Materials Science .......................... page 71
Science and the Arts and Humanities .................... page 69
Social, Economic, and Political Sciences ............... page 69

Wednesday, 18 June 2014

Joint Oral Session 1
Education
History and Philosophy of Science
Science and the Arts and Humanities
Social, Economic, and Political Sciences

HUB 367
Wednesday
8:25 a.m. – 11:50 a.m.

Organizer for the Education section: Kimberly D. Tanner
(San Francisco State University).

Organizer for the History and Philosophy of Science section:
Donald J. McGraw (Ephraim, Utah).

Organizer for the Science and the Arts and Humanities:
Robert L. Chianese (California State University Northridge,
Emeritus).

Organizer for the Social, Economic, and Political Sciences section:
Carl A. Maida (University of California Los Angeles).

Session chair: Donald J. McGraw

8:25 Introductory comments

8:30 203 Ethics Education for Students Engaging in Undergraduate Biological Research, ALEXANDRA QUACKENBUSH* and AMELIA J. AHERN-RINDELL (Department of Biology, University of Portland, 5000 N Willamette Blvd., Portland, OR 97203; quackenb15@up.edu, ahernrin@up.edu).

8:50 204 Complexity of Information Literacy in our 21st Century and the STEM Undergraduate Curriculum, DANIELLE MIHRAM* and G. ARTHUR MIHRAM (1Leavey Library, University of Southern California, Suite 113, 650W 35th Street, Los Angeles, CA 90089-2571; 2 P. O. Box 1188, Princeton, NJ 08542-1188; dmihram@usc.edu).

9:10 205 An Experimental Study of the Efficacy of Game Augmentation Learning Effects on Computer Aided Instruction (CAI) of Physics Science Tasks, MICHAEL ELIOT (Department of Physics, Huntington Beach High School, 16033 Bolsa Chica St., 104, Huntington Beach, CA 92649; physics.hbhs@gmail.com).

9:30 206 Experience Culture to Better Understand Others, DEBORAH KISSINGER (Department of Psychiatry, John A. Burns School of Medicine, University of Hawaii, 1356 Lusitania Street, 4th Floor, Honolulu HI 96813; kissinger@dop.hawaii.edu).

9:50 207 When Railroads Blow Up: The Development of Regulations for Shipping Hazardous Cargo, 1903-2013, MARK ALDRICH (Department of Economics, Smith College, Northampton MA 01038; MAldrich@Smith.edu).

10:10 BREAK

Science and the Arts and Humanities

10:30 208 Designing Comics and Multi-Media Narrative for the Exploration of and Audience Engagement with the Southern California Spiny Lobster Fishery, VICTORIA MINNICH (Independent Scholar, 4015 Havenhurst Ave., Riverside, CA 92507); stokastika@
gmaill.com, accidentalanthropologist@gmail.com, ohtheotheraa@gmail.com).

**History and Philosophy of Science**

10:50 209 The Pendulum and Three Standards that Measured the Ancient World, **ROLAND A. BOUCHER** (Independent Scholar, 11 Deerspring, Irvine, California 92604; rolandfly@sbcglobal.net).

11:10 210 Evolution is Both True and Inevitable, **LAWRENCE H. WOOD** (Physicist, Retired, 8433 Camano Loop NE, Lacey, WA 98516; marylar@comcast.net).

11:30 211 Mathematics, a Language, is Not Science; Nor does the Scientific Method Mime the Mathematician’s Theorem-proving Process, **G. AURTHER MIHRAM** and **DANIELLE MIHRAM** (*PO Box 1188, Princeton, NJ 08542-1188; 2 Library, University of Southern California, Suite 113, 650W 35th Street, Los Angeles, CA 90089-2571; dmihram@usc.edu).
Joint Oral Session 3
Engineering, Technology, and Applied Sciences
Physics and Materials Science

HUB 265
Wednesday
1:25 p.m. – 3:30 p.m.

Organizer for the Engineering, Technology, and General Science section: Frank Jacobitz (Department of Engineering, University of San Diego).

Organizer for the Physics and Materials Science section: George Quainoo (Department of Physics and Engineering, Southern Oregon University).

Session chair: George Quainoo

1:25 Introductory comments

Physics and Materials Science

1:30 219 Electrochemical Impedance Spectroscopy of Ti-6Al-4V Containing Boron Additions in Hanks Balanced Salt Solution, OBED VILLALPANDO*, TRAVIS VOORHEES, MORGAN WONG, MATTHEW BORGIALLI, HANNAH LEU, and VILUPANUR RAVI (California State Polytechnic University, Pomona).

1:50 220 High Temperature Oxidation Behavior of Aluminized Austenitic Stainless Steel, CORY GAINES*, NICHOLASAGEE-ACOSTA, MICHAELCASPER, MATTHEW DOWNS, BRANDON ELLEDGE, BETTY LEUNG, and VILUPANUR RAVI (California State Polytechnic University, Pomona).

2:10 221 Effect of Activator in Pack Aluminizing Type 304 Stainless Steel, ARMANDO CORONADO*, SHAHAN KASNAKJIAN*, SUTINE SUJITTO-SAKUL*, MICHELL ARANDA*, CHRISTOPHER CALLE* and VILUPANUR RAVI (California State Polytechnic University, Pomona).

Engineering, Technology, and Applied Sciences

2:30 222 Role of Matrix Stiffness in the Mechanochemical Regulation of Endothelial Inflammation, HARRY A. SCOTT*, XIAO YANG, SOROUSH ARDEKANI, and KAUSTABH GHOSH (Department of Bioengineering, University of California, Riverside).

2:50 223 Synthesis and Characterization of Novel Nitroglycerin Nanoformulation for Superior Anti-Inflammatory Therapy, SOROUSH ARDEKANI**, HARRY SCOTT*, SHARAD GUPTA*, SHANE EUM*, XIAO YANG*, UMAR MOHIDEEN, and KAUSTABH GHOSH** (1Department of Bioengineering, University of California, Riverside; 2Department of Physics and Astronomy, University of California, Riverside; 3Department Biosciences and Biomedical Engineering, Indian Institute of Technology, Indore, India).

Joint Oral Session 4
Cell and Molecular Biology

Molecular Reproduction and Development

HUB 355
Wednesday
1:25 p.m. – 4:50 p.m.

Organizer for Cell and Molecular Biology section: Kristen Mitchell (Department of Biology, Boise State University).

Session chair: Kristen Mitchell

1:25 Introductory comments

Cell and Molecular Biology

1:30 225 The Role of AlgX Carbohydrate-binding Module during Alginate Biosynthesis in Pseudomonas aeruginosa, DANH C. DO**, BRANDON GALLAHER**, ZIED GAIEB, DIMITRIOS MORIKIS, and NEAL L. SCHILLER (1Division of Biomedical Sciences, 2Department of Biochemistry, 3Department of Bioengineering, University of California, Riverside).

1:50 226 Disposable Electronic Cigarettes and Electronic Hookahs: Evaluation of Performance, SANJAY GHAI*, MONIQUE WILLIAMS, and PRUE TALBOT (Department of Cell Biology and Neuroscience, University of California, Riverside).

2:10 227 Role of LOX-dependent Matrix Stiffening in Diabetic Retinal Endothelial Inflammation,
2:30 228 Bisphosphonates and Connexin 43: A Systematic Review of Evidence, POOYAN SADR-ESHKEVARI*, SAJJAD ASHNAGAR2, ASHKAN RASHAD3, and NORA PROCHNOW4 (1Professional Program for the International Dentists; School of Dentistry, University of California, Los Angeles; 2Scientific Research Center, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran; 3Oral and Maxillofacial Surgery Department, University Medical Center, Hamburg-Eppendorf, Martinistr. Hamburg, Germany; 4Department of Neuroanatomy and Molecular Brain Research, Ruhr University Bochum, Bochum, Germany).

2:50 229 Metabolic Network Construction Based on the Genome of the Marine Diatom Thalassiosira pseudonana and the Analysis of Genome-wide Transcriptome Data to Investigate Triacylglyceride Accumulation, KAREN PARKER (Moss Landing Marine Labs, San Jose State University).

3:10 BREAK

3:30 230 A Video Bioinformatics Approach to Evaluate Cofilin Dynamics, ATENA ZAHEDI1*, VINCENT ON2, IRYNA ETHELL3 (1Department of Bioengineering; 2Department of Electrical Engineering; 3Department of Biomedical Sciences, University of California, Riverside).

Molecular Reproduction and Development

3:50 231 Expression of the ATP-Binding Cassette Transporter Sp-ABCC5a in Pigment Cells is Required for Sea Urchin Gastrulation, LAUREN E. SHIPP*, ROSE Z. HILL, GARY W. MOY4, TUFAN GOKIRMAK1, and AMRO HAMDOUN (Scripps Institution of Oceanography).

4:10 232 Modeling Spermiogenesis in the Water Strider Aquarius remigis, GEORGE OTT*, NICHOLAS SHIRKEY, LEAH HAIMO, RICHARD CAR-DULLO, and CATHERINE THALER (Department of Biology, University of California, Riverside).

4:30 233 The Phosphatidyl-inositol-3-kinase/AKT Pathway Controls Mouse Oocyte Developmental Competence, SHILA MANANDHAR*, FEDERICA FRANCIOSSI, and MARCO CONTI (Center for Reproductive Sciences, University of California, San Francisco, 513 Parnassus Ave., HSW1656, Box 0556, San Francisco CA 94143-0556; contim@obgyn.ucsf.edu).

Joint Oral Session 5
Chemistry and Biochemistry
Earth Sciences
HUB 367
Wednesday
1:25 p.m. – 5:10 p.m.

Organizer for the Chemistry and Biochemistry section: Owen M. McDougal (Department of Chemistry and Biochemistry, Boise State University).

Organizer for the Earth Sciences section: Jad A. D’Allura (Department of Chemistry, Physics, Materials, and Engineering, Southern Oregon University).

Session Chair: Owen M. McDougal

1:25 Opening comments

Earth Sciences

1:30 234 Oligocene Volcanism and Intrusions along Soda Mountain Ridge, Western Cascades Volcanic Series, Southwest Oregon, JAD A. D’ALLURA1*, KACY CARLSON2, and ROBERT BUCKMISTER, II3 (1Department of Chemistry, Physics, Materials, and Engineering, Southern Oregon University; 2B. S. Geology, University of Orego; 3Geological Sciences, University of Oregon).

1:50 235 Transitioning Towards the Modern Animal Biota: Small Shelly Fossils from the Cambrian of the Himalaya, IAN R. GILBERT4 and NIGEL C. HUGHES (Earth Sciences Department, University of California, Riverside).

Chemistry and Biochemistry

2:10 236 Medicinal Garlic, Raw or Cooked? KENNETH CHONG3, MARTHA P. ZAMORA2, DILESHNI A. TILAKAWARDANE3, NANCY E. BUCKLEY2, JAMES A. REGO1, and YAN LIU4* (1Chemistry and Biochemistry Department, 2Biological Sciences Department, California State Polytechnic University, Pomona).

2:30 237 Chemicapacitor Detectors in Gas Chromatography, W. K. TOLLEY* and SANJAY V. PATEL

### Notes
- (time italicized and underlined) identifies a student presentation
- * identifies the speaker from among several authors listed
- 63 (bolded number) is the abstract number
- abstracts contain complete contact information for authors
CONTRIBUTED ORAL PAPERS – Wednesday

2:50 238 Augmenting NMR Crystallography Through Fragment Methods, JOSHUAL D. HARTMAN (Department of Chemistry, University of California, Riverside).

3:10 BREAK

3:30 239 NMR Crystallography in the Enzyme Active Site of Tryptophan Synthase, BETHANY G. CAULKINS*, BABACK BASTIN1, CHEN YANG1, THOMAS J. NEUBAUER1, ROBERT P. YOUNG1, EDUARDO HILARIO2, LI FAN2, MICHAEL F. DUNN2, MICHAEL J. MARSELLA1, and LEONARD J. MUELLER1 (Departments of 1Chemistry and 2Biochemistry, University of California, Riverside).

3:50 240 Determining Bacterial vs. Viral Infections via Chemi-Resistive CNT Devices, NUVIA MARIA SAUCEDO*, YINGNING GAO2, and ASHOK MULCHANDANI2 (1Department of Chemistry and 2Department of Chemical and Environmental Engineering, University of California, Riverside).

4:10 241 Breaking through the Other Side: De novo Designed Peptides that Cross the Cell Membrane for Biomolecule Delivery, J. ABBREY MONREAL and JONEL P. SALUDES* (Department of Chemistry, Washington State University, Pullman).

4:30 242 Heat-Induced Coarsening of Gold Nanoparticle-Graphene Oxide Hybrids, HANQING PAN*, YOHANNES ABATE2, and YOUNG-SEOK SHON1 (1Department of Chemistry and Biochemistry and 2Department of Physics and Astronomy, California State University, Long Beach).

4:50 243 Optimizing the Extraction Efficiency of Biologically Active pH Sensitive Steroidal Alkaloids from Veratrum californicum, JARED MATTOS*, ROBERTO CRUZ, NIC BAUGHMAN, PETR MALEK, CHRIS CHANDLER, and OWEN McDOUGAL (Department of Chemistry and Biochemistry, Boise State University).
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- Social events
- Resource activities for K-12 students and teachers
- Awards for outstanding teaching and research

Lectureship series

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Boards on which to attach poster presentations will be set up in HUB 302 N. The poster boards have numbers on them that coincide with the numbers assigned to the posters in this program (see number to the left of the title of each presentation). You must use the appropriately numbered board for your poster. Please use map tacks (provided) to attach your poster to the board. Do not use tape!

Posters for the Wednesday morning session can be set up starting at 8:15 a.m. Wednesday morning and must be in place no later than 8:45 a.m. that morning. Posters for the Thursday morning session can be set up starting at 8:15 a.m. that morning and must be in place no later than 8:45 a.m. Posters can be removed starting at 11:45 a.m. and must be removed no later than 12:15 p.m. each day.

All presenters must be present with their posters for the duration of the session in which they are presenting in order to discuss their research with interested parties.

Presenters assume full responsibility for the security of their poster and other materials. Unclaimed posters will be discarded at the close of the technical sessions on Friday afternoon.

LUDWIG BARTELS (Department of Chemistry and Materials Science, and Engineering Program, University of California, Riverside).

245 Comparison of Surface Preparation Methods for Single Crystal Bismuth Selenide, W. ZHOU* and J. A. YARMOFF (Department of Physics and Astronomy, University of California, Riverside).

246 Proximity-Induced Anomalous Hall Effect in Graphene, ZHIYONG WANG*, CHI TANG, ZHISHENG LIN, RAYMOND SACHS, YAFIS BARLAS, and JING SHI (Department of Physics and Astronomy, University of California, Riverside).

247 Transport Properties and Devices of Molybdenum Disulfide, FENGLIN WANG*, PETR STEPANOV, MASON GRAY, and CHUN NING (JEANIE) LAU (Department of Physics, University of California, Riverside).

248 2D Materials beyond 2D: Growth of MoS2 and Related Materials on Patterned Substrates, EDWIN PRECIADO*, DAVID BARROSO, ARIANA NGUYEN, SAHAR NAGHIBI, KELLY BROWN, VELVETH KLEE, SARAH BOBEK, JOHN MANN, and LUDWIG BARTELS (Department of Chemistry, University of California, Riverside).

249 Effect of Misorientation on the Electronic Properties of van-der-Waals (vdW) Materials, MAHESH R. NEUPANE*, DARSHANA WICKRAMARATNE1, SUPENG GE2, SHANSHAN SU1, GEN YIN1, and ROGER K. LAKE1 ('Department of Electrical Engineering, 2Department of Physics and Astronomy, University of California, Riverside).
250 In Situ Observation of Electrostatic and Thermal Manipulation of Suspended Graphene Membranes, WEN-ZHONG BAO1, KEVIN MYHRO1*, ZENG ZHAO1, ZHEN CHEN2, WAYOUNG JANG2, LEI JING1, FENG MIAO1, HANG ZHANG1, CHRIS DAMES2, and CHUN NING LAU1 (1Department of Physics and Astronomy and 2Department of Mechanical Engineering, University of California, Riverside).

251 Computational Exploration of Aspects of Contact Formation and Bending in 2D Layers of Transition Metal Dichalcogenides, MARK MICKLICH*, JESSICA MCKINLEY, VELVETH KLEE, CHEN WANG, and LUDWIG BARTELS (Department of Chemistry and Materials Science, and Engineering Program, University of California, Riverside).

252 Post-Growth Tuning of the Bandgap of Single-Layer Molybdenum Disulfide Films by Sulfur/Selenium Exchange, QUAN MA1*, MIGUEL ISARRARAZ, CHEN WANG, EDWIN PRECIADO, VELVETH KLEE, SARAH BOBEK, KOICHI YAMAGUCHI, EMILY LI, PATRICK OENTHAL, ARIANA NGUYEN, DAVID BARROSO, DEZHENG SUN, GRETEL VON SON PALACIO, MICHAEL GOMEZ, ANDREW NGUYEN, DUY LE, GREG PAWIN, JOHN MANN, and LUDWIG BARTELS (Department of Chemistry, University of California, Riverside).

253 Spin Hall Effect in Graphene with Enhanced Spin-Orbit Coupling, Z. S. LIN1*, Z. Y. WANG, B. W. YANG, and J. SHI1 (Department of Physics and Astronomy, University of California, Riverside).

254 Enhanced Photoluminescence and Photocurrent Spectra in MoS2 under Ionic Liquid Gating, ZHEN LI1*, SHUN-WEN CHANG2, and STEPHEN B. CRO-NIN12 (1Department of Electrical Engineering, 2Department of Physics, University of Southern California).

255 Giant Interaction-induced Gap and Electronic Phases in Rhombohedral Trilayer Graphene, YONGJIN LEE1*, DAVID TRAN, KEVIN MYHRO, JAIRO VELASCO, JR., NATHANIEL GILLGREN, YAFIS BARLAS, and CHUN NING (JEANIE) LAU (Department of Physics, University of California, Riverside).

256 Magnetic Proximity Effect Induced Effects in Topological Insulator/YIG Heterostructures, ZILONG JIANG1*, CHI TANG1, FERHAT KATMIS2, PENG WEI2, JAGADEESH S. MOODERA2 and JING SHI1 (1Department of Physics and Astronomy, University of California, Riverside; 2Francis Bitter Laboratory, Massachusetts Institute of Technology).

257 Electronic Properties of Misoriented Bilayer Transition Metal Dichalcogenides, SUPENG GE1*, DARSHANA WICKRAMARATNE2, MAHESH NEUPANE3, SHANSHAN SU3, and ROGER LAKE1 (1Department of Physics and 2Department of Electrical Engineering, University of California, Riverside).

Education

258 It’s Critical: Student Attitudes Toward Critical Thinking and an Assessment of a Lecture to an Introductory Engineering Class, ESTHER K. CHO1, KARLY V. JERMAN1, KAMERON J. LACALLI1, SABRINA E. LUCERO1, VICTORIA S. MARAGA2, DAVID P. PENNINGTON2, AIMÉE E. SLAVENSKY1, RACHEL E. STEIN1, NEIL C. VRANICAR1, and FRANK G. JACOBITZ (Shiley-Marcos School of Engineering, University of San Diego).

259 Staying on Track: Revisiting the DNA Subway as a Tool to Engage Life Sciences Community College Students in Basic Research, ALEJANDRO CORTEZ1*, NH TRAN2, JAMES BURNETTE III1, and RICHARD A. CARDULLO2 (1Dynamic Genome Program, 2College of Natural and Agricultural Sciences, University of California, Riverside).

Molecular Reproduction and Development

260 Transcriptomics between Fertile and Infertile Colonies of the Urochordate B. schlosseri Reveal Key Genes Involved in Germline Formation and Maintenance, DELANY RODRIGUEZ1*, KELSEA FARELL1, ERIN SANDERS1, ADAM LANGENBACHER1, E. STEIN1*, NEIL C. VRANICAR1, and FRANK G. JACOBITZ (Shiley-Marcos School of Engineering, University of San Diego).

261 The Role of Chromatin Modification in Germ Cell Specification and Development, JENESSA R. OLSON1* and EKATERINA VORONINA (Division of Biological Sciences, University of Montana).

262 Using a Reactivated Sperm Model to Determine the Role of Calcium in the Regulation of Mosquito Sperm Motility, ELIZABETH S. KOO1*, NHI TRAN2, KARLY V. JERMAN1, and RICHARD A. CARDULLO2 (1Department of Biology, University of California, Riverside).

263 Prospective Isolation and Molecular Characterization of Germ Line Stem Cells from Botryllus schlosseri.
SUSANNAH H. KASSMER*, DELANY RODRIGUEZ*, ADAM LANGENBACHER, and ANTHONY DE TOMASO (Neuroscience Research Institute and Molecular, Cellular and Developmental Biology, University of California, Santa Barbara).

264 Detection of a Trypsin-like Protease in the Accessory Glands of Culex quinquefasciatus and the Reproductive Tract of Aquarius remigis. EREATHNI U. JAYAWAREDENA*, CATHERINE D. THALER, and RICHARD A. CARDULLO (Department of Biology, University of California, Riverside).


266 Membrane Proteins Regulate Viral Immunity by Controlling Viral siRNA Production in Arabidopsis. ZHONGXIN GUO*, BINHUI ZHAN, JINFENG LU, STEPHANIE COFFMAN, and SHOUWEI ZHONGXIN GUO* (Marine Biology Research Division, Scripps Institution of Oceanography).


Physics and Materials Science

268 Nitrogen Dopant Distribution in Polycrystalline N-doped Graphene Monolayer Films. LIUYAN ZHAO*, RUI HE1,2, AMIR ZABET3, KEUN SOO KIM4, THEANNE SCHIROS5, MICHAEL ROTH6, PHILIP KIM7, GEORGE W. FLYNN7, ARON PINCZUK7, and ABHAY N. PASUPATHY1 (1Department of Physics, Columbia University; 2Department of Physics, University of Northern Iowa; 3Department of Chemistry, Columbia University; 4Department of Physics and Graphene Research Institute, Sejong University, Seoul, Korea; 5Energy of Frontier Research Center, Columbia University).

269 Studying the Microstructure Changes of CVD-Synthesized Graphene with Growth Pressure using Fluorescence Quenching Microscopy (FQM). PAIGE ROMERO1*, HAMDEH HOSSEINI BAY2, WEI WANG1, CENGIZ S. OZKAN2 and MIHRIMAH OZKAN3 (Departments of 1Materials Science and Engineering, 2Mechanical Engineering and 3Electrical Engineering, University of California, Riverside).

270 Internal Polarization of Bromine Adatoms on Si(111) Measured by Low Energy Alkali Ion Scattering. J. KEAGY*, S. TEMIZ, and J. A. YARMOFF (Department of Physics and Astronomy, University of California, Riverside).

271 Demonstrating Entanglement by Testing Bell’s Theorem in Majorana Wires. DAVID E. DRUMMONDI*, KIRILL SHTENGEL1, ALEXEY A. KOVALEV2, CHAND-YU HOU13, and LEONID P. PRYADKO1 (1Department of Physics and Astronomy, University of California, Riverside; 2Department of Physics and Astronomy, and Nebraska Center for Materials and Nanoscience, University of Nebraska-Lincoln; 3Department of Physics, California Institute of Technology).

272 Fluctuation-Induced Forces between Inclusions Embedded in Membrane. TYLER CARO*, JEFFREY WAGNER, UMAR MOHIDEEN, and ROYA ZANDI (Department of Physics and Astronomy, University of California, Riverside).

273 Magnet and Accumulator for Making a Two-dimensional Positronium BEC. ALINA M. ESCALERA*, PARTH B. PATEL, and ALLEN P. MILLS, JR. (Department of Physics and Astronomy, University of California, Riverside).

274 Mechanical Characterization of an Adhesive Tape. RUKMINI A. RAVI (Claremont High School, Claremont, CA).

275 Corrosion of Nickel Chromium Alloys in Molten Sodium Sulfate Salt at 900°C. ZACK GENTRY, ANDREW SAKAMOTO, MATTHEW COREY, NORTON THONGCHUA*, and KISHAN PATEL (Chemical and Materials Engineering Department, California State Polytechnic University, Pomona).

Earth Sciences

276 Imaging Tiny Earthquakes in the San Andreas Fault with a Mini Seismic Array. MANUEL MENDOZA* and ABHIJIT GHOSH (Earth Science Department, University of California, Riverside, 900 University Ave., Riverside, CA 92521; mmendoza@ucr.edu).
Atmospheric and Hydrospheric Sciences

277 From Passive Samplers to Estimates of Dry Nitrogen Deposition in the Western United States, ANDRZEJ BYTNEROWICZ1*, WITOLD FRACZEK2, ROBERT JOHNSON3, MARK FENN1, LEIMING ZHANG4, and DARREL JENERETTE5* (1USDA, Forest Service, Pacific Southwest Research Station, Riverside, California; 2Environmental Systems Research Institute, Redlands, California; 3Center for Conservation Biology, University of California, Riverside; 4Air Quality Research Division, Environment Canada, Toronto, Ontario, Canada; 5Department of Botany and Plant Sciences, University of California, Riverside).

Chemistry and Biochemistry

278 Characterization of Glycosidases in the Aquarius remigis Sperm Plasma Membrane, KIMBERLY STEPHENS1*, CATHERINE D. THALER2, and RICHARD A. CARDULLO1,2 (1Department of Entomology and 2Department of Biology, University of California, Riverside).

279 Investigating the Folding Dynamics of the RNA Pseudoknot Structural Motif via Massively Parallel Molecular Dynamics, KHAI NGUYEN1*, AMETHYST RADCLIFF3, SAMANTHA CAO1, PHUC LA1, MONA BACKHOM1, RICHARD WANG1, and ERIC SORIN1 (Departments of 1Chemistry and Biochemistry, 2Physics and Astronomy, and 3Computer Engineering and Computer Science, California State University, Long Beach).

280 The Study of Diffusion of Volatile Organic Compounds Through a Synthetic Membrane Using a Low Cost Apparatus in an Undergraduate Laboratory Setting, JULIAN LEE1*, RICHARD RAKIJIAN, and MARCO M. ALLARD (Department of Chemistry and Biochemistry, La Sierra University, Riverside, CA).

281 Single-stranded DNA-Protein Binding and Collections through Asymmetrical Flow Field-Flow Fractionation, LUIS JIMENEZ1*, JONATHAN ASHBY2, SAMANTHA SCHACHERMEYER2, and WENWAN ZHONG2 (1Program in Biomedical Sciences, 2Department of Chemistry, University of California, Riverside).

282 Fluorescamine-based Screening of Nanoparticle-Protein Interactions, JONATHAN ASHBY3*, ERIK LIGANS2, and WENWAN ZHONG1 (1Department of Chemistry, 2Department of Biology, University of California, Riverside).

283 Flow Field-flow Fractionation-based Localization and Quantitation of MicroRNA Biomarkers, KENNETH FLACK*, JONATHAN ASHBY, and WENWAN ZHONG (Department of Chemistry, University of California, Riverside).

284 Analysis of Tobacco Expressing Candidate Methyltransferase Transgenes from Moss, GABRIEL JULOYA*, LAUREN KIVLEN, LEI ZHU, and EUGENE A. NOTHNAGEL (Department of Botany and Plant Sciences, University of California, Riverside).

285 Microsecond Monomer-Oligomer Exchange in the Intrinsically Disordered Protein Statmin as Revealed by Saturation Recovery EPR, JESUS M. MEJIA* and MICHAEL D. BRIDGES (Department of Chemistry and Biochemistry, California State University, Fullerton).

286 The Effect of Morphology of ZnO Support on Activity of Gold Catalyst in Low Temperatures Oxidation of Benzyl Alcohol, REZA SHIDPOUR*, HADI SALARI, ABDOLREZA SIMCHI, and MANOUCHEHR VOSSOUGHI (Department of Chemistry, University of California, Riverside).
Thursday Morning, 19 June 2014

**Poster Session 2**
HUB 302 N
Thursday
9:00 a.m. – 11:45 a.m.

**Evolution, Organismal Biology, and Biodiversity**

**287** Designing Computational Models of Planaria Regeneration for Use in Evolutionary Search, JARED MAT-TOS*, MARIANNA BUDNIKOVA, NIC CORNIA, TIM ANDERSEN, and JEFFREY HABIG (Department of Computer Science, Boise State University).


**289** Red Water of Mesodinium Blooms in the Columbia River Estuary Contain Elevated Levels of Euduboscquella, a Parasitic Dinoflagellate that Infects Tintinnid Ciliates, DEIRDRE McATEER*, PETER KAHN, and PETER ZUBER (Center for Coastal Margin Observation and Prediction, Oregon Health Sciences University).

**Agriculture, Food, and Renewable Resources**

**290** The Effect of Biochar Soil Amendments on Wheat Biomass, CLAUDIA C. MARIN*, ELIZABETH CRUTCHFIELD, J. GILES WAINES and MILTON E. McGIFFEN, Jr. (Department of Botany and Plant Sciences, University of California, Riverside).

**Anthropology and Archaeology**

**291** Archaeological Feature Extraction from Aerial Imagery: Ahupua‘a o Kāloa, Kaua‘i, JOHN T. O’CONNOR (Department of Anthropology, University of Oregon).

**Psychology**

**292** Relationship of Physician-Patient Communication to Patient Satisfaction, Health, and Psychological Outcomes: A Meta-Analysis, TRICIA A. MILLER*, JULIET BENI EDGCOMB, and M. ROBIN DIMATTEO (Department of Psychology, University of California, Riverside).

**293** Aversions to Water Consumption Increase with Proximity of Use, MARY GAUVAIN and DANIEL HARMON* (Department of Psychology, University of California, Riverside).

**294** The Effect of Differing Conversation Types on Bystanders, CHRISTINA CARNER*, CHRISTOPHER DISHOP*, and VERONICA V. GALVÁN (Department of Psychological Sciences, University of San Diego).

**295** Stress and Coping in College Students, SARAH JENSEN*, CORI TERGESEN*, and VERONICA V. GALVÁN (Department of Psychological Sciences, University of San Diego).

**Engineering, Technology, and Applied Science**

**296** Effect of ICG Concentration on the Fluorescence Emission Characteristics of Erythrocyte-Mimicking Optical Nanoprobes, JACK TANG1*, WANGCUN JIA2, VIC-TOR SUN2, J. STUART NELSON2, and BAHMAN ANVARI1 (1Department of Bioengineering, University of California, Riverside; 2Beckman Laser Institute and Medical Clinic, University of California, Irvine).

**297** Increasing Power Output by Reducing the Windmill Blade Tip Vortex, ELEANOR FROST (Chaminade College Preparatory School, Los Angeles, CA).

**298** A Study of Sperm Motility of Culex quinquefasciatus Sperm, CARLA DE LOS SANTOS1*, MARCO GARCIA2, CATHERINE D. THALER2, and RICHARD A. CARDULLO1,2 (1Department of Bioengineering and 2Department of Biological Sciences, University of California, Riverside).

**299** Fabrication of Silica Nanofibers for DNA Extraction, MARISSA GIONET-GONZALES*1, LUIS JIMENEZ2, YANG LIU3, and WENWAN ZHONG4 (Departments of 1Bioengineering, 2Biomedical Sciences, 3Environmental Toxicology, and 4Chemistry, University of California, Riverside).

**300** Visualization of Direct Numerical Simulation Results of an Advection-Diffusion Equation for Magneto-Geostrophic Turbulence, KRISTIAN WITTMAN1*,
Ecology, Environmental Sciences, and Sustainability

301 Epiphytic Moss as a Biomonitor of Nitrogen Deposition in the Pacific Northwest, TIMEA DEAKOVA*, TERRY ROLFE2, ERIN SHORTLIDGE1, MEENA AKSHI RAO1, TODD ROSENSTIEL1, and ANDREW RICE2 (Department of Biology, Department of Environmental Science and Management, Portland State University).


303 Evaluation of the Design, Performance, and Metal Emissions of Electronic Cigarettes, MONIQUE WILLIAMS*, AMANDA VILLARREAL1, KRASSIMIR BOZHILOV2, and PRUE TALBOT1 (Department of Cell Biology and Neurosciences, University of California, Riverside; Central Facility for Advanced Microscopy, University of California, Riverside).

304 Isolation and Characterization of a Crude Oil-Tolerant Bacterium from the Great Salt Lake, RÜHUL KUDDUS, JONATHAN OAKES, JOHURIMAM NOAH KUDDUS, and EASTON DOWNS* (Department of Biology, Utah Valley University).

305 Gradient Analysis of Terrestrial Arthropod Community Composition in a California Desert Habitat, SARAH L. O’NEILL*, RICHARD REDAK, and MATT DAUGHERTY (Department of Entomology, University of California, Riverside).

Cell and Molecular Biology

306 PG0686 May Function in Oxidative Stress Resistance as a Redox Sensor in Porphyromonas gingivalis W83, ALEXIA D. XIMINIES*, YUETAN DOU1, WILSON ARUNI1, LAWRENCE SANDBERG2, and HANSEL M. FLETCHER1 (Division of Microbiology and Molecular Genetics and Division of Biochemistry, School of Medicine, Loma Linda University).

307 Using Neural Stem Cells to Understand Developmental Defects, VASUNDHRA BAHL*, KIMBERLY JOHNSON1, JULIAN HARTZELL1, SUZAYNN SCHICK2 and PRUE TALBOT1 (Department of Cell Biology and Neuroscience, University of California, Riverside; Department of Medicine, University of California, San Francisco).

308 Prediction of Cardiac and Skeletal Teratogens Using Human Induced Pluripotent Stem Cell-Based in vitro Models of Differentiation, LAUREN WALKER*, NICOLE SPARKS1, VERONICA PUIG-SANVICONENS2 and NICOLE ZUR NIEDEN (Department of Environmental Toxicology, University of California, Riverside; Department of Cellular and Molecular Medicine, University of California, San Diego; Department of Cell Biology and Neuroscience, University of California, Riverside).

309 Comparing Mandible Bone Marrow Derived Osteoblast Attachment to Titanium Scaffolds With or Without UV Treatment, MARIA SIERRA ASIAN B. BALATAN*, NANCY SILVA2, MANABU ISHIJIMA2, POOYA SOLTANZADEH1, CHIKA IWASAKI1, and TAKAHIRO OGAWA1 (Howard Hughes Medical Institute Pre-College Science Education Program, UCLA School of Dentistry; UCLA School of Dentistry).

310 Neurobehavioral Effects of In Utero Exposure to Polybrominated Diphenyl Ethers (PBDEs) on the F1 Progeny of C57Bl/6 Mice, M. VALDEZ*, G. GONZALEZ2, R. GUITIERREZ2, H. CHENG2, T. KYAW3, J. VALDEZ2, M. BLAIBEL2, H. CHERUKURY3 and M. CURRAS-COLLAZO2 (Neuroscience Graduate Program, Department of Cell Biology and Neuroscience, University of California, Riverside; Biological Science Department, California State University, Fullerton).

311 Cytotoxicity of Electronic Cigarette Refill Fluid Aerosols, RACHEL Z. BEHAR* and PRUE TALBOT (Department of Cell Biology and Neuroscience, University of California, Riverside).

312 The Effects of Astrocytic Swelling on Neuronal Excitability, KELLI LAUDERDALE, TODD A. FIACCO, and TINA TUNG (Department of Cell Biology and Neuroscience, University of California, Riverside).

313 Transcriptional Regulation of LPS-Induced Inflammatory Genes in Dental Pulp, ANIKA BENONS*, JONATHAN VERGARA-DIAZ*, SHEBLI MEHRAZARIN2, MINSUNG HUH2, and MO KANG2 (Howard Hughes Medical Institute Pre-College Science Education Program, UCLA School of Medicine, University of California, San Francisco).
Education Program, UCLA School of Dentistry; ²UCLA School of Dentistry).

314 Characterizing Candidate Allorecognition Genes in Botryllus schlosseri. DARYL A. TAKETA*, ADAM D. LANGENBACHER, DELANY RODRIGUEZ, ALLISON B. ANDRASKI, KEVIN J. YOUNG, LIVIU CENGHER, MICHAEL A. TRIBINO, KATHARINA R. CLORE-GRONENBORN, and ANTHONY W. DE TOMASO (Department of Molecular, Cellular and Developmental Biology, University of California, Santa Barbara).

315 Changes in Glutamatergic and GABAergic Receptor Subunits in a Rodent Model of Post-Traumatic Stress Disorder. JOSE CATALAN1*, ROBERTO GUTIERREZ, ALEXANDER PRIEN, and MARGARITA CURRAS-COLLAZO (Department of Cell Biology and Neuroscience, University of California, Riverside).

316 Cardiovascular Toxicity and Sympathetic Nervous System Disruption following Developmental Exposure to Organohalogen Pollutant. LAWRENCE BARON*, ROBERT SPURGIN*, ROBERTO GUTIERREZ, ALEXANDER PRIEN, and MARGARITA CURRAS-COLLAZO (Department of Cell Biology and Neuroscience, University of California, Riverside).

317 Collagen Related Proteins Can Modulate the Invasive Ability of Filifactor alocis. OZIOMA CHIOMA*, MIRIAM HABIBI, LISA VROOM, and ERIC WANG (Division of Microbiology and Molecular Genetic School of Medicine, Loma Linda University).

318 Low Level Laser Therapy and Malignant Cells: A Pilot Systematic Review. MOLOOD SADRESHKEVARY1, SAJJAD ASHNAVAR2, ROMINA SADRESHKEVARY2, and POOYAN SADR-ESHKEVARI1 (Queen Mary University; London, UK; ²Students Scientific Research Center, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran; ³University of California, Los Angeles Extension; ⁴School of Dentistry, University of California, Los Angeles).

319 Astrocytic Localization of Supraoptic Serine Racemase and its Potential Participation in NMDA-stimulated Vasopressin Responses in Hypothalamo-Neurohypophysial Explants. SIMON KIM1, MATTHEW VALDEZ1, JOE VALDEZ1, GWENDOLYN GONZALEZ1, ROBERT FERNANDEZ1, ROBERT GUTIERREZ1, and MARGARITA C. CURRAS-COLLAZO1,2* (¹Department of Cell Biology and Neuroscience, University of California, Riverside; ²Neuroscience Graduate Program, University of California, Riverside).

320 Vitamin D and Resveratrol: A Fountain of Youth in Gene Regulation. MARYA S. SABIR2, ZAINAB KHAN1, MICHAEL A. GALLIGAN1, ANGELIKA DAMPSTONE1, G. KERR WHITFIELD2, MARK R. HAUSSLER2, and PETER W. JURUTKA1,2 (¹Mathematical and Natural Sciences, Arizona State University; ²Basic Medical Sciences, University of Arizona College of Medicine).

321 Identification of Toxicants In Cinnamon-Flavored Electronic Cigarette Refill Fluids. RACHEL Z. BEHAR, BARBARA DAVIS*, YUHUAU WANG, VASUNDHRA BAHL, SABRINA C. LIN, and PRUE TALBOT (Department of Cell Biology and Neuroscience, University of California, Riverside).

322 qPCR Analysis of Gene Expression in Salivary Glands of NOD Mice Treated by Bone Marrow Cells. BARAKA GATHERE1, JACQUELINE GARCIA1, RYAN RABIF, and SHEN HU (Howard Hughes Medical Institute Pre-College Science Education Program, UCLA School of Dentistry).

323 A Comprehensive Comparison Between RNA-Seq and Microarray for Transcriptomic Profiling. CHARLES WANG1, BINSHENG GONG1, PIERRE R. BUSHEL1, VICTOR RUAN1*, JEAN THIERRY-MIEG1, DANELLE THIERRY-MIEG1, JOSHUA XU1, HONG FANG2, HUIXIAO HONG2, LEMING SHI, SCOTT AUERBACH1, and WEIDA TONG2 (¹Center for Genomics, and Division of Microbiology and Molecular Genetics, School of Medicine, Loma Linda University; ²Division of Bioinformatics and Biostatistics, National Center for Toxicological Research, US Food and Drug Administration, Jefferson, AR; ³Microarray and Genome Informatics Group, National Institute of Environmental Health Sciences; ⁴National Center for Biotechnology Information, National Library of Medicine, National Institutes of Health; ⁵Center for Pharmacogenomics, Schools of Life Sciences and Pharmacy, Fudan University, Shanghai, China; ⁶National Toxicology Program, National Institute of Environmental Health Sciences).

324 Understanding Promiscuous Efflux Functions of MDR Transporters with Guidance from Evolution. TUFAN GOKIRMAG*, JOSEPH P. CAMPANALE, LAUREN E. SHIPP, GARY W. MOY, and AMRO HAMDOUN (Scripps Institution of Oceanography).

325 Metabolic Effects of Soybean Oil and Fructose in Female Mice. ANTONIA RIZO*, FRANCES SLADEK, POONAMJOT DEOL, and JANE EVANS (Department of Cell Biology and Neuroscience, University of California, Riverside).
326 **IFN-gamma and IL-10 Production by NK Cells Cultured with Probiotics**, SCARLETT PLANTILLAS*, THAIS HOGARTH†, HELEN TSENG², and ANAHID JEWETT³ (¹Howard Hughes Medical Institute Pre-College Science Program, UCLA School of Dentistry; ²UCLA School of Dentistry).

327 **Adverse Metabolic Effects of a Soybean Oil Diet**, CYNTHIA PEREA*, JANE EVANS, POONAMJOT DEOL, and FRANCES SLADEK (Department of Cell Biology and Neuroscience, University of California, Riverside).

328 **TRPV1 Channel Activity Triggered by Hyperosmotic Stimulation Increases Phosphorylated NOS Activity in Rat Supraotic Slices**, ANDRANIK KHACHATUROV*, SHAWN'T TOSONIAN, CHRISTY BEITZEL, and MARGARITA CURRAS-COLLAZO (Department of Cell Biology and Neuroscience, University of California, Riverside).

329 **Effect of Interleukin 4 on Oral Cancer Stem Cells**, OLUFUNMILOLA ODUFALU*, OLUTOBI JEKAYINFA†, NICOLE RIGAS² and KI-HYUK SHIN² (¹Howard Hughes Medical Institute Pre-College Pipeline Program, UCLA School of Dentistry; ²UCLA School of Dentistry).

330 **Toxicology-in-a-Dish: Using In Vitro Stem Cell Models to Predict Health Defects Due to Cigarette Smoke Exposure**, SABRINA C. LIN*, RATTAPOL PHANDTHONG, NIKKI WENG, BRENDA MONTES, and PRUE TALBOT (UCR Stem Cell Center and Department of Cell Biology and Neuroscience, University of California, Riverside).

331 **Lyve1 Distinguishes Yolk Sac Myelo-erythroid Progenitor Wave from Primitive Hematopoiesis**, YEON JOO KIM*, LYDIA LEE, and HANNA MIKKOLA (University of California, Los Angeles).
Abstracts are grouped by program. Not all presenters submitted an abstract. Except for editing of titles, authors and affiliations for consistency, abstracts have not been edited. Grammar and content are presented as submitted by the authors.

**PLENARY TALKS**

**Tuesday Evening Plenary Lecture**
Tuesday at 6:30 p.m. in HUB 302 S

1  *And Ever the Twain Shall Meet: An Exposé of Sexual Differences in the Animal Kingdom*, **DAPHNE J. FAIRBAIRN** (Department of Biology, University of California, Riverside).

A common perception is that male animals are generally larger, more colorful and more behaviorally flamboyant than their mates. Although this is the prevalent pattern in most birds and large mammals, a comparison of sexual differences across all classes in the Animal Kingdom reveals that it is not typical. The survey confirms that differences between the sexes in size, shape, color, behavior and life history are indeed the norm. However, it is far more common for females to be the larger, more conspicuous sex than the reverse. Further, the differences between sexes can be several orders of magnitude greater in species where females are the larger sex. In the extreme, females are thousands of times more massive than their mates and the sexes are so disparate that they would not be recognized as belonging to the same species if not observed hatching from the same batch of eggs or mating as adults. To understand and explain these patterns, the presentation combines concepts from evolutionary biology, ecology, behavior and physiology. Select examples of species in which males are much larger and more flamboyant than females are contrasted with examples of species in which males are inconspicuous dwarfs relative to their mates. These detailed examples of the most extreme sexual differences illustrate how and why the sexes differ and also reveal why these differences extend far beyond the sex-specific reproductive organs to encompass many aspects of the morphology, life history, ecology and behavior of each sex.

**Wednesday Evening Sigma Xi Distinguished Lecture**
Wednesday at 7:00 p.m. in HUB 302 S

3  *Two Revolutions: Copernicus and Darwin*, presented by **FRANCISCO J. AYALA** (Departments of Biological Sciences and Philosophy, University of California, Irvine).

Darwin occupies an exalted place in the history of Western thought, deservedly receiving credit for the theory of evolution. However, Darwin accomplished something much more important than demonstrating evolution. Darwin’s *Origin of Species* is, first and foremost, a sustained argument to solve the problem of how to account scientifically for the design of organisms. Accumulating evidence for common descent with diversification may very well have been a subsidiary objective of Darwin’s masterpiece. Darwin seeks to explain the design of organisms, their complexity, diversity, and marvelous contrivances as the result of natural processes. Darwin brings about the evidence for evolution because evolution is a necessary consequence of his theory of design.

The advances of physical science brought about by the Copernican Revolution had driven mankind’s conception of the universe to a split-personality state of affairs. Scientific explanations, derived from natural laws, dominated the world of nonliving matter, on the Earth as well as in the heavens. Supernatural explanations, which depended on the unfathomable deeds of the Creator, were accepted as explanations of the origin and configuration of living creatures. Authors, such as William Paley in his *Natural Theology* of 1802, had developed the “argument from design,” the notion that the complex design of organisms could not have come about by chance, or by the mechanical laws of physics, chemistry, and astronomy, but was rather accomplished by an Omnipotent Deity.

It was Darwin’s genius to resolve this conceptual schizophrenia. Darwin completed the Copernican Revolution by drawing out for biology the notion of nature as a lawful system of matter in motion that human reason can explain without recourse to supernatural agencies. The complex organization and functionality of living beings can be explained as the result of a natural process—natural selection—without any need to resort to a Creator or other external agent. The origin and adaptations of organisms in their profusion and wondrous variations were thus brought into the realm of science.

**Wednesday Noon Plenary Lecture**
Wednesday at 12:15 p.m. in HUB 355

2  *Ecological Restoration and Post Natural Aesthetics*, presented by **ROBERT LOUIS CHIANESE** (Emeritus, Department of English, California State University, Northridge).

No abstract was provided for this talk.
Thursday Noon Plenary Lecture #1
Thursday at 12:15 p.m. in HUB 269

4 The Expanding Universe, Dark Matter and Dark Energy: The Three Greatest Discoveries in Cosmology, GILLIAN WILSON (Professor of Physics and Astronomy, University of California, Riverside, 900 University Ave., Riverside, CA 92521).

Only in the last century, thanks to the advent of giant telescopes, have we come to realize how strange our Universe really is. Join Dr. Wilson as she recounts how a series of often unlikely, larger-than-life characters made three great discoveries. Learn how a mule driver helped show that the Universe is expanding, how clusters of galaxies were the key to realizing that most matter is in a mysterious dark form, and how distant exploding stars recently revealed that the expansion of the Universe is accelerating. Learn what it is like to be a professional astronomer in the 21st century, and the fun and frustration of using giant telescopes on the ground and in space in the ongoing quest to determine the fate of our Universe.

Thursday Noon Plenary Lecture #2
Thursday at 12:15 p.m. in HUB 268

5 Currents Implicated in Cardiac Arrhythmia, DAVID BLACKMAN (affiliated faculty member, Department of Mathematics, Southern Oregon University, 1250 Siskiyou Blvd., Ashland, OR 97520; gribear@icloud.com).

In the case of cardiac arrhythmia, the usual suspects are actually quite innocent. While calcium bursts, first reported by Leon Glass (PNAS, 95 no. 17, 10283-10287), are clearly associated with arrhythmia, these bursts are not the origin of the arrhythmic signal. Indeed, any majority current from voltage controlled potassium channels or any other toggled channels are innocent. Ever since the Hodgkin-Huxley model was presented in 1952 (J. Physiol. (1952) 117, 500-544), electrophysiology has attempted to explain arrhythmia with increasingly complex chaos modeling. These efforts culminated in the 1999 paper of Raimond L. Winslow et. al. (Biophysical Journal, 76 Issue 4, 1868-1885, 1 April 1999). Winslow’s paper featured a cast analysis with 93 differential equations and 101 initial conditions and constants.

Both Glass’s and Winslow’s papers focus on calcium transport. However, a contemporary paper about T-wave alternans by David S. Rosenbaum, et. al. (Circulation, 99, 1385-1394) clearly implicates a very subtle minority current in the arrhythmia phenomenon, which shifts the focus away from calcium bursting over to passive potassium transport. T-wave alternans can be traced to a depletion of the potassium gradient. If passive potassium leakage deficiency is the cause of arrhythmia, then stimulated active transport should be the cure.

A mathematical analysis of the T-wave was performed to model the T-wave alternans phenomenon. The result of this analysis clearly implicates a reduction in potassium passive transport (potassium leakage current) as the culprit behind the T-wave alternans phenomenon and cardiac arrhythmia.

Thermodynamic analysis of the sodium pump demonstrates that the sodium potassium pump is stimulated by extracellular potassium and is also affected by magnesium ions. In theory, increased pump current can be substituted for reduced passive current in a therapeutic regimen. For example, mild hyperkalemia can, in theory, and does, in practice, arrest cardiac arrhythmia. The relative importance of potassium versus magnesium in the scheme of things is actually a minor problem. Both ions stimulate the Sodium Potassium pump. An accidental and dramatic demonstration of this theory, which occurred in the winter of 2003, will be discussed.

Parametric limitations to this therapy will also be discussed. For example, serum potassium above 6 mEq per liter is of little value and the implications of theorem 2 of the mathematical model, the calcium sodium exchanger theorem, place real limitations on this therapy.

The physics, mathematics, and enzymology of the five theorems of the mathematical model will be the central focus of this talk. Theorem one indicates that the myocyte acts more like a diode than a capacitor. Theorem 2 exposes a membrane voltage toggled sodium calcium exchanger. Theorems three and four derive an equation for the T-wave of the ECG, a theoretical derivation rooted in the conjecture that because the potassium ion is one half spin, it should be subject to Fermi statistics.

The consequence of this mathematical analysis is that ischemic boundary cells have a depressed and elongated T-wave. A linear combination of the normal T-wave with this aberrant T-wave serves to model the T-wave alternans phenomenon. T-wave alternans is a predictor of arrhythmia months in advance. The connection between these phenomena will be elucidated.

Friday Noon Plenary Lecture
Friday at 12:15 p.m. in HUB 260

6 Higher Infinity and the Foundations of Mathematics, JOEL DAVID HAMKINS (City University of New York).

Let me tell you the story of infinity and what is going on in the foundations of mathematics. For over a century, mathematicians have explored the soaring transfinite tower of different infinity concepts. Yet, fundamental questions at the foundation of this tower remain unsettled. Indeed, researchers in set theory and the foundations of mathematics have uncovered a pervasive independence phenomenon, whereby foundational mathematical questions are often in principle neither provable nor refutable. Presented with what may be these inherent limitations on our mathematical reasoning, we
now face difficult philosophical questions on the nature of mathematical truth and the meaning of mathematical existence. Does mathematics need new axioms? Some mathematicians point the way the way towards what they describe as an ultimate theory of mathematical truth. Some adopt a scientific attitude, judging new mathematical axioms and theories by their predictions and explanatory power. Others propose a multiverse mathematical foundation with pluralist truth. In this talk, I shall take you from the basic concept of infinity and some simple paradoxes up to the continuum hypothesis and on to the higher infinity of large cardinals and the raging philosophical debates.

### SYMPOSIA

**Multi-Scale Bioengineering**

**Wednesday, 8:35 a.m. in MS&E 0103**

7 Controlled One-on-One Encounters between Immune Cells and Microbes Provide a New Window into the Mechanisms of the Innate Immune Response, VOLKMAR HEINRICH (Department of Biomedical Engineering, University of California Davis, 451 East Health Sciences Drive, Davis, CA 95616; vheinrich@ucdavis.edu).

Infectious, autoimmune, and chronic inflammatory diseases present a rising threat, underlining the need for a deeper understanding of how the immune system recognizes—or fails to recognize—pathogens. Many prevailing gaps in our knowledge can be attributed to an imbalance between the cross-disciplinary nature of the immune response and a lack of truly interdisciplinary studies of the underlying mechanisms. Moreover, there is mounting evidence that insight into the human immune system cannot be reliably inferred from animal models or cell lines.

Immune cells are perhaps the most relevant functional units of the immune system. Mechanistic analyses of single-live-cell encounters with microbes deserve a front-and-center place in the study of host-pathogen interactions. Such enquiries should be integrative, encompassing the spectrum of mechanisms by which immune cells home in on (by chemotaxis), take hold of (through adhesion), and internalize (by phagocytosis) microbial pathogens. We here discuss new, interdisciplinary approaches to study independently single-cell chemotaxis, adhesion, and phagocytosis by analyzing one-on-one encounters between immune cells and bacteria or fungi. These experiments use non-adherent cells, thus preventing premature cell activation. They offer unprecedented control over cell-microbe contacts and have a time resolution of fractions of a second. They also facilitate an essentially axisymmetric configuration of the cell-microbe pair, which is viewed from the side, allowing us to visualize the interaction with unique clarity. These experiments have been validated with various types of human immune (and other) cells, and have already revealed insight into cellular behavior that had been inaccessible to traditional techniques.

8 Scalable Drug Infusion Technologies, ELLIS MENG (Department of Biomedical Engineering and Ming Hsieh Department of Electrical Engineering, University of Southern California, 1042 Downey Way, DRB-140, Los Angeles, CA 90089-1111; ellis.meng@usc.edu).

Controlled drug administration is a critical tool for scientific investigation, drug discovery, and most importantly, the treatment of chronic diseases and conditions. Animal models, typically starting in rodents, are commonly employed in the early investigation of potential therapies. However, methods of and technologies for administration available for use in small animals are limited and do not allow for advanced temporal and spatial control of delivery. These factors severely limit the ability to maximize the therapeutic efficacy of infused agents and management of associated side effects. Thus, a new paradigm for studying and treating diseases using next generation delivery pumps enabled by biomedical microelectromechanical systems (bioMEMS) was introduced. These pumps feature on-demand dosing with operation over a wide dynamic range of flow rates, remote and wireless operation, accurate electrolysis-based pumping, a refillable drug reservoir, and broad drug compatibility. Our advanced bioMEMS pumps infuse drugs directly to the site of therapy and enable chronic drug therapy with only a single surgical procedure. The drug infusion technologies developed were specifically designed to be scalable so as to enable infusion pumps for miniaturized for pre-clinical research and devices large enough to accommodate clinical needs. This talk will present the infusion approach and different applications enabled by the technology.

9 Biological Insights from Measuring the Physical Properties of Cells and Organisms, WILLIAM H. GROVER (Department of Bioengineering, University of California, Riverside, 219 MS&E Building, 900 University Ave., Riverside, CA 92521; wgrover@engr.ucr.edu).

The fundamental physical properties of a cell or microorganism—its mass, volume, and density—provide a unique window into the biology of that cell or microorganism. Since a cell’s physical properties are largely determined by its biological state, changes in cell state can manifest themselves as measurable changes in the cell’s physical properties. And since all cells have these physical properties, techniques for measuring these properties are truly “label free” and suitable for studying all types of cells and microorganisms.

In this presentation, I will share results from our most recent measurements of the physical properties of different cell types. We measure the mass, volume, and density of single living cells using Suspended Microchannel Resonator...
10 A Kinetic Model of Multivalent Nanoparticle Binding, JERED B. HAUN1,2,3* and MINGQIU WANG1 (1Department of Biomedical Engineering, 2Department of Chemical Engineering and Materials Science, 3Chao Family Comprehensive Cancer Center, University of California Irvine, 3107 Natural Sciences II, Irvine, CA 92617; jered.haun@uci.edu).

Targeted delivery of imaging or therapeutic agents holds tremendous potential to transform detection and treatment of diseases such as cancer and atherosclerosis. However, this potential has remained largely untapped clinically because molecularly-targeted agents have failed to provide sufficient delivery yield and/or specificity. Thus, new strategies are needed not just to improve targeting results, but radically shift the paradigm. Nanomaterial carriers offer numerous advantages as a delivery platform, but targeted nanoparticle agent development has focused simply on generating specificity. This means that binding performance is only evaluated based on equilibrium behavior. But adhesion within the body is a dynamic process, and thus we believe that a kinetic treatment will be far more powerful. In previous work, we developed a framework to study multivalent nanoparticle adhesion from a kinetic standpoint and studied the influence of numerous design parameters. One of the major findings was that multivalent binding causes the kinetic binding rates to vary on a time-scale that can be captured experimentally. The focus of our most recent work is on developing a computational simulation of nanoparticle docking that includes stochastic and biophysical components to capture the time-variant nature of nanoparticle binding kinetics. Previous simulation treatments have focused on how the formation of multiple bonds affects thermodynamic energy. Our approach will enable recapitulation of the temporal components of experimental binding studies while adding valuable information about bond dynamics and providing predictive power for future experimental investigations.

11 In-situ Advanced Optical Spatiotemporal Analysis of Collagen Systems, JULIA LYUBOVITSKY1*, YU-JER HWANG2, XUYE LANG3, CASSANDRA TURGMAN4, and JOSEPH GRANELLI1 (1Department of Bioengineering, University of California, Riverside, 239 MSE, Riverside, CA 92521; 2Cell, Molecular and Developmental Biology Program, University of California, Riverside, Riverside, CA 92521; 3Department of Biochemistry, University of California, Riverside, CA 92521; jered.haun@uci.edu).

Recently, we applied in-situ multiphoton imaging that employs intrinsic contrasts of second harmonic generation (SHG) and two-photon fluorescence (TPF) to evaluate structural states of fibrillar collagen within collagen hydrogels. We prepare these systems while employing different ions, incubate them at different temperatures and modify them with reducing sugars. The investigations of how the reactions between the reducing sugars (prevalent in diabetes mellitus) and collagen affect the 3D collagen architecture had been revealing. For example, we incubated 37 °C polymerized collagen hydrogels with fructose – a simple sugar in honey, fruit and high-fructose corn syrup. After about 20 days of incubation at 37 °C, there was a rather significant induction of in situ fluorescence. The two-photon fluorescence emission was detected at about 460 nm for 730 nm excitation wavelength and shifted to 480 nm when we changed the excitation wavelength to 790 nm. The one-photon fluorescence emission was centered at about 416 nm when excitation was 330 nm. It red shifted and split into two peaks centered at about 430 nm and 460 nm for 370 nm excitation; 460 nm peak became predominant for 385 nm excitation and further shifted to 470 nm for 390 nm excitation. SHG and TPF imaging showed restructuring of hydrogels upon fructose modification. Our studies on collagen hydrogels create a solid foundation in understanding of how reducing sugars affect the collagen and its 3D architecture. They can possibly aid in diagnosing the complications of a chronic disorder such as diabetes mellitus in situ.

12 Label-free Imaging of Neural Activity from Brain to Single Neurons, M. REZUANUL HAQUE, MICHAEL C. OLIVEIRA, MELISSA M. EBERLE, CARISSA L. RODRIGUEZ, CHRISTIAN M. OH, and B. HYLE PARK* (Department of Bioengineering, University of California, Riverside, CA; hylepark@engr.ucr.edu).

Current technology largely allows for detection of neural activity on two distinct spatial scales: in ensemble collections of neurons as in MRI, and in a limited number of individual neurons using electrodes and optical microscopy. More recent techniques, including multi-electrode arrays and genetically-encoded calcium indicators, have started to allow detection of activity on an intermediate scale. However, these methods require some level of invasiveness, either in the form of near or direct contact with electrodes or requiring introduction of some exogenous contrast agent. We have been exploring the potential of optical coherence tomography (OCT) for label-free imaging of neural activity on a range of spatial scales from the brain to single
neurons. On a larger spatial scale (4x4x2mm), we have observed the temporal evolution of localized changes in backscattered intensity in three dimensions in both global (induced with PTZ) and focal (induced with 4-aminopyridine (4-AP)) murine seizure models and analyzed the differences in seizure propagation in the time-resolved 3D functional maps. At an intermediate range (0.3x0.3x1.0mm), OCT can be used to detect changes associated with activity in acute hippocampal brain slice that can be correlated with recordings from multi-electrode arrays. On a single cell level, OCT can be used to detect transient changes in the thickness of single cells in the optic nerve associated with the limbus compound eye. These results demonstrate the potential of OCT as a single, label-free optical imaging platform to detect neural activity on a range of spatial scales.

13 Mechanism of Bone Remodeling in Normal and DMP-1 Deficient Mice, MEGAN VELTEN*, JIAN Q. FENG†, and PRANESH B. ASWATH* (Materials Science and Engineering Department, Box 19031, University of Texas at Arlington, Arlington, TX 76019; †Department of Biomedical Sciences, Texas A&M Health Science Center, Baylor College of Dentistry, Dallas, TX; Aswath@uta.edu).

Differences in apparent and actual density have been noted in the mineralized tissue of postnatal dentin matrix protein-1 (DMP1) mice. In order to investigate this difference at the lowest hierarchical level, a XANES (X-ray Absorption Near Edge Structure) spectroscopy investigation of DMP1 null mice was performed. Female wild type (WT) and DMP1 null mice (KO) were sacrificed (21 d), stored, and the femurs (n=5) were collected, sectioned, and dehydrated. The K- and L-edges of Ca and P and the L-edge of O were obtained at the Canadian Light Source synchrotron facility. The P L-edge data (50x50µm spot size, ~10-20 nm penetration depth) showed evidence of phosphate soluble species in the KO samples, but the higher energy P K-edge data (200x50µm, ~500 nm penetration depth) showed no significant difference in the phosphate bonding structures of the WT and KO mice. The low energy Ca L-edge data showed evidence of a local depletion of Ca in the KO mice while the O L-edge data showed increased carbonate content of the KO bone. Taken together this data creates a picture of a unique local coordination of phosphorus in the mineralized tissue of the DMP1-null bone at an earlier stage in the lifecycle than the phenotype is generally observed. These changes observed in the crystal structure of the mineral matrix help explain DMP1 role in the mineralization of tissue.

14 Engineering Nutrient Derived Alloys for Medical Applications, HUINAN LIU (Department of Bioengineering, Materials Science and Engineering Program, and Stem Cell Center, University of California, Riverside, CA 92521, USA; huinanliu@engr.ucr.edu).

Current medical implants and devices are mostly made of titanium alloys or stainless steel – permanent materials that potentially increase patients’ risk in infection and chronic pain, and often require secondary surgeries for removal. Because of clinical problems associated with these traditional materials, a novel class of biodegradable metallic materials, i.e., magnesium-based alloys, attracted great attention and clinical interests. Controlling the interface of Mg with the biological environment, however, is the key challenge that currently limits this biodegradable metal for broad applications in medical devices and implants. This talk will particularly focus on how to create nanostructured interface between the biodegradable metallic implant and surrounding tissue for the dual purposes of (1) mediating the degradation of the metallic implants and (2) simultaneously enhancing bone tissue regeneration and integration. Nanophase hydroxyapatite (nHA) is an excellent candidate as a coating material due to its osteoconductivity that has been widely reported. Applying nHA coatings or nHA containing composite coatings on Mg alloys is therefore promising in addressing the challenges in commercializing biodegradable metallic implants. The composite of nHA and poly(lactic-co-glycolic acid) (PLGA) as a dual functional interface provides additional benefits for medical implant applications. Our results indicate that nHA and nHA/PLGA coatings slow down Mg degradation rate and enhance adhesion of bone marrow stromal cells, thus promising as the next-generation multifunctional implant materials. Further optimization of the coatings and their interfacial properties are still needed to bring them into clinical applications.

15 Multi-step Self-organization of Tissue-scale Tubules, CHIN-LIN GUO (Division of Engineering and Applied Science, Caltech, Pasadena, CA; guochin@caltech.edu).

The ability of cells to self-organize into multi-scale architectures raises the possibility that understanding such processes can help engineer organs for regenerative medicine. Here, we engineer in vitro microenvironments to study how epithelial cells can self-organize into tissue-scale tubules without the guidance of morphogen gradients. We find two distinct behaviors. When cells are surrounded by pre-assembled 3-D extracellular matrix, they spontaneously develop long-range mechanical interactions (up to 600 microns) to promote tumor cell invasion. In contrast, when ECM assembly is limited and broken into multiple stages, cells form two tissue architectures of distinct scales: low cell density leads to the formation of isotropic acini (50-100 microns), and high cell density leads to the self-organization of long tubules (few centimeter-long, hundreds of micrometer-wide). Our results pave the way for a quantitative study of how cell-microenvironment interactions lead to multi-scale self-organization and/or tumor invasion.
Despite the promising potential of induced pluripotent stem cells (iPSCs) for personalized regenerative medicine and tissue engineering, their tendency of tumorigenesis and teratoma formation poses a major challenge for therapeutic applications. In this regard, controlling the differentiation of the cells to specific target cell types in vitro provides a means to overcome such risks. Traditionally, the formation of embryoid bodies has been used to enhance differentiation of stem cells, but the low efficiency with heterogeneous differentiation of the method remains a major limitation. Considering significant effects of microenvironments on stem cell differentiation, therefore, tightly controlled scaffolding may provide a tool to maximize the differentiation efficiency. In this study, electrospun nanofibrous scaffolds with varied mechanical properties were used to differentiate human iPSCs to mesendodermal or ectodermal lineages. During pre-culture of the iPSCs, a flat, two-dimensional colony morphology was observed on stiffer scaffolds accompanied by enhanced proliferation. In contrast, a round, three-dimensional colony morphology was observed for iPSCs cultured on softer scaffolds with retarded self-renewal. Such differences in colony morphology depending on the mechanical properties of scaffolds, resulted in significant alterations in stem cell differentiation. For mesendodermal differentiation, its differentiation was positively correlated to increased stiffness of the scaffolds while it was inversely correlated for ectodermal differentiation. These results offer promising solutions to enhance the efficiency of iPSC differentiation towards specific lineages by means of modulating micro-mechanical environments of the cells.

17 Engineering the Neural Microenvironment to Promote Spinal Cord Regeneration, STEPHANIE K. SEIDLITS1,2,8, RYAN M. BOEHLER2, ALINE M. THOMAS3, DOMINIQUE SMITH4, DANIEL J. MARGUL5, ASHLEY G. GOODMAN6, TODOR V. KUKUSHLIEV7, TING HE2, DYLAN A. MCCREEDY7, JAIME PALMA2, DONNA M. HASSANI4, BRIAN J. CUMMINGS, AILEEN J. ANDERSON, and LONNIE D. SHEA2 (1Department of Bioengineering, University of California Los Angeles, 420 Westwood Plaza, Los Angeles, CA 90095; 2Department of Chemical and Biological Engineering, 3Department of Biomedical Engineering, 4Department of Psychology, Northwestern University, 2145 Sheridan Rd., Evanston, IL 60208; 5Department of Physical Medicine and Rehabilitation, Anatomy and Neurobiology, University of California Irvine, Sue and Bill Gross Hall, Irvine, CA 92697; seidlits@ucla.edu).

The local environment after spinal cord injury (SCI) lacks cues support axon growth, cell survival, and remyelination and exhibits an abundance of cues that inhibit these processes. Development of clinically effective strategies to restore function after SCI will require consideration of multiple aspects of this inhibitory environment. The goal of this research is to develop a multifaceted therapy for SCI repair which uses a biomaterial platform to present an architecture that guides regenerating axons across the injury site and gene delivery vectors encoding for growth factor cues that enhance cell survival, reduce inflammation, prevent formation of a dense glial scar and promote axonal growth and remyelination. Previously, we have reported that porous bridges with a defined channel architecture that significantly encourage axons to regenerate across the injury site and can be used to deliver lentiviral vectors.

This research builds upon the success of these bridges by adding a gene delivery component to enable localized, sustained expression of multiple factors designed to simultaneously address different barriers to spinal cord regeneration. Moreover, these factors were selected to target various barriers to spinal cord regeneration. First, we report that delivery of lentivirus encoding for interleukin-10 (IL10) significantly reduces the presence of specific inflammatory cells thought to be detrimental to repair. In addition, we demonstrate that tandem delivery of sonic hedgehog (SHH) and neurotrophin-3 (NT-3) significantly increases the number of myelinated, regenerated axons in a mouse model of SCI.

18 Physical Determinants of Endothelial Inflammation, KAUSTABH GHOSH (Department of Bioengineering, University of California, Riverside, CA 92521; kgosh@engr.ucr.edu).

Chronic endothelial inflammation contributes significantly to the development of pathological conditions such as atherosclerosis and diabetic retinopathy. Aging and diabetes, important risk factors for these diseases, are also characterized by chronic endothelial inflammation. Importantly, the stiffness of sub-endothelial extracellular matrix (ECM) is significantly altered in such inflammatory conditions. However, whether a causal relationship exists between aberrant ECM stiffness and chronic endothelial inflammation remains unknown. Here we show that excessive ECM stiffening or softening alone can significantly enhance leukocyte-endothelial cell (EC) adhesion, the earliest step in endothelial inflammation. Further, the preferential increase in leukocyte-EC adhesion on soft and stiff ECM correlates inversely with levels of nitric oxide, an endogenous anti-inflammatory factor, but directly with the activation of NF-kB, the master inflammatory transcriptional switch. Importantly, these studies have revealed a mechanosensitive ion channel that plays a critical role in this ECM stiffness-dependent biphasic regulation of endothelial inflammation. Our ongoing work is aimed at delineating the underlying mechanotransduction pathway that mediates this process as it has the potential to offer a new therapeutic target for immunomodulation and cardiovascular normalization.
Advances in Fluid Mechanics and Turbulence
Wednesday, 8:35 a.m. in MS&E 0113

19 Lagrangian and Eulerian Acceleration Properties in Homogeneous Turbulence with Shear and Rotation, FRANK G. JACOBITZ1*, KAI SCHNEIDER2, WOUTER J.T. BOS3, and MARIE FARGE4 (1Mechanical Engineering Department, Shiley-Marcos School of Engineering, University of San Diego, 5998 Alcalá Park, San Diego, CA 92110, USA, jacobitz@sandiego.edu; 2Laboratoire de Mécanique, Modélisation, et Procédés Propres du Centre National de la Recherche Scientifique, Aix-Marseille Université, 38 rue Joliot-Curie, 13451 Marseille Cedex 20, France, kschneid@lcm.univ-mrs.fr; 3Laboratoire de Mécanique des Fluides et d’Acoustique du Centre National de la Recherche Scientifique, Ecole Centrale de Lyon, Université de Lyon, 69134 Ecully Cedex, France, wouter.bos@ec-lyon.fr; 4Laboratoire de Météorologie Dynamique du Centre National de la Recherche Scientifique, Ecole Normale Supérieure, 24 rue Lhomond, 75231 Paris Cedex 5, France, farge@lmd.ens.fr)

The properties of Lagrangian and Eulerian acceleration of turbulence are important for a variety of problems ranging from fundamental theoretical considerations to modeling of dispersion processes. The acceleration statistics of rotating and sheared homogeneous turbulence are studied here using direct numerical simulations. The study focuses in particular on the influence of the Coriolis to shear rate ratio and also on the scale dependence of the statistics. The probability density functions (pdfs) of both Lagrangian and Eulerian acceleration show a strong and similar influence on the rotation ratio. The flatness further quantifies this influence and yields values close to three for strong rotation. For moderate and vanishing rotation, the flatness of the Eulerian acceleration is larger than that of the Lagrangian acceleration, contrary to previous results for isotropic turbulence. A wavelet-based scale-dependent analysis shows that the flatness of both Eulerian and Lagrangian acceleration increases as scale decreases. For strong rotation, the Eulerian acceleration is more intermittent than the Lagrangian acceleration, while the opposite result is obtained for moderate rotation.

20 Subtle Effects of Air Lubrication, CAMPBELL DINSMORE1*, MARKO PRINCEVAC1, RICHARD COPCA, JOSHUA HAUSER, WARNER TSE, PAUL LOU, JIT MALAY, and CHRISTOPHER MORALES (Department of Mechanical Engineering, University of California, Riverside, 900 University Ave., Riverside, CA 92521; cdinsmore@engr.ucr.edu).

With the advent of terms like “globalization” and “export driven economy”, international trade is clearly an important part of the world’s economic landscape – trade that travels, in significant part, across the world’s oceans. Even though maritime shipping is efficient, making it more effective is crucial to reducing global transportation costs and the shipping industry’s environmental impact. Consequently, numerous studies have investigated the “air lubrication” of the ship’s hull in which air bubbles are introduced along a ship’s wetted surfaces in an attempt to reduce the drag on the ship. Significant power reductions (about 6% net) have been achieved with some air lubrication systems. Almost completely absent in these studies, however, is the bubbles’ impact on the propeller’s thrust. Consequently our initial focus has been to design and conduct model tests in a water channel that attempt to capture this effect. During these tests, bubbles were injected near the propeller of a remote controlled boat and the resulting thrust was measured. Combinations of trials with and without bubbles were run and initial results indicate a 4.5% reduction in thrust when bubbles are present. Alongside this experimental work, theoretical investigations into the nature of the bubble/water interaction have also been undertaken. This work has led to the development of creeping flow equations describing flow fields in both very small bubbles and the water that surrounds those bubbles. In this presentation, preliminary experimental results for the propeller tests and theoretical solutions for shear flow around micro-bubbles will be presented.

21 New Superfog Screening Tool – Development and Validations through Laboratory Experiments, CHRISTIAN BARTOLOME1*, MARKO PRINCEVAC1, AKULA VENKATRAM1, DAVID WEISE2, GARY ACHTEMEIER2, and SHANKAR MAHALINGAM4 (1Department of Mechanical Engineering, University of California, Riverside, Riverside, CA 92521; 2USDA Forest Service Pacific Southwest Research Station, Riverside, CA 92507; 3USDA Forest Service Southern Research Station, Athens, GA 30602-2044; 4College of Engineering, University of Alabama, Huntsville, AL 35805; cbartolo@engr.ucr.edu).

Superfog is dense smoke cloud that reduces visibility to less than 10 feet. Major car pile ups, such as ones in Florida on the Interstate Highways 4 and 75 in 2008 and 2012, have resulted due to the formation of a Superfog. Here we will present laboratory modeling efforts that have been conducted to explain the origins of Superfog and that led to the development of a new screening tool. Thermodynamics of water vapor, droplet size distribution, liquid water content, extinctions coefficients and boundary layer development were explored. Wind tunnel measurements of smoldering smoke and smoke boundary layer growth have been conducted for various environmental and fuel conditions.

In these experiments the favorable conditions for the Superfog formation were determined to be: fog droplet sizes less than 1 micrometer, minimum cloud condensation nuclei concentrations of 10^6 per cem, liquid water content greater than 2 g kg^-1, ambient temperature less than 40°F, ambient humidity greater than 80%, fuel moisture contents greater...
than 40% by mass, and wind velocities less than 1 m s⁻¹ (2.2 mph).

The Superfog Analysis Model (SAM) has been developed to aid land managers to quickly assess situations as favorable or unfavorable to the formation of Superfog. SAM has been validated by laboratory experiments and has been successful in predicting previous Superfog events. The underlying theory and laboratory experiments in the development of SAM will be presented.

22 A Study of the Flow Field Surrounding Interacting Line Fires, Trevor Maynard*, Marko Princevac, and David Weise (USDA Forest Service Technology and Development Program, San Dimas, CA 91773, tbmaynard@fs.fed.us; University of California, Riverside, Riverside, CA 92521, marko@engr.ucr.edu; USDA Forest Service Pacific Southwest Research Station, Riverside, CA 92507, dweise@fs.fed.us).

The interaction of converging fires often leads to significant changes in fire behavior, including increased flame length, angle, and intensity. In this presentation, the fluid mechanics of two adjacent line fires is discussed theoretically and experimentally. A simple potential flow model is used to explain the tilting of interacting flames towards each other, which results from a momentum imbalance triggered by fire geometry. The model was validated by measuring the velocity field surrounding stationary alcohol pool fires. The motion of smoke structures was analyzed using a cross-correlation optical flow technique. The measured velocities and flame angles are found to compare reasonably with the predicted values, and an analogy between merging fires and wind-blown flames is proposed.

23 Ignition of Live Vegetation by Convection and/or Radiation – Preliminary Results, David R. Weise*, Thomas H. Fletcher, Sara McAllister, and Jonathan Gallacher (USDA Forest Service, Pacific Southwest Research Station, Riverside, CA 92507, dweise@fs.fed.us; Brigham Young University, Provo, UT 84602, tom_fletcher@byu.edu; USDA Forest Service, Rocky Mountain Research Station, Missoula, MT 59807, smallister@fs.fed.us).

In wildland fires, the process of ignition is not well-described. Particularly in live fuels (living vegetation), the relative importance of radiation and convection have received little study; however, radiation has been assumed to be the dominant heat transfer mode. We are studying the ability of radiant and convective sources to ignite samples of fresh live vegetation over the annual growth cycle to determine whether the seasonal changes in ignition trends hold between different modes of heating. Convective heating is produced using a flat-flame burner, and tests with both convection and radiation include a radiative panel above the burner. Radiation only tests are performed in a small-scale wind tunnel with radiant panel. Preliminary results from three species - lodgepole pine (Pinus contorta), big sagebrush (Artemisia tridentata), and chamise (Adenostoma fasciculatum) will be presented.

24 Experiments on Surface Fire Transition to the Elevated Live Fuels, Sunday Omodan*, Christian Bartolome, Raul-delga Delgadillo, Joey Chong, Gloria Burke, Marko Princevac, and David Weise (Department of Mechanical Engineering, Bourns College of Engineering, University of California, Riverside, 900 University Ave. CA 92521, USA, cbartolo@engr.ucr.edu, rdelg002@ucr.edu, marko@engr.ucr.edu; USDA Forest Service, Pacific Southwest Research Station, Riverside, California, USA, jchong@fs.fed.us, gburke@fs.fed.us, dweise@fs.fed.us).

Ecosystem damage by wildland fire is on the increase. An estimated 9,907 wildland fires burned 577,675 acres and an additional 542 prescribed fires were used to treat 48,544 acres by various agencies in California in 2013. Five percent of California wildland is covered by chaparral which can burn vigorously under favorable conditions. Fire in the elevated canopy in chaparral fuels has been described as a crown fire. Fire behavior modeling and measurements lead to tools for decision making in both combating wild fires and validating fire predictions. The majority of crown fire research has been focused on coniferous forests, and limited research has been conducted on chaparral crown fires.

Laboratory experiments conducted in a wind tunnel facility are focused on understanding chaparral crown fire behaviors, particularly the ignition, mechanisms of flame propagation, spreading, burning dynamics of the flame front and fuel consumption rates. Impacts of surface fire, relative position of the crown in either the continuous and intermittent flame zone, presence of wind, environmental temperature and humidity, and fuel moisture content are variables being examined.

Experiments conducted under zero wind speed conditions produced near vertical surface flames and lower flame heights which resulted in some cases of crown ignition failure. Introduction of wind speed of 1 m/s led up to 3 times higher surface flames when compared to the zero wind speed conditions. Video footages taken during experiments and data on fire behavior characteristics will be presented.

25 Characterizing Wicking for Development of Paper-based Analytical Devices, Carlos Castro*, Cindy Rosillo, and Hideaki Tsutsui (Department of Mechanical Engineering, University of California, Riverside, 900 University Ave. Riverside, CA 92521; htutsui@engr.ucr.edu).

Paper-based analytical devices are emerging technologies with transformational potential in revolutionizing
point-of-care diagnostics. Because paper is a low-cost, ubiquitous, and self-wicking material, it is an ideal substrate for developing simple-to-use, portable, and disposable devices for fluid specimen. Existing devices are typically simple lateral-flow tests whose functions are limited to low-level qualitative detection of analytes. To significantly expand functionality of paper-based analytical devices, it is necessary to better understand fluid transport within the channel networks defined on the paper substrate. In this study, we investigated fluid wicking in various one- or two-dimensional geometries that were created by printing and melting a wax-based ink on a sheet of filter paper. Wet-out flows through porous media are often described using the Lucas-Washburn equation, which models the porous medium as a bundle of rigid capillaries. However, this classical equation is insufficient in describing effects of swelling, tortuosity, channel boundary, and evaporation, all of which are evident in operations of most paper-based devices, resulting in retardation of fluid flow. We experimentally investigated effects of these parameters and developed a modified version of the Lucas-Washburn equation which now provides a more accurate prediction of fluid wicking through paper channels under non-ideal conditions. In addition, we analyzed the wet-out flow in a variety of channel components that can be used to construct more complex fluidic circuitries. Collectively, these results are expected to help develop more functional paper-based analytical devices.

26 Recent Advances in Optical Thermocavitation, DARREN BANKS*, MOLLY DANIELS, and GUILLERMO AGUILAR (Department of Mechanical Engineering, University of California, Riverside, 900 University Ave., Riverside, CA 92521; dbank005@ucr.edu).

While optical thermocavitation has been observed by photonics and fluids researchers for over 50 years, recently a surge of research interest has led to novel applications and developments in this field. Notably, the use of relatively low-power and readily available continuous-wave lasers to induce optical thermocavitation has opened up a range of possibilities, from using high-velocity liquid jets produced by cavitation bubbles as optical and acoustic waveguides, to drug delivery by micro-perforation in the stratum corneum. At the same time, new techniques for characterizing cavitation, such as the Spatial Transmission Modulation method, are nascent. We present an overview of modern developments in the field of optical thermocavitation, including advances in measurement and characterization technology, insight into the thermocavitation process, and emerging applications in biomedicine and other fields of thermocavitation.

27 Single Droplet and Train Impingement Pool Cooling, DARREN BANKS*, CYNTHIA AJAWARA, JIE LIU, and GUILLERMO AGUILAR (Department of Mechanical Engineering, University of California, Riverside, 900 University Ave., Riverside, CA 92521; dbank005@ucr.edu).

The thermal interaction of an impacting, cooling water droplet or train of droplets and a heated (T = 60°C) solid substrate is explored for various pool conditions on the substrate. The cooling effects are related to impact velocity (0-3 m/s), pool depth (0-20 mm), and droplet diameter (1-5 mm); for a train of droplets the influence of impact frequency (0.5-30 Hz) is added. Using high speed video, the droplet diameter and impact velocity are measured, as well as the dynamics of the cavity formed within the liquid pool after impact. Embedded at the substrate surface is a fast response RTD which provides temperature history. Using a finite-time step integration of Duhamel’s theorem, the instantaneous heat flux and net heat extraction at the surface are computed.

For a single droplet impact, heat transfer appears to be maximized within an intermediate range of impact Weber number. Higher and lower Weber numbers than this range dramatically decreases heat flux. The optimum Weber number is increased by larger pool thicknesses. This range is characterized by the cavity approaching the substrate but not making contact; this brings cool droplet fluid into direct contact with the substrate. Decreasing the Weber number prevents droplet fluid from reaching the substrate; increasing it appears to push liquid away from the measurement point, reducing heat flux at that point. Trains of droplets demonstrated an initial drop in temperature and then fluctuations around a quasi-steady ‘cooled’ temperature point; the magnitude and period of these fluctuations was dependent on the impact frequency.

28 Magnification of Concentrations in Cities, NICO SHULTE*, SI TAN, and AKULA VENKATRAM (Mechanical Engineering, University of California, 3401 Watkins Drive, Bourns Hall A342, Riverside, CA 92507; nschu003@ucr.edu).

A transit oriented development (TOD) is typically a compact community of homes, offices, and shops built within walking distance of a transit station, such as a light rail or a bus station. TODs can change the dispersive ability of the atmosphere relative to that in open terrain. We are conducting a field study of dispersion within TODs in which we measure particle concentrations and meteorology within different built environments within Los Angeles, and simultaneously measure meteorology at a location located upwind of the urban area. Our goal is to develop a model that allows us to understand the effect of the built environment parameters such as the building height, plan area fraction, and frontal area fraction, on the dispersion within a TOD. The effect of buildings is quantified in terms of the magnification, the ratio of urban to rural concentration. We evaluated several alternative dispersion models for the urban environment using observations obtained in our field study, and found that dispersion in urban areas is governed by the mean wind speed and turbulence at street level. We then use the
dispersion models and the micro-meteorological measurements at urban and rural sites to evaluate the magnification. The magnification is usually greater than 1 because the wind speed at street level is reduced relative to the rural area. The magnification is also largest during the early morning, when traffic emissions are also usually large.

29 Understanding the Impact of Built Environment on Air Quality in Transit Oriented Developments, SI TAN*, NICO SCHULTE, and AKULA VENKATRAM (Mechanical Engineering, University of California, 3401 Watkins Drive, Bourns Hall A342, Riverside, CA 92507; stan004@ucr.edu).

Transit Oriented Developments (TODs) are designed to promote walking, cycling, and public transportation to reduce motor vehicle emissions by increasing the density of people through the use of multi-story buildings. In principle, TODs should improve local air quality, but the effect of these multi-story buildings on dispersion within the urban canopy is not yet known. Thus, we are conducting a field study to investigate the impact of building morphology on local air quality in TODs. To understand dispersion in urban areas, we need to develop a model that allows us to estimate micrometeorological parameters at urban street level using values measured at upwind rural locations. The micrometeorological parameters can be used as surrogates for estimating magnification factors, which is defined as the ratio of rural to urban concentrations, to evaluate the effects of buildings. We made micrometeorology measurements simultaneously at an upwind rural site, at rooftop, and at street level to evaluate the evolution of turbulence and wind speed from rural to urban area. The measurements were made in two cities in California, with average building heights of 6m and 36m. The wind speed at rooftop is slightly lower than the corresponding upwind rural value, and is further reduced at street level. Vertical turbulent velocity fluctuation increases from upwind to rooftop, and decreases from rooftop to street level. As a result, the vertical turbulent velocity fluctuation at street level is similar to the upwind value, and is relatively insensitive to the building height.

30 Near Road Impact of Sound Walls on Air Quality Mitigation, MARKO PRINCEVAC*, SAM POURNAZERI, and BRANDN GAZZOLO (Department of Mechanical Engineering, University of California, Riverside, Riverside, CA 92521; marko@engr.ucr.edu).

Vehicular emissions are one of the major sources of air pollution in urban areas and several epidemiological studies have shown that long term exposure to vehicle related pollutants increases the risk of respiratory diseases, birth defects, premature mortality, cardiovascular disease, and cancer. Since mid-20th century major highways are commonly accompanied with roadside structures known as sound walls. These structures are mainly designed to protect residential areas close to the highway by damping the roadway noise.

The incorporation of these roadside structures brought up the question: how do these structures impact the air quality in residential areas located in the vicinity of highways?

A thorough understanding on the direct impact of sound walls on flow and dispersion can significantly help air quality modelers in development of dispersion models that can accurately predict the human exposure in the areas close to highways. These models can be further incorporated into regulatory approved dispersion models such as AERMOD (Cimorelli et al., 2005) which are used in project-level conformity and hot spot analysis.

The presented research addresses the effects of sound walls through systematic water channel simulations accompanied with numerical modeling, Quick Urban and Industrial Complex (QUIC) model, and traditional simple Gaussian-type dispersion models. In our laboratory setup we visualized the dye spread to observe the average behavior of traffic related pollutants released into the atmosphere. Such visualizations can provide us with great details on the processes involved with the dispersion of such pollutants.

Boise Extravaganza in Set Theory (BEST)
Wednesday at 8:50 a.m. in HUB 260
continues on Thursday at 9:00 a.m. in HUB 260
continues on Friday at 9:30 a.m. in HUB 260

31 Boldface Resurrection and the Strongly Uplifting Cardinals, the Superstrongly Unfoldable Cardinals and the almost Hugely Unfoldable Cardinals, JOEL D. HAMKINS* and THOMAS A. JOHNSTONE (Department of Mathematics, College of Staten Island City University of New York, 1S-215, 2800 Victory Boulevard, Staten Island, NY 10314; jhamkins@gc.cuny.edu).

I shall introduce several new large cardinal concepts, namely, the strongly uplifting cardinals, the superstrongly unfoldable cardinals and the almost hugely unfoldable cardinals, and prove their tight connection with one another --- actually, they are equivalent!---as well as their equiconsistency with several natural instances of the boldface resurrection axiom, such as the boldface resurrection axiom for proper forcing.

32 Abstract submitted after publication deadline. Please refer to Program Changes sheet.

33 Abstract submitted after publication deadline. Please refer to Program Changes sheet.

34 Abstract submitted after publication deadline. Please refer to Program Changes sheet.

35 Abstract submitted after publication deadline. Please refer to Program Changes sheet.
36 Singularizing and Square, MENACHEM MAGIDOR 1 and DIMA SINAPOVA 2* (1Department of Mathematics, Hebrew University of Jerusalem, Israel; 2Department of Mathematics, Statistics and Computer Science, University of Illinois at Chicago, Chicago, IL 60607-7045; sinapova@math.uic.edu).

It is difficult to avoid the weaker square principles at successors of singulars, especially while also violating the Singular Cardinal Hypothesis (SCH). We will discuss the impact of singularizing cardinals on square properties. This is joint work with M. Magidor.

37 Weak Squares and the Failure of SCH, SPENCER UNGER, (Department of Mathematics, University of California Los Angeles, Los Angeles, CA 90095-1555; sunger@math.ucla.edu).

In the 1980’s Woodin asked whether it is consistent that both weak square and the singular cardinals hypothesis both fail at \( \kappa^+ \). In recent joint work with Dima Sinapova we give a partial positive answer to this question. In this talk, I will give some background to the question and ideas from the proof of our result.

38 Abstract submitted after publication deadline. Please refer to Program Changes sheet.

39 Abstract submitted after publication deadline. Please refer to Program Changes sheet.

40 Abstract submitted after publication deadline. Please refer to Program Changes sheet.

Program continues on Thursday. Please refer to page 110 of these Proceedings for those abstracts.

Advances and Challenges in Marine Cell Biology
Wednesday at 9:05 a.m. in MS&E 0003

41 Identification of Novel Egg Activation Circuits Revealed By Integrative Network Analysis of the Sea Urchin Egg Phosphoproteome, HONGBO GUO 1, ANTHONY MORADA 2, ANDREW LUGOWSKI 1, ANA ELISA GARCIA-VEDRENNE 3, RUTH ISSERLIN 1, ANDREW EMILI 1, and KATHY FOLTZ 2* (1Donnelly Center for Cellular and Biomolecular Research, 160 College Street, University of Toronto, Toronto, ON, Canada M5S3E1; 2Department of MCD Biology and Marine Science Institute, University of California Santa Barbara, Santa Barbara, CA 93106; 3Department of EEM Biology, University of California Santa Barbara, Santa Barbara, CA 93106; kathy.foltz@lifesci.ucsb.edu).

At fertilization, an egg rapidly launches a coordinated series of metabolic, cytoskeletal and biosynthetic programs that initiate the egg-to-embryo transition. Studying the complex signaling circuitry that regulates these processes requires model systems that exhibit exquisite synchronicity of fertilization and are amenable to both single cell and biochemical analyses. As such, echinoderms are uniquely suited to probing the mechanism of egg activation. Relying primarily on post-translational modifications to maternal proteins, especially phosphorylation, the echinoderm egg establishes polyspermy barriers within seconds and commits to development within minutes. Using a high throughput phosphoproteomic enrichment platform, we have characterized over 4000 distinct protein phosphorylation events that occur in the Strongylocentrotus purpuratus egg at fertilization. The phosphorylation status of a subset of the proteins was carried out as validation of the approach. Computational integrative network analyses comparing the phosphoproteomes of unfertilized eggs and those at 2 and 5 min post-fertilization revealed many proteins and regulatory circuits that had not been implicated previously in egg activation, including those with similarity to mammalian immune cell activation. An index of these candidate proteins provides a road map for testing specific hypotheses about the mechanism of egg activation. Analyses of the phosphorylation status and experiments designed to test the function of specific proteins are in progress.

42 Comparative Genomes Emphasizing Echinoderms, R. ANDREW CAMERON (Division of Biology, California Institute of Technology, Pasadena, CA 91125; acameron@caltech.edu).

Echinoderms especially sea urchins and sea stars have long been excellent models for studies in cell and developmental biology. In this genomic era, they present new challenges for sequencing but also rich insights through comparative genomics into features conserved over deep evolutionary time. Not only do genome sequences reveal the entire gene catalog for an organism but they also expose the non-coding information that controls the way genes are regulated. The first echinoderm genome sequence assembly was that of the purple sea urchin. With the advent of next generation sequencing techniques two more genome assemblies have been completed and several more are rapidly becoming available. The time is now ripe to compare these genomes among themselves and with higher deuterostomes to identify conserved functions and structures. I will examine the extent and quality of the genome sequences being decoded. Then look at how comparative genomics has been used to understand how cellular and developmental processes work.

43 Life’s Wonderful Solutions: Convergent Molecular Evolution Underlies Origins of Bioluminescence in Marine Animals, TODD OAKLEY (Department of Evolution Ecology and Marine Biology, University of California Santa Barbara,
Despite contingency in life’s history, the similarity of evolutionarily convergent traits like bird and bat wings may represent predictable solutions to common conditions. However, the extent to which the molecular changes underlying convergent traits are themselves convergent remains largely unexplored. I will discuss the convergent origins of bioluminescence and bioluminescent organs. In two different cases, convergent molecular changes underlie convergent phenotypic changes. I first argue that bioluminescent organs of two different squid are convergent, yet their overall levels of gene expression are predictably similar. I next argue that the enzymes responsible for catalyzing bioluminescence in a crustacean and a fish that eats them arose by co-opting similar genes convergently. These results point to widespread parallel changes in gene expression associated with convergent phenotypes. Therefore, nearly optimal and perhaps predictable solutions may drive not only the evolution of phenotypic traits, but also the evolution of overall gene expression levels that underlie those traits.

44 Dissecting Transporter Function in Sea Urchin Embryos, AMRO HAMDOUN*, TUFAN GOKIRMAK, JOSEPH CAMPNALE, and LAUREN SHIPP (Scripps Institution of Oceanography, University of California San Diego, La Jolla CA 92037; Hamdoun@ucsd.edu).

One quarter of the genome encodes membrane proteins, including ion channels, receptors and transporters. Despite extensive expression of these genes in development, understanding of their functions remains rudimentary. Here I review approaches and insights from our efforts to sort, localize and physiologically characterize ATP-binding cassette (ABC) efflux transporters expressed during early development of sea urchin embryos. I will present examples of the use of high-resolution, live-cell imaging of plasma membranes to map transporters to membrane physiological phenotypes and to determine their roles in control of cell motility. I will review how the results have revealed unanticipated functions for membrane transporters in intercellular signaling and tradeoffs between these signaling functions and the functions of transporters protection of the embryo.

45 Predicting Pollutant Transfer from the Oceans to Humans Using Biochemistry and Structural Biology, SASCHA C. T. NICKLISCH1*, GEOFFREY CHANG2 and AMRO HAMDOUN1 (*Marine Biology Research Division, Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA 92037-0202; 2Skaggs School of Pharmacy and Pharmaceutical Sciences, Department of Pharmacology, School of Medicine, University of California San Diego, La Jolla, CA 92093-0657; ahamdoun@ucsd.edu).

Small toxic molecules, such as marine natural products and anthropogenic pollutants, can persist in the environment, bio-accumulate in tissue and then transfer through the food chain to humans. Many of these compounds have implications for human health and can be carcinogenic, endocrine disrupting, mutagenic and/or teratogenic. The physicochemical properties, such as vapor pressures, octanol- and air-water partition coefficients, that govern their fate are well known, but less understood are their interactions with membrane proteins that govern chemical uptake and elimination. ATP Binding Cassette (ABC) multidrug resistance (MDR) transporters are present in cell membranes of all organisms and have been extensively studied in the context of rational pharmaceutical design. The overall goal of our work is to apply the same principles to understanding the molecular mechanisms by which natural and man made compounds move through marine cells. Using approaches from biochemistry and protein structural biology, we determined the extent to which there are predictable, evolutionarily-conserved patterns of molecular recognition of persistent organic pollutants (POPs) by MDR proteins. We determined the “real-world” levels of more than 320 POPs in muscle of 120 wild-caught yellowfin tuna (Thunnus albacares) worldwide and tested the most abundant compounds for pollutant/transporter interaction kinetics using purified tuna and mouse ABCB1 protein. The majority of the highly abundant pollutants found in tuna muscle tissue are inhibitors of both mouse and tuna ABCB1, including the flame retardant PBDE-209 (~4.1 μM) and the dielectric and coolant fluid PCB-145 (~4.4 μM). In addition, stereoisomer specific interaction kinetics for compounds (i.e. Dieldrin, 9.2 μM and Endrin, 0.9 μM) were conserved in mouse and tuna proteins, reaching IC_{50} values in the range of the pharmaceutical and model ABCB1 inhibitor cyclosporine A (~1.2 μM). The molecular mechanisms underlying this conserved interaction are the basis for a predictive understanding of small molecule bio-accumulation, and have implications for understanding the behavior of marine natural products and for rational design of low persistence industrial chemicals.

46 Sensing Acid/Base Conditions via the cAMP Pathway, MARTIN TRESGUERRES (Scripps Institution of Oceanography, University of California San Diego, 9500 Gilman Drive (0202), La Jolla, CA 92093, mtresguerres@ucsd.edu).

All organisms regularly experience variations in the levels of carbon dioxide, protons (~pH) and bicarbonate ions in their intra- and extra-cellular fluids. For example, feeding may induce blood alkalosis, exercising and environmental hypercapnia may induce acidosis, and photosynthesis and calcification may induce acidosis or alkalosis (depending on the fluid compartment considered). To maintain homeostasis, acid/base (A/B) stress must be readily compensated. Additionally, carbon dioxide, pH and bicarbonate levels are known to regulate many other biological functions not directly related to A/B regulation. Thus, all organisms must be able to sense A/B conditions. The cyclic AMP pathway...
can mediate multiple physiological responses through PKA-dependent phosphorylation, EPAC proteins, and channel gating. This presentation will discuss the potential roles of soluble adenyl cyclase and transmembrane adenyl cyclases in sensing carbon dioxide, pH and bicarbonate and triggering physiological responses in marine organisms.

47 Diversity in Germ Line Determination, GARY WESSEL (Department of Molecular and Cellular Biology, Brown University, Providence RI 02912; rhet@brown.edu).

A germ-cell lineage is formed during development of the embryo in most animals and eventually makes the eggs and sperm of the adult. This lineage is essential for reproduction, yet the mechanism of how these cells are initially formed is remarkably diverse amongst different animals. Some animals (flys, roundworms, frogs) determine their germ line by acquiring specially aggregated cytoplasmic factors in the early embryo that directs the resultant cell to a germ-line fate. Other animals (mice, primates) instead rely on cellular communication to induce a germ line fate. We are examining these cellular and molecular mechanisms in echinoderms (e.g. sea urchins, sea stars) to take advantage of the manipulations possible in these organisms, and in the context of significant developmental diversity. We find that sea urchins likely use an acquired mechanism to assign the germ-line fate to the four small micromeres that contribute to the germ line, whereas their sister group of sea stars do not have micromeres, and instead appear to use inductive mechanisms (cellular communication) later in development to accomplish the same task. These molecular mechanisms, and the evolutionary transitions that such animals undergo in forming the germ line, are informative to the process of stem cell formation, to the concept of germ line continuity, and to the evolutionary consequences in development for each mechanism in germ line formation.

48 Allorecognition in a Basal Chordate: A Simplified Model for Transplantation Tolerance, ANTHONY W. DE TOMASO (Department of MCD Biology and Marine Science Institute, University of California Santa Barbara, Santa Barbara, CA 93106; detomaso@lifesci.ucsb.edu).

The key event in adaptive immune function is the ability to discriminate between alleles of a highly polymorphic family of proteins called the MHC, by a diverse set of both adaptive and innate receptors. This process is often referred to as histocompatibility, and responsible for the rejection of transplanted tissues. While no orthologs of the MHC or cognate receptors exist in pre-vertebrates, the process of histocompatibility does, and there are well-studied system found throughout the metazoa, from the simplest (marine sponges) to humans. We are studying histocompatibility in the basal chordate, Botryllus schlosseri, and my talk will focus on recent results focused on dissecting this recognition event. Our data suggests that the core processes underlying the ability to discriminate between polymorphic ligands does not reside in the nature of the interacting molecules, but rather the ability of the cell to integrate multiple signaling events from the cell surface and make a decision on a response. These pathways are highly conserved throughout the metazoa, and integration underlies clinically important immune processes such as tolerance and education, of which we know little. Importantly, Botryllus is a simplified model to study these processes. Allorecognition occurs on an epithelial layer of a macroscopic extracorporeal vasculature which can easily manipulated; and to date only two inputs (one activating and one inhibitory) to this process have been shown. Current results will be discussed.

Forensic and Clinical Service Challenges in a Juvenile Arson Explosives and Research Center (JAERIC)
Wednesday, 9:05 a.m. in HUB 379

49 Geopsychological Profiling of Juvenile Fire Setters and Bomb Makers in San Diego County for Schools, ERIC JACOBS*, ADRIANA DEL VECCHIO*, and CHRISTINE COLLINS* (University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; Ronnjohncts@gmail.com, jacobssandiego.edu and Grace@sandiego.edu).

Juvenile fire setting and bomb making behavior has been closely monitored in San Diego for approximately the last ten years through the Burn Institute’s Juvenile Arson Education Research Intervention Research Center (JAERIC). When juvenile fire setters and bomb makers are identified through the community (e.g., schools, churches, parents, and legal authorities), they are often referred to JAERIC for assessment and treatment. In response to these JFSB behaviors, youth are exposed to risk assessments in treatment aimed at reducing the risk for public safety. A significant number of these fire setting incidents occur near or on the campuses of schools located in San Diego County. The deployment of public safety resources could be informed by strategically oriented assessment of the location of these fire-setting incidents. With geopsychological profiling, the County of San Diego would be better informed as to which school districts and areas contain various types of fire setting and bomb making behaviors. This information will allow for more proactive and preventative programs, which could be crafted to address these issues. This presentation examines a research-based model that facilitates geopsychological profiling of JFSBs.

50 Use of a DSM-5 Quadrant with Juvenile Fire Setters and Bomb Makers, DERRICK YOUNG*, PATRICIA JONES, KORI RYAN*, and JESSICA MUELLER* (University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; Ronnjohncts@gmail.com, Ejacobs@sandiego.edu and Grace@sandiego.edu).
Forensic mental health specialists have an ethical and legal obligation to develop assessment and treatment protocols that take into account the full ranges of symptoms that point to psychopathology. These symptoms are assessed using the DSM-5. The DSM-5 is the most commonly used diagnostic reference for mental health practitioners. With the DSM-5’s transition away from the five axis, (dichotomous) diagnoses, toward a continuum-based standard with sometimes overlapping symptoms and/or diagnoses, it is important to re-evaluate how the DSM-5 is used in terms of forensic cases. This is especially relevant when public safety behaviors such as fire setting or bomb making are targeted for treatment. Motivations for these behaviors are largely stemming from psychopathology, and must be adequately identified and disentangled from other risk factors. The DSM-5 is a resource that provides detailed information regarding the types of symptoms, characteristics, and potential treatments for various mental health diagnoses. In relation to juvenile fire setters and bomb makers, the DSM-5 can function as a continuous assessment guide for mental health professionals. When developing assessments for juveniles, mental health professionals will have the ability to determine what particular clinical features of four JFSB-relevant disorders may be present in these juveniles. A DSM-5 Quadrant approach can result in a more precise assessment that also leads to evidence-based treatment.

51 Geopsychological Profiling of Juvenile Fire Setters and Bomb Makers in San Diego County, ANDI FESSLER*, PATRICIA JONES*, and YASMIN SAADATZADEH* (University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; Ronnjohncts@gmail.com, Ejacobs@sandiego.edu and Grace@sandiego.edu).

Nearly 46% of all deliberately set fires set within the United States occur at the hands of children and adolescents, with 1 in 4 fire related deaths attributed to children inappropriately playing with fire. As such, the ability of mental health professionals to identify and critically assess potential risk factors (e.g., individual, peer, family, school, and community influences) when working with juvenile offenders, specifically fire setters and bomb makers, remains paramount. As static (e.g., prior fire setting/bomb making behavior, abhorrent interests) and dynamic (e.g., family lifestyle instability, relational conflict) risk factors unique to a particular region are assessed to attain a more comprehensive and thorough biopsychosocial risk assessment rating, clinicians may then employ more appropriate and specialized clinical interventions given the population of interest. More specifically, professionals must effectively employ a balanced utilization of standardized, empirically based instruments, and professional judgment as they analyze the unique characteristics of each individual and construct a clinical picture of the offender. Our goal is to explore the unique geopsychological risk factors present within juvenile fire setter and bomb maker populations of San Diego County, as well as the forensic implications regarding evidence based risk assessment procedures. Finally, implications for the development of specialized and empirically supported clinical intervention will be explored with respect to programs crated to treat such offenders and reduce the potential for future risk.

52 Clinical Decision Making in the Treatment of Juvenile Fire Setters during the Treatment Termination Phase: A Second Risk Assessment, DERRICK YOUNG*, ANDI FESSLER*, CHRISTINE COLLINS*, and ALEXIS WILSON* (University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; Ronnjohncts@gmail.com, Ejacobs@sandiego.edu and Grace@sandiego.edu).

Juvenile fire setters in treatment may exhibit characteristics that indicate additional at-risk behaviors still present post treatment. As mental health professionals, determining the appropriateness and necessity of additional assessments during the treatment termination phase may aid in a better understanding of the risk level of juveniles in treatment. This will also indicate necessary steps to be taken in order to reduce the likelihood that a juvenile fire setter will relapse into pre-treatment behaviors. Psychological and cognitive developmental stages can be used in identifying factors that may influence the behavior of juveniles who start fires. For example, a juvenile in the early adolescence stage might verbally express a desire for match play or show nonverbal excitement when exposed to images of fire. Clinical practitioners need to be able to identify the at-risk characteristics in juvenile fire setters that indicate a need for additional treatments. Additionally, risk factors associated with recidivism (e.g., family conflict, limited parental acceptance/support, and peer group influences) must be critically assessed as well. Given an aggregation of risk factors, practitioners must be able to determine which treatments can be implemented in order to reduce the possibility of harm and ensure the safety of the juvenile under little to no supervision. It is important for practitioners to be able to identify at-risk behaviors, risk factors, and cognitive behavioral intervention effectiveness to reduce the likelihood of harm through fire setting actions. Our goal is to examine clinical decision making of mental health professionals in the treatment of juvenile fire setters during the treatment termination phase.

53 The Forensic Psychological Patterns of “No Shows” in Juvenile Fire Setters and Bomb Makers, CINDY KIM*, YASMIN SAADATZADEH*, ANDI FESSLER*, and JESSICA MUELLER* (University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; Ronnjohncts@gmail.com, Ejacobs@sandiego.edu and Grace@sandiego.edu).

Each year fires and bombs made by youths in the United States are responsible for hundreds of fire deaths, thousands of burn injuries, billions of dollars in property loss, and
claim more than half of all internationally set fires. In order to understand the motivations and intentions of juvenile fire setting and bomb making occurrences, individual factors (e.g., social and cognitive experiences reflecting social meanings, expectations, and temperament), behavioral factors (e.g., characteristics of the fire-setting behavior itself), and environmental factors (e.g., support systems, methods of control, and expectations of others) must be critically examined. Some premises posit that aberrant behavior, such as fire setting and bomb making, occurs as a result of weak or nonexistent bonds to society, which causes adolescents to behave in socially unacceptable ways. In addition, nonattendance by these delinquent juvenile fire setters and bomb makers has been a continuous struggle for clinical intervention delivery and forensic psychological reviews. While steps have been taken to reduce the number of “no shows,” the numbers of truancy continue to escalate, paralleling escalating recidivism and the increasing costs and impact. In an effort to reduce recidivism and “no shows,” the forensic psychological patterns of the absences in juvenile offenders are examined with attention to the juvenile’s developmental stages and age, biopsychosocial factors, and typical fire setting behaviors.

The Importance of Citizen Science in Forming Scientific Communities from the Local to the National Level

Wednesday, 9:05 a.m. in HUB 268

54 Big Visions, Big Data .... Big Problems, RUSTY RUSSELL (Department of Botany, Smithsonian Institution, Washington, DC 20013; russellr@si.edu).

There is an axiom of science is that there is never enough data. This is, of course, true for natural history sciences as well. However, a great deal of natural history data that has already been collected over the course of more than 250 years is still unavailable, locked in analog form, distant from most research efforts. Another common saying is that you cannot be in two places at the same time. Being in one body in one location also places a certain constraint on one’s capacity to collect ‘enough data’. In the last decade (and, technically, over many decades) a phenomenon generally called ‘citizen science’ has opened the doors to the creation of huge amounts of data on a scale previously unimaginable. From tiny, local projects to global efforts to better understand our planet and deep space, the incorporation of volunteers, both known and anonymous, has made a significant difference. This presentation will provide an overview of global ‘big science’ efforts that employ public participation, a discussion of the nature of projects that do and don’t work, and a study of the mindset and behavior of individuals who commit themselves to help move science forward.

55 Rediscovering California: Engaging the Public in Biodiversity Research and Conservation, ALISON YOUNG*, REBECCA JOHNSON*, SCOTT LOARIE, TERENCE GOSLINER, ELIZABETH BABCOCK, and JEAN FARRINGTON (California Academy of Sciences, 55 Music Concourse Dr., San Francisco, CA 94118; ayoung@calacademy.org, rjohnson@calacademy.org).

The mission of the California Academy of Sciences is to explore, explain, and sustain life. Our museum inspires visitors about the natural world, while our scientists document biodiversity and discover new species in hotspots around the globe. Our citizen science program combines science learning with research, empowering the public to do the same type of work as our scientists, while engaging communities to answer real research questions and connecting people to biodiversity all around them. We are developing a community of naturalists while simultaneously providing scientists and management partners with data required to better understand and conserve biodiversity.

Partnerships have been key to the success of the Academy’s citizen science program. Strong partnerships with management organizations ensure data collected support both research and conservation outcomes. We have organized a citizen science coalition in the Bay Area to further best practices and biodiversity research in the region. With iNaturalist.org, we are building a global network of volunteers and professionals working together to tackle pressing biodiversity and conservation challenges. We are encouraging people to document organisms around them, to help answer research questions, and to come together in ‘bioblitzes’ of parks and open spaces – all with iNaturalist and their smartphones. Together with iNaturalist we developed and launched an app that enables people globally to resurvey historical museum specimens. This experience in the field provides participants the excitement of discovery and demonstrates the importance of museum specimens while generating invaluable data about the changing distributions of plants and animals, key information for conservation.

56 Thinking about Knowledge and Power: Orienting Undergraduates to the Potential and Limits of Citizen Science/PPSR, DANIELA SOLERI (Geography Department, University of California Santa Barbara, Santa Barbara, CA 93106-4060; soleri@geog.ucsb.edu).

“Citizen” science, or public participation in scientific research (PPSR), is quickly gaining attention and diversifying. Practitioners and other researchers are trying to delineate PPSR’s theoretical and practical bases, even as its significance is being demonstrated. For example, there is accumulating evidence that PPSR can foster scientific literacy, environmental awareness, conservation activism, and community organizing; that different forms of participation are associated with different outcomes; and that data gathered by the public and by professionals can be comparable.
At its most fundamental level, PPSR is about knowledge and power. It addresses knowledge in applying the scientific method, though possibly in unconventional ways, but may also include other sources of knowledge. It addresses power because it broadens participation in scientific knowledge generation beyond the academy to any interested member of the public, and to any stage of the scientific process. Given its engagement with knowledge and power, and the hopes and ambitions of the many different current actors, PPSR appears to have much to offer higher education. In this presentation I explore some questions regarding how best to support PPSR’s potential contributions to science and society in undergraduate education: What are the salient characteristics and critical issues to explore when introducing undergraduate students to PPSR and its unique strengths and shortcomings? How can we help students think critically and practically about the validity of scientific knowledge and democratizing potential of participation? The goal of this presentation is to stimulate discussion and exchange of ideas.

57 Urban Citizen Science and the Future of Cities, LILA M. HIGGINS*, GREGORY B. PAULY, and BRIAN V. BROWN (Natural History Museum, 900 Exposition Boulevard, Los Angeles, CA 90007; lhiggins@nhm.org).

Los Angeles is the 14th largest urban agglomeration in the world, with over 18 million people inhabiting 4,850 square miles. Los Angeles also sits in the California Floristic Province, one of Conservation International’s 34 global “biodiversity hotspots.” Despite the high biodiversity and remarkable urbanization of the region, very little research has focused specifically on urban biodiversity even though such studies can be quite fruitful. For example, in sampling insects for one week in one backyard, scientists at the Natural History Museum of Los Angeles County (NHMLAC) discovered one fly species new to science and two other species never before documented in North America. But how do you study biodiversity across a large urbanized region where much of the land is private? We suggest that citizen science is the best answer. Over the last 11 years the NHMLAC has developed a suite of citizen science projects that meet the needs of both scientists and urban residents. Nature Gardens were constructed as a field site and training ground for citizen scientists, and two signature projects were begun that study insects and herpetofauna. Both projects examine how urbanization is impacting the distribution of species and also document introduced species. By engaging citizen scientists to document L.A.’s biodiversity, the Museum is building a dataset, through crowdsourcing, that can influence conservation and urban planning. These data will help Angelenos build a city that works better for humans and for wildlife and can serve as a model to other urban agglomerations around the world.

58 Seeking Out Stink Bugs in Southern California: Using Citizen Scientists to Learn More About Stink Bug Diversity, Behavior and Distribution, and Track the Spread of the Invasive Brown Marmorated Stink Bug (Halyomorpha halys), JAMES M. BRYANT* and MARK S. HODDLE² (Museum Department, City of Riverside, 3580 Mission Inn Ave., Riverside, CA 92501; ²Center for Invasive Species Research, University of California, Riverside, CA 92521; jbryant@riversideca.gov).

The Brown Marmorated Stink Bug (BMSB), while a severe agricultural and home owner pest on the US east coast, is a relatively new invasive pest in CA and its distribution within the state is not well understood. For this reason, the project partners are launching an effort to recruit citizen science volunteers to employ smartphone applications and other digital methods for recording and sharing nature observations, in order to document “finds” of stink bugs, in general, in Southern California, and ultimately provide early detection of additional occurrences of BMSB. Most stink bug species are large, easy to photograph, with conspicuous egg masses, and the partners would provide on-line instructions for collecting georeferenced observations as well as simple tools for stink bug identifications and recognition of evidence of parasitism. Once submitted, photo reports would be verified by Museum and UCR Entomology personnel and then databased for analysis. The national BMSB research team will be aided in its planning for deployment and evaluation of a biological control program for this pest. Via online sharing tools, volunteer participants would quickly see concrete results of their efforts, acquire a positive picture of native species while heightening alertness to BMSB and other invasive species, and ultimately gain appreciation for the role of naturally-occurring enemies of pests as well as species used in biological control programs.

Forensic and Clinical Psychological Research in Uganda: Challenges for Trauma on Top of Trauma Service Delivery Wednesday, 1:25 p.m. in HUB 379

59 Culturally-responsive Approaches for Addressing the Perceptions and Acceptability of Trauma Interventions in Uganda, ERIC JACOBS*, ELIZABETH GRACE*, MAGGIE WILHELM*, CINDY KIM*, ADRIANA DELVECCHIO*, and KATHLEEN THOMAS* (University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; E-mail: REjacob@sandiego.edu, Egrace@sandiego.edu, Grace@sandiego.edu).

Exposure to trauma is a problem that is encountered worldwide, with Uganda being no exception. However, in Uganda perceptions of trauma and appropriate interventions are not consistent with what is experienced in Western countries. Extant communication and understanding...
regarding mental health between the United States and East Africa is quite limited. Yet, the need for trauma interventions and research in this region is significant. For example, war-related trauma for adults and child-soldiers alike are everyday realities for the vast majority of individuals in Uganda. Approximately 30% of individuals exposed to life threatening events can develop symptoms of Post-Traumatic Stress Disorder (PTSD). An increase in services to this geographic area requires an examination of current cultural views on mental health issues and assistance approaches, which often prevents individuals from seeking help due to fear of ridicule by others. Current cultural beliefs are also heavily influenced by the religious views of the area, and result in the perception that the mentally ill individual may be evil, bewitched, or deserving of the illness for a wrongdoing. The clinical goal is to explore culturally responsive ways in which these views on mental health and help seeking behavior can be altered. This paper examines current Ugandan views of the culture that contribute to an outlook that is counterproductive from a mental health perspective. The paper also explores strategies for providing culturally appropriate psychoeducational and other evidence-based therapeutic-based interventions.

60 Group Counseling Training and Supervision for Trauma Issues Faced in Uganda: Why a Counseling Theory is Important, DERRICK YOUNG*, MAGGIE WILHELM*, MONIQUE LITTLE*, and KATHLEEN THOMAS* (University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; Ronnjohncts@gmail.com, Ejacobs@sandiego.edu, and Grace@sandiego.edu).

In Uganda, many citizens face significant trauma from political uprisings and oppression stemming from conflicts between and within communities and villages. The implementation of evidence-based therapeutic-based interventions can be used to address the symptoms exhibited by individuals exposed to traumatic events. This approach stresses a need for developing a culturally congruent sense of wellness to aid in the restructuring for optimal living. For example, mental health professionals may use various mental health treatment theories and the DSM-5/ICD-10 that are used to diagnose PTSD and other psychological issues. There is serious concern that significant proportions of Ugandans have experienced trauma from the past that flow seamlessly into current functioning. For example, young males have been forced and trained to fight and kill for different militant organizations against their own will. At the same time, women and young girls have been subjected to acts of sexual misconduct and rape, which leads to a lack of psychological control regarding their thoughts and behaviors. Culturally-responsive mental health theories can guide competent clinical mental health professionals in assessing what treatment appropriately applies to a patient’s unique clinical situation. Group psychotherapy training and supervision for trauma issues faced in Uganda are also areas that can be addressed by mental health professionals.

61 Culturally-Responsive Approaches for Addressing Severe Mental Health Issues Associated with HIV and AIDS, KATHLEEN THOMAS*, MELISSA KOENIGSBERG*, CHRISTINE COLLINS*, and MONICA GAMBILADO* (University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; Ronnjohncts@gmail.com, Ejacobs@sandiego.edu, and Grace@sandiego.edu).

This research addresses the necessity of using culturally responsive approaches for individuals with severe mental health issues associated with HIV and AIDS in Uganda. A significant increased rate of deliberate self-harm is associated with HIV/AIDS phobia and the diagnosis of HIV/AIDS within this population. The pervasiveness of this problem is sufficient to demonstrate a need for increased mental health services that are culturally appropriate, and accounts for acute psychological trauma. Other relevant traumatic events include rape, recurring psychological trauma due to war, unemployment, and domestic problems that stem from byproducts of an unstable political environment. This intervention approach also requires an examination of cultural differences in gender roles. Practitioners must examine the role that societal gender norms assume with regards to individual experiences related to accessing health care and mental health services. Examinations of cultural motivations for actions such as attempted suicide must also occur. Research has demonstrated that Ugandan patients are generally more motivated by anger, which may be fueled by their current environment compared to their Western counterparts. Ugandan patients identify shame as a motivating emotion behind suicidal ideation and action, which is commonly present post-HIV/AIDS diagnosis. Shame from medical illness, coupled with community isolation, can lead to the severe mental health issues in question. Though studies show that, while the majority of Ugandans believe that mental health conditions like depression should be treated, their opinions on where treatment should be sought vary greatly. In this paper, an understanding how mental illness is conceptualized within this culture can assist qualified practitioners create culturally competent and ethically-appropriate treatment plans.

62 An overview of East African Research and Trauma Hope (EARTH), ELIZABETH GRACE*, MAGGIE WILHELM*, MONICA GAMBILADO* and NICK BOYD* (University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; Ronnjohncts@gmail.com, Ejacobs@sandiego.edu, and Grace@sandiego.edu).

East African Research and Trauma Hope (EARTH) is an organization designed to facilitate the study, development, and implementation of mental health services across diverse Eastern African populations. This is completed with an emphasis in war history, violence, and trauma. EARTH looks to provide a compassionate, evidenced-based approach.
to address biological, psychological, and social influences. This is achieved by providing assessment, counseling, and education to resolve personal and interpersonal issues through culturally sensitive interventions and specialty services. EARTH promotes quality of care and best practices, locally and abroad, through consultation, research, education, and training. EARTH’s first aim is to provide greater access to counseling through innovative and modern technologies to communities in the United States as well as Eastern Africa. Second, there is an emphasis on education regarding the effects of trauma, social and interpersonal skills, human rights, assimilation, and culturally responsive techniques. Lastly, specialized trauma counseling is implemented to train paraprofessionals and clients with the goal of spreading awareness regarding the effects of trauma. This is done in conjunction with the use of skilled trauma techniques in the emotional healing process. EARTH holds the perspective that the healing of negative and traumatic life experiences can be obtained through evidence-based, culturally sensitive trauma work.

63 Organization and Delivery of Clinical Mental Health Services in Uganda, ELIZABETH GRACE*, CINDY KIM*, YASMIN SADAATZADEH*, MONIQUE LITTLE*, and MELISSA KOENIGSBERG* (University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; Ronnjohnts@gmail.com, Ejacobs@sandiego.edu, and Grace@sandiego.edu).

There is insufficient knowledge and understanding between Eastern Africa and North America, and clinical mental health is no exception. Consideration of several important factors (e.g., local beliefs, religions, political philosophy, historical influences, and economic structures) is imperative to determine appropriate program structures and services in those regions of the world. Child soldiers are some of the most complex traumatized populations of children and adolescents. With the history of violence, and an estimated 1:1.3 million psychiatrist to population ratio, there is significant need for clinical mental health services in Uganda. Taking into account the complexity of such a unique culture, conscientious and effective services need to incorporate the appropriate evidence-based research as well as address biological, psychological, and social influences regarding various forms of physical, emotion, and psychological trauma. This can be achieved through assessment, clinical mental health counseling, and psychoeducation to resolve personal and interpersonal issues through culturally sensitive interventions and specialty services. Greater access to counseling through innovative yet culturally sensitive modern technologies also needs to be developed specifically for affected communities in Eastern Africa. In addition, education regarding the effects of trauma and interpersonal skills, human rights, assimilation and acculturation (i.e. stateside) needs to be addressed. Furthermore, the facilitation of specialized counseling in trauma is necessary to train paraprofessionals and clients regarding trauma, and to encourage the use of skilled techniques for trauma in the emotional healing process.

Should Science Reform the Humanities?
Wednesday, 1:30 p.m. in HUB 268

64 Parable of the Chicken House: The Importance of Metaphors in Science and Humanities, JESSE JAMES THOMAS (San Diego State University, 5500 Campanile Drive, San Diego, CA 92182-6062; you1@verizon.net, jthomas@mail.sdsu.edu).

Should science reform the humanities? No, but they can collaborate, and neither Pinker nor Wieseltier make that obvious. Consider, however, developing polymath C. S. Peirce’s suggestion a century ago to blend (scientific) evolution and (humanistic) metaphor.

1. Evolutionary History of Both Science and the Humanities: Nature, life, and human existence are teleonomic (end-directed). Only process models work in either science or the humanities. The laboratory is time; God, nature, or humanity is both scientist and artist; evolution is the experiment; survival is the verification. Reality (scientifically and artistically) survives and thrives. Chaos may lurk, but both Science and Humanities puts it to work.

2. Traditional Science (Analogy) and Art (Metaphor): Analogies are self-contained and can be clearly stated. Metaphors are “out-of-the-box,” unpredictable but creative. Creation myths included metaphor, but modern scientific method requires precision, so metaphor tends to be thrown out with the bathwater. Art struggles to save it, as does recent “far-from-equilibrium” physics and “noise in-order out” biology, which are open and creative. Science and humanities today need each other.


65 Should Science Reform the Humanities? NICOLE ASHLEY MEDA (San Diego State University, 5500 Campanile Drive, San Diego, CA 92182-6062; Meda.nicole2@gmail.com).

Should the sciences reform the humanities? No, but the humanities and the sciences would both benefit from learning from each other. Steven Pinker argues that imbuing science into the
humanities could reverse the recent decline in the status of
the humanities, while Simon Wieseltier argues that, since
the sciences has authority over fact, while humanities deals
with values, they must stay separate. My position is in both
agreement and disagreement with both viewpoints. I agree
with Pinker in that the humanities could benefit from incor-
porating certain aspects of the sciences, but I feel that the
sciences could benefit from learning from the humanities as
well. Like Wieseltier, I agree that the sciences and humani-
ties ultimately deal with separate end goals and thus the sci-
ences do not have the authority to impose their will onto
the humanities. But I believe that the humanities, as well as the
sciences, could benefit from learning from each other on
their own accord. The sciences cannot try to impose itself
into the humanities without ultimately altering the purposes
of the humanities since the two desire different end goals.
However, the sciences and humanities have been intimately
intertwined since the beginning and thus there is much they
can learn from each other, so neglecting to adopt an interdis-
ciplinary approach prevents the achievement of both fields’
ultimate potential.

66 Expanding Artistic Expression through Science? SHER-
IDON STOKES (Herb Alpert School of Music, University
of California Los Angeles, 445 Charles Young Drive East,
2539 Schoenberg Music Building, Los Angeles, CA 90095; sherstokes@aol.com).

Should science reform the humanities? No, however sci-
dence does contribute essential principles to the underlying
creativity of the humanities. Through the scientific process
the performer of music learns to express oneself, expand-
ing the art’s boundaries and capabilities. Science provides
an explanation to the performer using a scientific logical
approach to the underlying techniques of the performing
arts. The performer’s understanding and use of scientific
principles in the art’s techniques greatly accelerates learning
of the art form as well as the expanding the art form itself.
This understanding creates a strong emotional feeling within
the performer, to the point where science and music cannot
be separated.

An understanding of the scientific principles translates
the emotional experience of the performer: joy, excitement,
relaxation, sorrow, anger, sweetness, inspiration and creativ-
ity into interpretive expressive qualities. Understandings of
the scientific principles behind the art often result in a sudden
shift in attitude, moving the artist from outside to inside the
art form because an awareness of the complexity of what
they are learning. The presentation will summarize the prin-
ciples in body mechanics, breathing techniques, muscle con-
trol, external and internal stimulus according to linguistics,
laryngology, respiratory therapy, acoustics, atmospheric and
sensory physics based on 60 years of music performance,
film recording, teaching experience and research.

67 Should Science Reform the Humanities? DARREN
IAMMARINO (San Diego State University, 5500 Campa-
nile Drive, San Diego, CA 92182-6062; processtheology@
yahoo.com, diammarino@mail.sdsu.edu).

Should science reform the humanities? Yes, but only if
the humanities also reform the sciences in a process of mutual
transformation and enrichment. Wieseltier downplays the
potential value and importance of the digital humanities to
clearly and graphically express layers of information. Pinker,
who claims that science is “hard,” happily ignores the most
difficult problem of all—the reconciliation of religion and
science.

1. The first argument states that the most fruitful area
for immediate mutual transformation is the application of
computer technology and statistical analysis to the humani-
ties. Therefore, the digital humanities are the most logical
point of contact. Infographics and podcasts provide examples
of how the visual/audio arts have helped to shape data
and information, and how scientific methodologies and com-
puter technology have allowed for large-scale data mining.

2. The second argument presents a far greater chal-
lenge—paving the way for religion AND science rather than
religion VS. science. This paper proposes a systematic way
forward. 1) Abandon the New Atheism vs. Intelligent Design
discussion completely. Furthermore, the debate must expand
outside the confines of Western Monotheisms vs. scientific
reductionism/materialism. 2) Instead, begin dialogue from
the standpoint of Chinese and Indian religions. 3- Address
the fact that religion will always remain as more than truth
claims; it is fundamentally about hope. 4) Allow permanent
sections on religion and science at professional societies on
both sides. 5) Explore progressive, naturalistic forms of the-
ism (e.g. process theology, emergent theism etc.) that do not
advocate denying major scientific theories.

68 Problem-Posing: How Altering Our Educational Phi-
losophy Can Bridge the Divide Between the Sciences and
the Humanities, TREVOR AULDRIDGE* and JEREMY
JUYBARI (San Diego State University, 2164 Dickinson
Drive, Carlsbad, CA 92008; trevorauldridge@live.com,
jjuybari@gmail.com).

This paper establishes two arguments in relation to how
the Sciences and Humanities can reform each other. First, we
contextualize the development of the Sciences and Humani-
ties. Second, we put forth a potential role that an alternative
educational philosophy can better enhance the development
of these disciplines in relation to the “progressive agenda”.

1. Disparities in development between the two disciplines
do not necessarily come from the method in which these two
disciplines produce knowledge but can also be attributed to
the sociopolitical context in which they are evolving. The
morality of science, Pinker claims, derives from the sci-
centific method (which is corruptible). Wieseltier hints at
the notion of “should we do it vs. can we do it” of science and
that science only pursues the “can”, which further imposes a moral dilemma of problem solving and posing. Science can solve the world’s problems, but by what means? There is no morality sui generis in either of these two disciplines, but is produced in their relationships to the world/society.

2. Problem-Posing educational philosophy can cultivate critical scientist-humanists and critical humanist-scientists. Need an educational system/philosophy that situates the ability to analyze “Chardin’s” painting in scientific and humanistic terms, but we also need to be able to question why individuals are looking at that particular painting in the first place. Interpretation is paramount. Educational philosophy needs to let students have confidence in their own powers. Promoting student autonomy can contribute to production of the “progressive agenda”.

69 A House Divided: The Humanism of Science and the Scientific Nature of the Humanities, MARK RICHARD WHEELER (San Diego State University, 5500 Campanile Drive, San Diego, CA 92182-6062; mark.wheeler@sdstate.edu).

Should science “reform” the humanities? A great deal depends on how we understand the notion of reform.

If by ‘reform’ we mean something like ‘help to improve’, then Pinker is surely right to suggest that the humanities have much to gain from the sciences. There is nothing new in this suggestion. The humanities are and have always been eminently rational disciplines. Scholars in the humanities, like their scientific colleagues, pride themselves on rigorous, rational, and public debate. Improvements in the various scientific methods and theories have, will, and ought to inform and improve the methods and insights of the humanities. But if the sciences can and should “reform” the humanities in this sense—if they ought to help improve the humanities—then so too the humanities can and should reform the sciences. Although it is an often neglected fact, one that both Pinker and Wieseltier fail to foreground in their discussions, that science and rational disciplines are inextricably intertwined. Much to gain from the sciences. There is nothing new in this suggestion. The humanities are and have always been eminently rational disciplines. Scholars in the humanities, like their scientific colleagues, pride themselves on rigorous, rational, and public debate. Improvements in the various scientific methods and theories have, will, and ought to inform and improve the methods and insights of the humanities. But if the sciences can and should “reform” the humanities in this sense—if they ought to help improve the humanities—then so too the humanities can and should reform the sciences. Although it is an often neglected fact, one that both Pinker and Wieseltier fail to foreground in their discussions, that science and rational disciplines are inextricably intertwined.

the same can be said about the contrary counterpart of this naïve and dogmatic scientism: the radically relativist and irrationalist rejection of all claims to objective scientific knowledge (and the claim, effectively, that science is another kind of poetry or history) suffers from a similar blindness or aphasia. Drawing on recent work in philosophy, I argue that the sciences neither can nor should attempt to re-form the humanities in their images; nor can the humanities, nor should they, attempt to re-create the sciences in their images.

Theory, Experiment, and Computations: A Synergistic Approach to Research
Thursday, 8:05 a.m. in MS&E 0113

70 Acetylcholine Promotes Binding of α-Contoxin MII at α,b2 Nicotinic Acetylcholine Receptors, SOMISSETTI V. SAMBASIVARAO1, JESSICA ROBERTS2, VIVEK S. BHARADWAJ1, JASON G. SLINGSBY1, CONRAD ROHLEDER1, CHRIS MALLORY3, JAMES R. GROOME2, OWEN M. McDUGAL*, and C. MARK MAUPIN* (1Chemical and Biological Engineering Department, Colorado School of Mines, 1500 Illinois Street, Golden, CO 80401; 2Department of Biological Sciences, Idaho State University, 650 Memorial Drive, Pocatello, ID 83209; 3Department of Chemistry and Biochemistry, Boise State University, 1910 University Drive, Boise, ID 83725; cmmaupin@mines.edu).

α-Conotoxin MII (α-CTxMII) is a 16-residue peptide with the sequence GCCSNPVCHLEHSNLC, containing Cys2–Cys8 and Cys3–Cys16 disulfide bonds. This peptide, isolated from the venom of the marine cone snail Conus magus, is a potent and selective antagonist of neuronal nicotinic acetylcholine receptors (nAChRs). To evaluate the impact of channel–ligand interactions on ligand-binding affinity, homology models of the heteropentameric α,b2-nAChR were constructed. The models were created in MODELLER with the aid of crystal structures of the Torpedo marmorata-nAChR (Tm-nAChR, PDB ID: 2BG9) and the Aplysia californica-acetylcholine binding protein (Ac-AChBP, PDB ID: 2BR8) as templates for the α,β1-subunit isoforms derived from rat neuronal nAChR primary amino acid sequences. Molecular docking calculations were performed with AutoDock to evaluate interactions of the heteropentameric nAChR homology models with the ligands acetylcholine (ACh) and α-CTxMII. The nAChR homology models described here bind ACh with binding energies commensurate with those of previously reported systems, and identify critical interactions that facilitate both ACh and α-CTxMII ligand binding. The docking calculations revealed an increased binding affinity of the α,β1-nAChR for α-CTxMII with ACh bound to the receptor, and this was confirmed through two-electrode voltage clamp experiments on oocytes from Xenopus laevis. These findings

ABSTRACTS – Symposia
provide insights into the inhibition and mechanism of electrostatically driven antagonist properties of the α-CTXMIIIs on nAChRs.

71  Impact of Ionic Liquids on the Structure of Cellulose, VIVEK BHARADWAJ*, TIMOTHY SCHUTT, COREY KINSINGER, TIMOTHY ASHURST, and C. MARK MAUPIN (Chemical and Biological Engineering Department, Colorado School of Mines, 1613 Illinois St., Golden, Colorado, 80401, USA; vbharadw@mymail.mines.edu).

Ionic liquids (ILs) are effective solvents for the dissolution of cellululosic biomass due to their ability to solvate cellulose, which is hydrophobic and therefore has limited solubility in aqueous environments. Molecular Dynamics (MD) simulations and NMR spectroscopy have been utilized to investigate the molecular-level interactions that facilitate the IL enabled dissolution of cellulose. The impact of various water-IL mixtures on the configuration of the sugar ring (e.g. chair or boat) were investigated in addition to the energetics of solvation. It is found that the presence of ILs stabilizes the skewed boat ring configuration in addition to modifying the geometry around the glycosidic bond (i.e. φ and ψ dihedrals). These changes in geometry are believed to favorably impact the hydrolysis of the glycosidic bond. An enhanced understanding of how ILs facilitate solvation and hydrolysis of the β(1-4) linkage in cellulose may lead to more efficient processing of cellulosic biomass for the production of renewable biofuels and value added chemicals/materials.

72  Using α-Conotoxin Molecular Scaffolds to Inform the Discovery of Potent and Selective Receptor Ligands toward the Treatment of Parkinson’s Disease, OWEN M. McDougall (Department of Chemistry and Biochemistry, Boise State University, 1910 University Drive, Boise, ID 83725; owenmcdougal@boisestate.edu).

Conotoxins are small cysteine rich peptides that are both potent and selective for binding macromolecular receptors in mammalian systems. Alpha-conotoxins specifically target nicotinic acetylcholine receptors (nAChRs) and have been explored for usage as therapeutic drugs for ailments including Parkinson’s disease, Schizophrenia, and Tourette’s Syndrome. Significant effort has been expended to understand the interaction between α-conotoxins and complex dopaminergic neuronal nAChRs. Experimental challenges are encountered to understand these dynamic, membrane bound, ligand gated ion channels. The emergence of computational tools with ever expanding breadth of capabilities has enabled the investigation of these intricate systems. Using a blend of computational applications and experimental verification of predictions, new insights into conotoxin binding paradigms will be presented.

73  Using Peptide Mutation and Structural Similarity to Aid in Drug Development, THOMAS LONG (Departments of Computer Science and Chemistry and Biochemistry, Boise State University, 1910 University Drive, Boise, ID 83725; thomaslong@u.boisestate.edu).

Specific nicotinic acetylcholine receptor (nAChRs) subtypes have been implicated in a number of neurological disorders including Parkinson’s Disease, Alzheimer’s disease, and drug addiction. In an effort to discover drugs capable of mitigating the effects of such diseases, our group has developed a software-based approach to drug development which utilizes α-Conotoxin MII (α-CtxMII), a 16-residue peptide known to be a potent and selective antagonist of neuronal nAChRs. In our approach, a large peptide library composed of α-CtxMII analogs is created and virtually screened using a genetic algorithm that has been incorporated into the Dockomatic software package. The PubChem structural database is then searched for small molecules which are structurally similar to the top scoring α-CtxMII analogs. Since the PubChem structural database is composed of small molecules which have already been subjected to clinical testing, the result of the search is a set of drugs already approved for human use. We consider it to be a useful addition to modern drug discovery techniques.

74  Comparison of the Microcirculation in the Human Conjunctiva in Healthy and Diabetic Patients, WILLIAM L. DOW*, FRANK G. JACOBITZ, and PETER CHEN (Chemical and Biological Engineering Department, University of San Diego, 5998 Alcala Park, San Diego, CA 92110, USA; Department of Bioengineering, University of California, San Diego, La Jolla, CA 92093, USA; wdow@sandiego.edu).

The microcirculation includes the smallest arterioles, capillaries, and venules with vessel diameters ranging from 8 to 150 µm, and represents a region where active and passive exchanges of nutrients and metabolites take place. Epidemiologists study the microcirculation in detail and have identified associations between microvascular disorder and organ damage. It has been hypothesized that, by the time the most common symptoms of hypertension and diabetes are recognized and accurate diagnosis can be made, permanent damage has been done to blood systems (Schmid-Schönbein, 1999). A comparison between healthy and diseased states may lead to the identification of changes in the microcirculation that can be used to diagnose a variety of vascular related disorders (To et al., 2011, Cheung et al., 2010). The bulbar conjunctiva is an ideal site to evaluate the microvascular network non-invasively in humans where the arteriolar, capillary and venous components can readily be seen. Analysis of the conjunctiva microvasculature based on observation and limited quantitative analysis has proven to be successful in identifying the changes associated with diabetes, hypertension, sickle cell anemia, and other vascular related disorders (Smith et al., 2009, Cheung et al., 2010, Cheung et a., 2002). In this study, a simulation approach that includes measured
morphometric data, projected mechanical properties, and dynamic information to model the conjunctiva vasculature of healthy and diabetic patients in implemented, allowing the theoretical prediction of disease states. The simulation results show that the diameter and mean pressure distributions of the healthy conjunctiva distinctly contrast those of the diabetic sample.

75 Augmenting NMR Crystallography through Fragment Methods, JOSHUA D. HARTMAN (Department of Chemistry, University of California, Riverside, 900 University Ave., Riverside, CA 92521; jhart005@ucr.edu).

New developments in fragment-based electronic structure methods have brought improved accuracy to crystal structure prediction. Through significant reductions in computational demand, fragment-based chemical shielding calculations make MP2 level results tractable for chemically interesting organic crystals thereby creating new opportunities for combining chemical shielding calculations with NMR measurements to determine crystal structure. In the present work, we explore fragment approaches for NMR shielding in crystals and explore the effects of coupling fragment methods with an electrostatic embedding model based on atom-centered distributed multipole moments. Through coupling raw shielding tensor calculations with standard linear regression techniques we examine the ability of fragment methods with charge embedding to reproduce known experimental chemical shifts in molecular crystals and to discriminate between different molecular crystal polymorphs.

76 Creating Computational Models of Cellular Development through Machine Learning in a Visual Programming Environment, NIC CORNIA1, TIM ANDERSEN, and JEFF HABIG (Department of Computer Science, Boise State University, 1910 University Dr., Boise, ID 83725; niccornia@u.boisestate.edu, tandersen@boisestate.edu, jwhabig@gmail.com).

VPEvolve is a free and open source application that uses machine learning to develop computational models. Additionally, it utilizes a Visual Programming Environment (VPE) for the setup of the Genetic Algorithm (GA) used to generate the computational models. Specifically, the User Interface is designed to use glyphs or components and connections to represent the population flow through genetic operators as the GA is applied. These glyphs give the user an intuitive way to set the parameters for the GA, better visualization of the GA flow, and allow the user to customize the components and connections. This customization of components allows the user to select a group of components and connections and create a single glyph, which makes it easier to setup when similar sections of components and connections are often used. VPEvolve is currently being developed along side research being done in Bioinformatics to create models of cellular development based on the regenerative properties of planaria or flatworms. Since these models are difficult to produce by hand, GAs can be particularly useful to facilitate the process of model creation and also validation. VPEvolve is a client-side application that allows the user to setup the parameters for the GA, uses a modeling platform such as CellSim, which performs the cellular development simulations, and presents the fitness values of the population to the user as the evolutionary search is performed.

Ecology and Conservation in River Networks
Thursday at 8:30 a.m. in HUB 379

77 Tectonic Controls over Ecological Transitions and Linkages Through River Drainage Networks, MARY E. POWER1*, WILLIAM E. DIETRICH2, and JACQUES C. FINLAY3 (1Department of Integrative Biology, University of California, Berkeley, CA 94720; 2Department of Earth and Planetary Science, University of California, Berkeley, CA 94720; 3Department of Ecology, Evolution, and Behavior, University of Minnesota, Minneapolis, MN 55455; mepower@berkeley.edu).

Like branching trees and circulatory systems, river drainages are hierarchical networks, with concentrative fluxes downstream and dispersive upstream-directed backflows. Unlike trees and circulatory plumbing, river networks are also shaped by the long profile of the hillslopes on which they evolve. The 9546 km2 basin of the Eel River of northwestern California is steepened, and tipped out of geomorphic equilibrium, by tectonic uplift along the Mendocino Triple Junction near its mouth. As in most rivers, channel slopes are steep in headwaters and generally decline downstream, but in the Eel, mainstem reaches draining large areas remain surprisingly steep, with important consequences for bed texture, solar radiation and hydraulic disturbance regimes; food web interactions; and ecosystem exchanges among channel, upland, and coastal marine habitats. Nick points (steps) along the river long profile also exert ecological controls on longitudinal distributions of riparian and channel biota. The degree of network branching along the long profile, potentially responding to lithology, vegetation, land use, and hydrology of the region, will in turn determine the frequency and areal extent of sub-basins with different drainage area and slopes that differentiate local ecological regimes. These sub-basins will cumulatively influence basin-wide production of watershed currencies like runoff, dissolved nitrogen, diatoms, cyanotoxins, insect emergence, or salmon, although probably not in a simple additive fashion. Considering sub-basin slopes as well as drainage areas partitioned by network branching should help us predict landscape transitions of basins from sinks to sources for atmospheric carbon and other biogeochemical fluxes.
Many organisms living in river networks are migratory. It is important to take into account the migratory life cycles of key species when we consider the ecology in river networks. Over their life cycles, salmonids, lampreys, shrimp, snails, and Anguilid eels migrate between rivers and oceans. Within river network, other organisms (frogs, aquatic invertebrates) migrate between mainstems and tributaries to exploit habitats and resources that are seasonally favorable for particular life stages. We will describe a hidden but important interaction of one mayfly *Ephemerella maculata* (*Ephemerellidae*), that has been discovered to migrate between mainstems and tributaries, and steelhead trout (*Oncorhynchus mykiss*) that migrate between the river and the ocean. *E. maculata* nymphs rear and emerge from productive mainstem rivers in summer. Female adults mate, then fly up adjacent small tributaries to oviposit. Subsequently, spent females drift and collect in pools, where they feed aquatic and riparian predators that would otherwise find little to eat in dark, unproductive tributary habitats. In field manipulations of mayfly subsidies, the migratory mayfly subsidy, but not terrestrial allochthonous inputs, significantly increased growth of juvenile steelhead trout rearing in tributaries. The habitat of juvenile steelhead trout in river networks in California is increasingly restricted to cool tributaries due to mainstem warming. The biological backflow mediated by this mayfly migration may deliver critical trophic support to Pacific salmonids near the southern limits of their ranges.

**78 Mainstem-Tributary Food Web Interactions in River Networks Mediated by Migratory Mayflies and Anadromous Fish**, HIROMI UNO* and MARY E. POWER (Department of Integrative Biology, University of California, Berkeley, CA 94720; hiromiuno1@berkeley.edu).

**79 A Strategy for Aquatic Biodiversity Conservation in California**, REBECCA M. QUIÑONES*, TED E. GRANTHAM, RYAN PEEK, ERIC HOLMES, NICK SANTOS, ANDY BELL, PETER B. MOYLE, and JOSHUA H. VIERS (Center for Watershed Sciences, University of California, Davis, CA 95616; rmquinones@ucdavis.edu).

*Freshwater biodiversity in the Mediterranean biome is among the most threatened worldwide. In areas where fishes are the best studied aquatic organisms, such as in California, USA, fishes can serve as surrogates for aquatic biodiversity as a whole. We evaluate patterns of fish distribution, identify factors likely driving changes in biodiversity, and evaluate reserve designs that optimize aquatic biodiversity conservation in California. We used a newly developed geospatial database (PISCES) to calculate extent of historical and current distributional range of all freshwater fishes (n = 181) in California. All records are spatially referenced to watersheds (Hydrologic Unit Code 12; HUC 12). Current species assemblages are being shaped by factors different from those that shaped historical assemblages. Assemblages in novel ecosystems appear to be driven by climatic factors (maximum temperature, mean precipitation), indicating ecosystems increasingly dominated by alien species. Because novel ecosystems differ in form and function from their historical counterparts, new strategies are needed to preserve biodiversity. We use the program Zonation to prioritize reserve selection that incorporates habitat connectivity and heterogeneity. Algorithms within the program are used to preserve watershed units with the highest conservation value while considering species richness and rarity. Two reserve designs are compared, one within the historical context (what would have been the best reserve design?) with one set in the current landscape (what is now the best reserve design?). Our methodology provides a roadmap for protecting endemic aquatic biodiversity in California, which will likely suffer high rates of extinction without systematic protection of watersheds.**

**80 Assessing the Performance of Geometric and Habitat-Based Indices of Population Persistence Using Continuous Space Models of River Networks**, KURT E. ANDERSON*, JONATHAN SARHAD, and SCOTT MANIFOLD (Department of Biology, University of California, Riverside, CA 92521; kurt.anderson@ucr.edu).

Freshwater scientists are increasingly demonstrating that the branching structure of river networks has substantial ecological consequences. This is especially true when considering metapopulation and metacommunity dynamics in river watersheds, where natural and anthropogenic disruptions to connectivity can dramatically reduce long term persistence potential. We explore population persistence by expanding a framework for modeling branching river networks as continuous systems using dynamic, spatially-explicit models linked to metric graphs. Unlike traditional graphs, metric graphs encode a continuous branching system where edges represent actual domain rather than simple connections among discrete nodes. Graph edges are connected by junction conditions that represent branch confluences. Using the metric graph framework, we model the effects of movement, network geometry, and the distribution of habitat within the network on population persistence in both radial and stochastic model networks. Via numerical simulations, we show that movement rates, habitat length, and the distribution of habitable area all play large roles in determining persistence potential. In particular, movement behaviors and habitat distributions that reduce the encounter rate between individuals and lethal habitat boundaries increase population persistence across all model types. We identify an index related to the distribution of habitable volume in the network as a promising indicator of population persistence potential. This index outperforms other metrics such as the maximum and minimum distance from the river outflow to an upstream boundary and the total habitable volume of a tree. We conclude by describing extensions and other potential applications of our framework.
81 Spatial Sampling on Streams: Principles for Inference on Aquatic Networks, NICHOLAS A. SOM1*, PASCAL MONESTIEZ2, JAY M. VER HOEF3, DALE L. ZIMMERMAN4, and ERIN E. PETERSON5 (1Arcata Fish and Wildlife Office, US Fish and Wildlife Service, Arcata, CA 95521; 2Biostatistique et Processus Spatiaux, INRA, Avignon, France; 3National Marine Mammal Laboratory, Alaska Fisheries Science Center, National Oceanographic and Atmospheric Administration, Seattle, WA 98115; 4Department of Statistics and Actuarial Science, University of Iowa, Iowa City, IA 52242; 5CSIRO Computational Informatics, Dutton Park, QLD, Australia; nicholas_som@fws.gov).

For ecological and environmental data, prior inquiries into spatial sampling designs have considered 2-dimensional (2-D) domains, and have shown that design optimality depends on the characteristics of the target spatial domain and intended inference. The structure and water-driven continuity of streams prompted the development of spatial autocovariance models for stream networks. The unique properties of stream networks, and their spatial processes, warrant evaluation of sampling design characteristics in comparison to their 2-D counterparts. Common inference scenarios in stream networks include spatial prediction, estimation of fixed effects parameters, and estimation of autocovariance parameters, with prediction and fixed effects estimation most commonly coupled with autocovariance parameter estimation. We consider these inference scenarios under a suite of network characteristics and stream-network spatial processes. Our results demonstrate, for parameter estimation and prediction, the importance of collecting samples from specific network locations. Additionally, our results mirror aspects from the prior 2-D sampling design inquiries; namely, the importance of collecting some samples within clusters when autocovariance parameter estimation is required. These results can be applied to help refine sample site selection for future studies, and further showcase that understanding the characteristics of the targeted spatial domain is essential for sampling design planning.

82 Stream Temperature Variability over Time and Space: Metrics and Models, E. ASHLEY STEEL (Pacific Northwest Research Station, USDA Forest Service, Seattle, WA 98103; asteel@fs.fed.us).

Variability in stream temperature within a stream network and over time matters for aquatic biota; yet, it is impossible to measure completely and challenging to model. A great deal of research has focused on human-induced increases in water temperature; however, human activities, e.g., dams, land-use, and climate change, impact the variability and complexity of water temperature regimes as well. We apply network models to map variability at multiple time scales; explore spatial pattern across metrics and over time; and conceptualize which aspects of temporal variance are driven by within network versus out-of-network processes. Using data collected every 30-min across the Snoqualmie River, WA, we demonstrate, for example, that while the spatial distribution of mean temperature over the stream network varies little between summer and winter, the spatial distribution of variance varies tremendously between summer and winter. Changes in variance have the potential for dramatic sub-lethal effects on food web dynamics, species phenology, and community composition. As evidence, we summarize results from a series of laboratory experiments measuring the impact of altered thermal regimes on the egg to fry lifestages of Chinook salmon. Understanding the drivers and patterns of thermal complexity as well as their impacts on biota are essential for effective management of aquatic systems.

Accelerating Chemical and Biomedical Discovery with Molecular Simulation
Thursday, 8:35 a.m. in MS&E 0003

83 Dynamical Ensembles of Nucleic Acids and Their Importance for Binding, IOAN ANDRICIOAEI (Department of Chemistry, University of California, Irvine, Irvine, CA; andricio@uci.edu).

I will present molecular dynamics computer simulations of several examples of conformational transitions that nucleic acids and their complexes undergo upon the application of external forces and/or torques: (1) DNA supercoil relaxation by topoisomerases, (2) the condensation of DNA by dendrimers and (3) DNA ejection from viruses. Then I will showcase the use of a formalism in the theory of stochastic processes to deduce the kinetics of these transitions, from simulation trajectories or experimental single molecule recordings of the transition, under other conditions that those that are actually simulated or recorded.

84 Effects of Spatial Organization and Molecular Scaffolds on the Diffusive Activity of Substrates in Enzyme Nanostructures, CHIA-EN A. CHANG* and CHRISTOPHER ROBERTS (Department of Chemistry, University of California, Riverside, Riverside, CA; chieanc@ucr.edu).

Many biological synthesis or metabolic processes occur within colocalized and multi-step enzyme reaction pathways with high yield and specificity. In these enzyme complexes, the relative orientation and position of the enzymes can allow for efficient diffusion of substrates between the active-sites of enzymes in the nanostructure. Taking advantage of enzyme colocalization, experimentalists synthesized a flexible DNA scaffolding for two DNA-modified enzymes: Glucose oxidase (GOx) and Horseradish peroxidase (HRP). During the catalytic oxidation of glucose, GOx reduces molecular oxygen, via a cofactor, producing H2O2 as a side product. As H2O2 is required by HRP to oxidize a substrate, GOx and HRP can share a product-reactant relationship. However, it is not understood which factors are crucial to determine
the catalytic enhancement for more efficient experimental design. We therefore established a modeling platform that utilized Brownian dynamics simulations with a few different levels of coarse-grained models for computational studies. In collaboration with Prof. Ian Wheelon at UCR, we designed the enzyme complexes based on the computational studies. The presentation will discuss the effects of position/orientation of the enzymes and the use of the DNA origami or DNA linker for potential catalysis enhancement.

85 AMBER 14: Peer to Peer Molecular Dynamics FTW, SCOTT LE GRAND (Amazon and Scatologic, Inc; varelse2005@gmail.com).

Recent code optimization targeted for AMBER 14 has improved single GPU performance by up to 30% and multi-GPU scaling by up to 70%. The latter was achieved by aggressive use of Peer-to-Peer copies and RDMA. This has unleashed new time scale regimes for sampling and simulation on low-end GPU clusters, beating every known software-based molecular dynamics codebase in existence. This talk will cover first how AMBER’s already efficient single-node performance was made even more so, the challenge not only of enabling peer to peer copies between GPUs, but obtaining hardware capable of enabling it, and finally, up to the minute results using MVAPICH2 and OpenMPI for RDMA directly between GPUs on separate nodes connected by dual-line FDR Infiniband.

86 Protein Force Field Developments: Explicit and Implicit Strategies, RAY LUO (Department of Biochemistry, Molecular Biophysics and Biomedical Engineering, University of California, Irvine, Irvine, CA; ray.luo@uci.edu).

Atomic simulations of biomolecules provide a detailed view of structure and dynamics that complement experiments. Increased conformational sampling, enabled by new algorithms and growth in computer power, now allows a much broader range of events to be observed, providing critical insights, largely inaccessible to experiments, such as characterization of the unfolded state or the transiently populated intermediates that occur during complex binding and recognition events. The Amber force field consortium have made significant inroads towards accurately representing the energetic surfaces relevant to both the native and non-native states of proteins and nucleic acids. In this talk, I will provide an overview of our latest efforts in protein force field and solvent model developments, in both atomistic and continuum representations that are widely used in biomolecular simulations.

87 Making Sense of Transmembrane Voltage Sensing by Voltage-Sensitive Ion Channels: Concerted Simulation and Experimental Studies, DOUGLAS TOBIAS (Department of Chemistry, University of California, Irvine, Irvine, CA; dtobias@uci.edu).

Voltage-gated ion channels open and close in response to changes in transmembrane potential. The details of how conformational changes in the voltage-sensing domains lead to opening/closing of the ion-conducting pore remain to be worked out. Crystal structures of the open states of voltage-gated potassium channels are available, but the structure of the closed/resting state is not known. In this talk I will report our efforts to generate a model of the resting state of the archaeal KvAP channel based on atomistic molecular dynamics (MD) simulations in explicit membrane environments, with restraints derived from experimental functional data. I will also present results from simulation studies of an isolated voltage-sensing domain in a hydrated membrane, which include validation by neutron diffraction measurements, and direct observations of elementary gating charge displacement events during a 30-microsecond MD simulation under applied transmembrane potential. Finally, I will discuss prospects for and present preliminary results on using x-ray and neutron interferometry measurements to validate and refine simulation-based models of the resting state and the voltage-sensing mechanism.

88 A Molecular Theory for High-throughput Prediction of Hydration Free Energies, YU LIU, JIA FU and JIAN-ZHONG WU* (Departments of Chemical and Environmental Engineering and Mathematics, University of California, Riverside, Riverside, CA; jwu@engr.ucr.edu).

The classical density functional theory (DFT) is proposed as an efficient computational tool for high-throughput prediction of the solvation free energies of small molecules in liquid water at the ambient condition. With the solute molecules represented by the AMBER force field and the TIP3P model for the solvent, the new theoretical method predicts the hydration free energies of 500 neutral molecules with average unsigned errors of 0.96 kcal/mol and 1.04 kcal/mol in comparison with the experimental and simulation data, respectively. The DFT predictions are orders of magnitude faster than conventional molecular dynamics simulations and the theoretical performance can be further improved by taking into account the molecular flexibility of large solutes.

Two Dimensional Materials for Next Generation Devices
Thursday, 8:35 a.m. in MS&E 0103

89 Ripples, Strains and Quantum Transport in Few Layer Graphene Membranes, CHUN NING (JEANIE) LAU (Department of Physics and Astronomy, University of California, Riverside, CA 92521; lau@physics.ucr.edu).

Graphene, a two-dimensional single atomic layer of carbon, has the double identity as nature thinnest membrane as well as an extraordinary conductor with unique electrical properties. Here I will present our results on suspended high mobility single- and few-layer graphene devices. We demonstrate
ripple formation, strain manipulation and the presence of an intrinsic gapped state in bilayer and trilayer graphene at the charge neutrality point, evidence for quantum phase transition, stacking-order dependent transport in trilayer graphene, and if time permits, quantum Hall transitions in these systems. Our results underscore the fascinating many-body physics in these 2D membranes, and have implications for band gap engineering for graphene electronics and optoelectronic applications.

90 Optoelectronic and Thermal Transport Properties of Two-Dimensional Materials and Heterostructures, CHUN-CHUNG CHEN1, ZHEN LI1, SHUN-WEN CHANG2, and STEPHEN B. CRONIN1,2* (1Department of Electrical Engineering, 2Department of Physics, University of Southern California, Los Angeles, CA 90089, USA; scrnonin@usc.edu).

I will report our latest results studying the optoelectronic properties and thermal transport characteristics of nanoscale materials and devices. We have measured thermal transport across a graphene/hexagonal boron nitride (h-BN) interface by electrically heating the graphene and measuring the temperature difference between the graphene and BN using Raman spectroscopy (Applied Physics Letters, 104, 081908 (2014)). Because the temperature of the graphene and BN are measured optically, this approach enables nanometer resolution in the cross-plane direction. A temperature drop of 60K can be achieved across this junction at high electrical powers (14mW). Based on the temperature difference and the applied power data, we determine the thermal interface conductance of this junction to be 7.4 × 10^4 Wm^-2K^-1, which is substantially below the 10^7-10^8 W/m^2K values previously reported for graphene/SiO2 interface.

We also report the first photocurrent spectra measured from single layer MoS2. Here, substantial improvements and modulation in the photocurrent (PC) and photoluminescence (PL) spectra of monolayer MoS2 are observed under electrostatic and ion liquid gating conditions. The magnitude of the photoluminescence can be increased 300% by ion liquid gating due to the passivation of surface states and trapped charges that act as recombination centers. The photocurrent also doubles when passivated by the ionic liquid. Interestingly, a significant shift of the PL peak position is observed under electrostatic (14meV) and ionic liquid (30meV) gating, as a result of passivation.

91 Indirect Excitons in van der Waals Heterostructures, M.M. FOLGER, I.V. BUTOV, and K.S. NOVOSELOV (Department of Physics, University of California San Diego, 9500 Gilman Drive, La Jolla, CA 92093-0319; mfogler@ucsd.edu).

All known superfluid and superconducting states of condensed matter are enabled by composite bosons (atoms, molecules, Cooper pairs) made of an even number of fermions. Temperatures where such macroscopic quantum phenomena occur are limited by the lesser of the binding energy and the degeneracy temperature of the bosons. High critical temperature cuprate superconductors set the present record of ~100 K. Here we propose a design for artificially structured materials to rival this record. The main elements of the structure are two monolayers of a transition metal dichalcogenide (TMD) and an atomically thin hexagonal boron nitride (hBN) spacer. Electrons and holes generated in the system would accumulate in the separate TMD layers and form bosonic bound states --- the indirect excitons. The resultant degenerate Bose gas of excitons would exhibit macroscopic occupation of a quantum state, vanishing viscosity, and superconductivity at high temperatures.

92 Manipulating Correlated Phases in Graphene, ALESSANDRA LANZARA (Department of Physics, University of California, Berkeley, 321 Birge Hall, Berkeley, CA 94720-7300; alanzer@lbl.gov).

The peculiar electronic structure of graphene, where quasiparticles have zero effective mass and follow the relativistic Dirac equations, is at the basis of a variety of novel exciting properties of this two dimensional material. In this talk I will discuss how strongly correlated electron phases can be realized in monolayer graphene and how the underlying band structure can be engineered by a variety of different tuning parameters. Comparisons to other Dirac-like two dimensional materials such as the topological insulators will be discussed.

93 Electron-Hole Excitations in Two-Dimensional Atomic Layer Materials, NATHANIEL M. GABOR (Department of Physics and Astronomy, University of California, Riverside, 900 University Ave., Riverside, CA 92521; nathaniel.gabor@ucr.edu).

Electron-hole pair excitations, or excitons, have been explored in a wide variety of materials, ranging from individual molecules to nanoscale semiconductor crystals, and in numerous fields from chemical biology to solid-state physics. This diverse interest stems from the fact that electron-hole pairs are discrete, neutral excitations that are highly sensitive to both a material’s electronic properties and the dielectric environment. Recently, considerable progress has been made in probing excitons and their dynamics, uncovering numerous phenomena such as multi-exciton generation and indirect exciton Bose-Einstein condensation. While electron-hole pairs have been explored in conventional materials, progress is no more evident than in quantum-confined materials, in which one, two, or three of the spatial dimensions of the system approaches the effective Bohr radius of the bound electron-hole pair.

While quantum electronic measurements probe charge transport of carriers at low energy, photoexcitation may drive electron-hole systems into a regime dominated by high-energy interactions. Near the charge neutrality point (CNP) in graphene and in atomic layer semiconductors, neutral...
electron-hole excitations are expected to dominate energy transport. In this talk, I will discuss photoresponse measurements of graphene and molybdenum ditelluride quantum systems that explore the emergence of novel mechanisms for energy transport through electron-hole excitations. By combining quantum transport with precision optical techniques, these measurements provide a glimpse into the strong interactions of electron-hole pairs, and establish the first steps in the search for correlated electron behavior in the regime of strong light-matter interactions.

94 2D Transition Metal Dichalcogenide Films: Facile Single-Layer Film Growth on SiO₂ and Bandgap Engineering through Alloycling, LUDWIG BARTELS (Department of Chemistry, University of California, Riverside, CA 92521; bartels@ucr.edu).

Transition metal dichalcogenides (TMD) present exciting materials systems that provide tunable and direct –bandgap semiconductor properties at the single-layer limit. Single layer films of MoS₂, MoSe₂, WS₂, etc. can be grown in CVD-like processes on SiO₂ and similar materials at process temperatures of ≤700°C. They extend in a continuous fashion across cm-scale substrates and are composed of micron-scale rotational domains. This provides for exciting opportunities in integration of direct bandgap materials and materials with photonic potential into silicon-based devices. By means of alloycling, their bandgaps can be tuned in a continuous fashion between 1.9 and 1.6 eV. Their growth can be seeded by pre-patternning of the substrate.

95 Engineering a Fault-tolerant Quantum Computer, JASON ALICEA (Department of Physics, and Institute for Quantum Information and Matter, California Institute of Technology, Pasadena CA 91125; aliceaj@caltech.edu).

During the past few decades studies of two-dimensional materials have catalyzed the development of numerous new physics paradigms. The quantum Hall effect—which can be seen in systems ranging from GaAs quantum wells to graphene and beyond—provides a spectacular example. Quantum Hall systems have indeed given birth to revolutionary concepts such as topological order, fractionalization, and the emergence of particles known as 'anyons' that exhibit richer exchange statistics than that of ordinary bosons and fermions. In this talk I will describe how one can modify well-understood quantum Hall phases that are routinely observed in the lab to stabilize different classes of so-called non-Abelian anyons. These particles not only promise to further push the boundary of our understanding of quantum mechanics, but may also ultimately allow for the fabrication of an intrinsically decoherence-free quantum computer.

96 Magnetic Topological Insulator Hetero-Structures, KANG L. WANG (Device Research Laboratory, Department of Electrical Engineering, WIN Institute of Neurotronics Systems, KACST-UCLA Center on Green Nano Electronics, University of California, Los Angeles, Los Angeles, CA 90095-1594; wang@ee.ucla.edu).

Magnetic topological insulator comprised of two-dimensional (2-D) materials has a potential of providing many interest physics and applications by manipulating the surfaces states, e.g., yielding quantum anomalous Hall effect giving rise to dissipation-less chiral edge current, giving axion electromagnetism and others. In the first part of this talk, we show the generation of robust magnetism by doping magnetic ions (Cr) into the host 2-D (Bi₁ₓSb₁₋ₓ)₂Te₃ materials. With gate-controlled magneto-transport measurements, we demonstrate the presence of both the hole-mediated RKKY coupling and carrier-independent van Vleck magnetism. By adjusting the Cr doping concentration and Bi/Sb ratio, we observe quantum anomalous Hall effect at 80 mK.

97 Topological Insulators and Beyond, DAVID HSIEH, (Institute for Quantum Information and Matter, California Institute of Technology, Pasadena CA 91125; dhsieh@caltech.edu).

Over the past several years, topological insulators have become an intensively researched topic in condensed matter physics. Interest in these materials stems not only from their being a fundamentally new phase of quantum matter, but also because they hold promise for novel technological applications ranging from low power spin-based electronics to fault-tolerant quantum computers. In this talk, I will describe the early theoretical and experimental works that established the existence of topological insulators. In particular, I will focus on the role that spin- and angle-resolved photoemission spectroscopy played in the discovery of topological insulators in three-dimensional bulk crystals. Finally I will discuss some of the exciting new varieties of topological matter that have more recently been proposed and describe experiments underway to search for them.
Boise Extravaganza in Set Theory (BEST)
Thursday at 9:00 a.m. in HUB 260
continues Friday at 9:30 a.m. in HUB 260

Note: Program continues from Wednesday. Please refer to page 89 in these Proceedings for those abstracts.

98 On a Class of Guessing Models, NAM TRANG
(Department of Mathematical Sciences, Carnegie Mellon
University, Pittsburgh, PA 15213; namtrang@andrew.cmu.
edu).

For an infinite cardinal $\kappa$, we define the notion of $\kappa$-guessing models. The notion of $\aleph_1$-guessing models has
been isolated by Viale and Weiss. For $\kappa > \aleph_0$, $\kappa$-guessing
models are combinatorial essence of supercompactness compat-
ible with successor cardinals, similar to the tree property
is a combinatorial essence of weak compactness compatible
with successor cardinals. We prove some combinatorial con-
sequences of guessing models as well as discuss their relations-
ships with forcing axioms. We also discuss the consist-
sity strength of the existence of $\kappa$-guessing models. The
upper-bound is “ZFC + there is a supercompact cardinal”. Regard-
ing lower-bounds, a theorem along this line is: the
existence of $\aleph_3$-guessing models (along with some mild car-
dinal arithmetic assumptions) yield models of “AD + $\mathbb{P}$ is regular”.

99 Abstract submitted after publication deadline. Please refer to Program Changes sheet.

100 Basic Tukey Reductions for Selective and Ramsey Filters on General Topological Ramsey Spaces, NATASHA
DOBRIKEN, JOSE G. MIJARES and TIMOTHY TRUJILLO*(Department of Mathematics, University of Den-
ver, Denver, CO 80208; du.timothy.trujillo@gmail.com).

Dobrinen and Todorcevic have shown that every p-point
ultrafilter has continuous Tukey reductions. We discuss a
generalization of this result to filters which are selective for
a topological Ramsey space. We will also give some applica-
tions of the result to the Tukey theory of ultrafilters. This is
joint work with N. Dobrinen and J. Mijares.

101 Tychonoff’s Embedding into an H-closed Space, JOHN
P. REYNOLDS (Department of Mathematics, University of
Kansas, Lawrence, KS 66045; jreynolds@ku.edu).

In 1930, Tychonoff proved that every space $X$ can be
embedded in an $H$-closed space, though it was not shown
if this embedding was necessarily dense. It was later shown
by several authors that, in fact, every space can be densely
embedded in an $H$-closed space. However, it was not shown
if the embedding used by Tychonoff was a dense embedding.
In 1992, Porter proved that the Tychonoff embedding did
indeed yield a dense embedding. We develop the Tychonoff
embedding from the viewpoint of multifuctions. Included
is an application of this embedding to characterizing those
spaces which have a coarser minimal Hausdorff topology,
i.e. Katetov spaces.

102 Topological Ramsey Spaces and Baire Sets, NATASHA
DOBRIKEN and JOSE G. MIJARES* (Department
of Mathematics, University of Denver, Denver, CO 80208;
Jose.MijaresPalacios@du.edu).

We characterize a class of topological Ramsey spaces
such that for each space $R$ in the class, the corresponding
Tychonoff space of approximation sequences contains sub-
spaces which are projections of $R$ in which every Baire set
is Ramsey. This answers a question due to S. Todorcevic
and generalizes some results of Carlson, Carlson-Simpson,
Prőmel-Voigt, and Voigt.

103 Generalized Choquet Spaces, SAMUEL COSKEY* and PHILIPP SCHLICHT* (1Department of Mathematics,
Boise State University, Boise, ID 83725; 2Department of
Mathematics, Rheinische Friedrich-Wilhelms Universität,
Germany; scoskey@boisestate.edu).

Considerable work has been done to study descriptive
set theory in spaces of size larger than the continuum. In
order to generalize the notion of Polish space or standard
Borel space to this setting, it is necessary to find a replace-
ment for the notion of complete metrizability. In this talk
we will study a class of spaces satisfying a variant of the
Choquet property, where the Choquet game is replaced by an
analogous game of length $\kappa$. We will show for example that
there is a surjectively universal space in this class. We then
give a Kuratowski-like result that under appropriate hypo-
theses, any two such spaces are isomorphic by a $\kappa$-Borel func-
tion. This is joint work with Philipp Schlicht.

104 Abstract submitted after publication deadline. Please refer to Program Changes sheet.

105 Abstract submitted after publication deadline. Please refer to Program Changes sheet.

Note: Program continues on Friday. Please refer to page 136
of these Proceedings for those abstracts.

Future Trends on the Past History of Life
Thursday at 9:05 a.m. in HUB 268

106 Molecular Biomarker Evidence for the Earliest Animal
Life from Unusual Fossil Steroids Produced by Sponges,
GORDON D. LOVE (Department of Earth Sciences, Uni-
versity of California, Riverside, CA 92521, USA; gordon.
love@ucr.edu).

Lipid biomarkers yield valuable and unique insights for
deep time geobiology and biogeochemistry concerning past
ocean redox structure and biospheric evolution. Currently, the earliest convincing record for animals (Metazoa) comes from a 100 million year record of distinctive C30 sterane biomarkers (24-isopropylecholestanes, 24-ipc steranes) produced by demosponges beginning over 635 million years ago. These compounds were detected in thermally immature Neoproterozoic-Early Cambrian marine sedimentary rocks from Huqf Supergroup of the South Oman Salt Basin (Love et al., 2009). This constituted the first robust evidence for animals predating the Marinoan glaciation (terminating at 635 Myr) and is supported by a close match with metazoan divergence age estimates from molecular clocks (e.g. Sperling et al., 2010) and the recent finding of “sponge-grade metazoan” fossils from Cryogenian strata in South Australia (Maloof et al., 2010).

24-isopropylecholesterol (and related precursor structures, 24-ipc sterols) can be produced by only some demosponges and we have recently found that 24-ipc compounds are major sterol constituents of genera from the order Hali-chondrida, in particular. Furthermore, 24-ipc do not appear to be synthesized by choanoflagellates, the closest living sister taxon of animals. The most parsimonious interpretation then is that 24-ipc steranes in Neoproterozoic rocks are markers for true multicellular demosponges and not for a unicellular stem-metazoan ancestor of all animals.


107 Evolution of Photosynthesis and the Rise of Oxygen, WOODWARD FISCHER (California Institute of Technology, 1200 East California Boulevard, Pasadena, California 91125; wfisher@caltech.edu).

The emergence of oxygenic photosynthesis fundamentally transformed our planet; however, the processes that led to the innovation of biological water splitting have remained largely unknown. From an evolutionary perspective, it is notable that modern biological water-splitting in photosynthesis begins with Mn oxidation in the water-oxidizing complex of photosystem II, suggesting several evolutionary scenarios wherein Mn(II) once played a key role as an electron donor for photosynthesis prior to the evolution of oxygenic photosynthesis. To test this hypothesis, we examined the behavior of the ancient Mn cycle using newly obtained scientific drill cores through an early Paleoproterozoic succession of sedimentary rocks (2.415 Ga) preserved in South Africa. These strata contain the oldest substantial Mn enrichments (up to ~17 wt %), well before those associated with the rise of oxygen such as the ~2.2 Ga Kalahari Mn deposit. Using both bulk and microscale X-ray spectroscopic techniques coupled to optical and electron microscopy and stable carbon isotope ratios, we determined that the Mn is hosted exclusively in carbonate mineral phases derived from reduction of Mn oxides during diagenesis of primary sediments. Additional observations of independent proxies for molecular oxygen—multiple S isotopes (measured in bulk by isotope-ratio mass spectrometry and in situ by secondary ion mass spectrometry) and redox-sensitive detrital grains—reveal that the original Mn-oxide phases were not produced by reactions with oxygen and instead points to a different high-potential oxidant. These results show that the oxidative branch of the Mn cycle predates the rise of oxygen, and supports the hypothesis that the water-oxidizing complex of photosystem II evolved from a former transitional photosystem capable of single-electron oxidation reactions of Mn.

108 Transitioning Towards the Modern Animal Biota: Small Shelly Fossils from the Cambrian of the Himalaya, IAN R. GILBERT* and NIGEL C. HUGHES (Earth Sciences Department, University of California, Riverside, CA 92521; igilb001@ucr.edu, nigel.hughes@ucr.edu).

In terms of its impact on the geological record the Cambrian evolutionary radiation marks one of the most striking events in the history of life on Earth: before it evidence of life is generally cryptic, after it fossils are obvious and plentiful when preserved. At a first order, this transition marks the appearance in the geological record of biomineralized skeletons with high preservation potential; however, it is clear that the Cambrian radiation involved more than simply the advent of biosynthetic pathways that made skeletons. Intriguingly, some of the first biomineralized animal fossils consisted of separate plates, spines, or scales, rather than fully integrated skeletons, and in some groups, shells may have evolved via the consolidation of these separate plates. We have been studying Cambrian microfossils from Himalayan rocks that fall under the general description of “small shelly fossils” identifying the biotic affinities of such fossils can be problematical, and our study shows that prior misidentification of these fossils has led to incorrect age estimates for the rocks containing them. Our recent analysis reveals new features that allow us to correct the taxonomic affinities of these fossils, and these identifications bring the suggested age of the rocks containing them into register with those ages suggested independently by other kinds of fossils and dating methods. These fossils show a diverse assemblage of Cambrian organisms living in the seas that would later constitute the Himalayan margin, and that these fossils were coeval with others found elsewhere on Earth.

109 Searches for Extrasolar Planets with the Next Generation of Ground-based Telescopes, BAHRAM MOBASHER (Department of Physics and Astronomy, 900 University Ave., University of California, Riverside, CA 92521; bahram.mobasher@ucr.edu).

The study of extrasolar planets and their atmospheres is
essential to understand the origin and evolution of the Earth and the Solar System. A widely used technique here is by the study of transiting planets, which pass in front of and behind their host stars. The next step forward is the study of the chemical composition of the atmosphere of closest planets. This is done by studying emission from the planet and/or at the transmission of starlight through the limb of the planet’s atmosphere.

Spectroscopy offers a powerful tool to constrain atmo-"spheric structure and composition. One challenge here is to study the atmosphere and composition of smaller planets (the size of the Earth). This requires large telescopes with sensitive instruments. The next generation of ground-based telescopes will provide a unique opportunity to study the Earth-like planets and perform a spectroscopic investigation of their atmosphere and its composition. In this talk I will discuss what we expect to learn from Thirty Meter Telescopes currently being designed and how these powerful instruments could enhance our knowledge about the other planets within the habitable zone of their

Computer Aided Drug Discovery and Development
Thursday at 1:00 p.m. in MS&E 0003

110 Structure Based Drug Discovery Targeting the Complement System, DIMITRIOS MORIKIS (Department of Bioengineering, University of California, Riverside, Riverside, CA; dmorikis@ucr.edu).

The complement system is part of innate immunity and a link between innate and adaptive immunity. It consists of over 30 proteins, receptors and regulators, and has been characterized as the bloodstream patrol against invading pathogens. However, in cases of inappropriate regulation the complement system is capable of attacking own tissues, resulting to inflammatory and autoimmune diseases, or loosest pathogen-fighting ability. Our drug discovery efforts target the function of complement protein C3, the converging point of all three complement activation pathways, and its proteolytic fragments C3a and C3d. We use structure-activity relations, molecular dynamics simulations, pharmacophore modeling, virtual screening, docking, and free energy calculations to design peptidic inhibitors, agonists, and antagonists of complement system proteins, receptors, and bacterial regulators. We will present our latest efforts in designing peptides of the compstatin family that inhibit the cleavage of C3 to C3a and C3b, and have the potential to become therapeutics for macular degeneration. We will also present the design of C3a-derived peptides that are agonists and antagonists of C3a receptor (C3aR), and are candidates for the treatment of complement-mediated inflammatory diseases. Finally, we will present the discovery of chemical compounds that target C3d and have the potential to be developed as biomarkers to diagnose, monitor and treat complement-mediated chronic pathological conditions. Our computationally designed/discovered molecules are experimentally tested using binding, biochemical, and cell-based assays, as well as NMR and fluorescence spectroscopies.

111 Bridging Calorimetry and Simulation through Precise Calculation of Binding Enthalpies in Host-Guest and Protein-Ligand Systems, ANDREW FENLEY* and MICHAEL GILSON (Skaggs School of Pharmacy and Pharmaceutical Sciences, University of California, San Diego, San Diego, CA; afenley@ucsd.edu).

Recent technological advances in both hardware and software have increased the throughput of explicit solvent molecular simulations to the point where we can now start making numerically precise connections to the thermodynamic data provided by isothermal titration calorimetry (ITC). Here, we present the direct calculation of the enthalpy of binding using microsecond timescale simulations for eight guests bound to cucurbit[7]uril (CB7) and two potent inhibitors bound to HIV protease. The computed binding enthalpies show reasonable agreement with experiment with block averaging analysis yielding numerical uncertainty estimates of the binding enthalpies to be on par with experimental error from previously published ITC data. For the CB7 system, the estimates are able to discern between the five high-affinity aliphatic guests and the three low affinity aromatic guests. And for HIV, the relative change in binding enthalpy between the inhibitors closely agrees with experiment. Furthermore, since we are using canonical simulations with additive potentials, we are able to extract the direct enthalpic contributions of the nonbonded interactions (electrostatic and van der Waals) which are critical for molecular recognition in binding. A similar decomposition using temperature derivatives of the free energy does not seem to be nearly as accessible. The presented approach to calculating binding enthalpies using explicit solvent simulations allows for a direct comparison with experimental values and thus could be used as an additional constraint when tuning future force field parameters specifically with the goal of increasing the predictable power of binding free energy calculations.

112 Activation Mechanisms of the M2 Muscarinic Receptor and Design of Allosteric Modulators, YINGLONG MIAO* and ANDY McCAMMON (Howard Hughes Medical Institute, University of California, San Diego, San Diego, CA; afenley@ucsd.edu).

G-protein coupled receptors (GPCRs) are important cell signaling proteins that have been targeted by ~1/3 of current marketed drugs for treating many human diseases such as cancer and heart failure. While significant advances have been made in recent structural and computational studies, detail mechanisms of GPCR activation that occurs on the millisecond timescales remain unclear. The X-ray crystal
structure of the M2 muscarinic receptor, a key GPCR that regulates the human heart rate and contractile forces of cardiomyocytes, was first determined in an antagonist-bound inactive state. Starting from the inactive X-ray structure with antagonist removed, we captured activation of the apo M2 receptor through hundred-of-nanosecond accelerated molecular dynamics (aMD) simulations. The receptor activation is characterized by large-scale structural rearrangements of the transmembrane helices via an intermediate state. With the simulation-derived activation-associated conformers, a fragment-based site mapping program FTMAP is applied to explore druggable allosteric binding sites in the M2 receptor. Virtual screening is then performed to select small-molecule drugs that bind these allosteric sites and modulate the receptor signaling. In contrast to highly conserved residues in the orthosteric site where the endogenous ligand binds, residues in the allosteric sites exhibit large diversity across different GPCR subtypes. Therefore, GPCR allosteric modulators are able to provide highly selective therapeutics.

113 Using Model Systems to Improve Binding Free Energy Calculations for Drug Discovery, DAVID MOBLEY (Department of Pharmaceutical Sciences and Department of Chemistry, University of California, Irvine, Irvine, CA; dmobley@uci.edu).

I will survey our work using molecular dynamics simulations to predict binding free energies in blind tests in a series of different model binding sites, highlighting lessons learned and major challenges still facing work in this area. In general, we find that RMS errors in the vicinity of 1.5 kcal/mol are possible with today’s force fields, at least for small molecules like those studied here. I also discuss how these techniques might find practical use in discovery applications, and work calculating other properties and how it can impact force field development.

114 Deciphering and Engineering Chromdomain-Methyllysine Peptide Recognition, WEI HE, NAN LI, RICHARD STEIN, ELIZABETH KOMIVES and WEI WANG* (Department of Chemistry and Biochemistry, University of California, San Diego, San Diego, CA; wei-wang@ucsd.edu).

Post-translational modifications (PTMs) play critical roles in regulating protein functions and mediating protein-protein interaction. An important PTM is lysine methylation that orchestrates chromatin modifications and regulates functions of non-histone proteins. Methyllysine peptides are bound by modular domains, of which chromodomains are representative. Here, we conducted the first comprehensive study of all chromodomains in the human proteome interacting with both histone and non-histone methyllysine peptides. We observed significant degenerate binding between chromodomains and histone peptides, i.e., different histone sites can be recognized by the same set of chromodomains, and different chromodomains can share similar binding profiles to individual histone sites. Such degenerate binding is not dictated by amino acid sequence or PTM motif but rather rooted in the physiochemical properties defined by the PTMs on the histone peptides. This molecular mechanism is confirmed by the accurate prediction of the binding specificity using a computational model that captures the structural and energetic patterns of the domain-peptide interaction. Furthermore, guided by the computational model, we completed the first targeted engineering of the chromodomain binding profiles towards hundreds of peptides by mutating only three residues on the interaction interface. This study presents a systematic approach to deciphering the domain-peptide recognition and pinpointing the critical residues of which mutation could manipulate this recognition.

115 CADD and Translational Science: Interfacing Industry Practices with Academia, VICTORIA A. FEHER* and ROMMIE AMARO (Department of Chemistry and Biochemistry, University of California, San Diego, San Diego, CA; vfeher@ucsd.edu).

Recently two events have put increased pressure on the productivity and success of academic CADD projects; a. the increased funding by the NIH on translational science and b. the movement by big pharma away from internally discovered drug leads to academic partnerships for new biology, validated targets or chemical entities. At a time when many academic research labs are utilizing HTS, through virtual screening or HTS research Centers, for novel target hit discovery, our group is instead utilizing small target-focused libraries of several hundred compounds purchased from commercial vendors for in vitro screening. This approach incorporates a “Best Practices Workflow” borrowed from small start up companies that incorporates cheminformatics, structure- and ligand-based computational methods for target-focused compound selection. Several examples will be discussed, including a recent successful approach for influenza endonuclease. A workflow incorporating Open Eye’s Omega, Filter and a three-dimensional structure- and ligand-based pharmacophore developed using VROCs will be presented. Cheminformatics filtered a library from ~150,000 compounds to allow a virtual screen of ~110,000 compounds. The VS yielded 264 compounds selections for testing in a FRET-based endonuclease inhibition assay. Sixteen inhibitors (IC50 < 50 μM) that span 5 molecular classes novel to this endonuclease were found (6.1% hit rate). Two compounds suppress viral replication with negligible cell toxicity.

116 Drug Repurposing and Adverse Event Mitigation via an Integrated Molecular Modeling and Systems Pharmacology Approach, DONG XU (Department of Biomedical and
Pharmaceutical Sciences, College of Pharmacy, Idaho State University; dxu@pharmacy.isu.edu).

It has been shown that the current paradigm of “one drug, one target” in drug discovery no longer holds true. Most drugs bind to multiple targets, leading to side effects and also potential new uses. In addition to the polypharmacological implications, new possibilities arise from medication regimens of two or more drugs. In silico methods spanning molecular modeling, systems biology and database mining are being developed to facilitate drug repurposing, detect adverse events, and predict mitigating effects of combination therapy. Advances in these areas are creating the foundation of the next paradigm in drug discovery: multiple drugs, multiple targets.

Molecular Reproduction and Development
Thursday, 1:00 p.m. in HUB 355
Continues on Friday, 8:10 a.m. in HUB 355

117 How Sperm Learn to be Fertile, KEITH SUTTON, MELISSA JUNGNICKEL, and HARVEY FLORMAN* (Department of Cell and Developmental Biology, University of Massachusetts Medical Center, Worcester, MA 01655; Harvey.Florman@umassmed.edu).

No abstract was submitted.

118 Time to Make New Skin: Periodic Stem Cell Activation and Matrix Renovation in C. elegans, ALISON FRAND (Department of Biological Chemistry, School of Medicine, University of California, Los Angeles, 615 Charles Young Drive, Los Angeles, CA 90035; afrand@mednet.ucla.edu).

Nematode larvae shed and rebuild external skeletons (cuticles) through the process of molting. Their cuticles are composed mainly of collagens, which are secreted by underlying tissues similar to mammalian epithelia. The activation of skin stem cells is coupled to progression of the molting cycle, but the molecular mechanisms that orchestrate these two processes are not well understood. Related processes in humans are needed for homeostasis and repair of the body, but deregulated in various carcinomas and common disorders of skin and connective tissue.

This talk will describe recent studies of the fibrillin-like fbn-1 gene, which emerged from a genetic screen for larvae unable to shed cuticles. The gene encodes several glycoproteins composed of tandem epidermal growth factor-like motifs, 2 integrin-binding sites, and a Zona Pellucida polymerization domain. Genetic and molecular biological analyses indicate that extracellular FBN-1 macromolecules are key components of apical matrices, including the epidermal stem cell niche. Further, FBN-1 macromolecules may confer resistance to mechanical forces at precise times in development, partly by interacting with integrins. Our findings reveal a significant role for biomechanical forces in completion of the molts, morphogenesis of the skin, and maintenance of body wall muscles. We propose that checkpoints in the stem cell cycle and the molting cycle survey and respond to the exchange of mechanical forces among epithelial cells and matrices.

119 Adaptive Co-evolution of Interacting Sperm-Egg Reproductive Proteins, WILLIE J. SWANSON (Department of Genome Sciences, University of Washington, Seattle, WA 98195; wjs18@uw.edu).

The identification of interacting male-female reproductive proteins is imperative for a molecular understanding of fertilization. Generally, the molecular descriptions have relied upon studies of male reproductive proteins. I will discuss characterizing interacting male-female reproductive proteins in abalone, a system with which many of the molecular details of fertilization are well established and one that serves as a model for the study of reproductive molecules and evolution of species-specific fertilization. I will focus on evidence of direct functional interactions between sperm and egg molecules using our integrative approach, utilizing genomic, proteomic, biochemical, and computational methods. The functional specificity sperm–egg interaction will be linked to potential role in reproductive isolation (speciation). Our understanding of the molecular interactions between sperm and egg and the evolutionary dynamics of genes encoding sperm/egg proteins contribute to a broader understanding of the function and evolution of reproductive genes.

120 Activation and Regulation of Insect Sperm Motility, CATHERINE D. THALER1*, HARUHIKO MIYATA2, LEAH T. HAIMO1, and RICHARD A. CARDULLO1 (1Department of Biology, University of California, Riverside, 900 University Ave., Riverside, CA 92521; 2Animal Resource Center for Infectious Diseases, Immunology Frontier Research Center, Osaka University, 3-1 Yamadaoka Suita, Osaka 565-0871, Japan; cathyt@ucr.edu).

Many insects produce sperm that have accessory fibers and microtubules surrounding the axoneme of the flagellum and these sperm reportedly undergo unusual motility behaviors. Sperm from the mosquito Culex quinquefasciatus initiate flagellar motility after mixing with male accessory gland components, and the sperm flagellum displays double wave (two superimposed waves propagate along the flagellum) and single helical wave forward motility patterns. Forward motility requires extracellular Ca2+ and the transition from the double to single wave is controlled by MAPK, since both MEK and ERK inhibitors block formation of the helical wave and sperm exhibit only the double wave. A MAPK substrate antibody stains the flagellum of accessory gland activated sperm and staining is most intense in the flagellum proximal to the head. In the absence of Ca2+ and the presence of a phosphatase inhibitor, sperm activate motility but...
swim backwards, suggesting that kinase activity is sufficient to generate a waveform and Ca\(^{2+}\) controls the direction of motility.

Trypsin is able to activate mosquito sperm motility without accessory gland components, suggesting that a trypsin-like protein is the endogenous activator. Sperm from the water strider *Aquarius remigis* are also trypsin activated and possess a PAR2-like trypsin receptor by antibody crossreactivity. Preliminary assays using the trypsin substrate BAEE suggest that water strider ejaculatory ducts contain a trypsin-like protease and we will examine the mosquito accessory glands for protease activity also. Protease activation of sperm is reported across many orders of insects, suggesting that this is an evolutionarily conserved mechanism of motility activation.

121 Elucidating the Molecular Mechanisms behind Female Choice, KELLY KWAN, YIDING JIA, PETER CHANG, BRENT YOUNG and MATTHEW D. DEAN* (Molecular and Computational Biology, University of Southern California, 304A Ray R. Irani Building, 1050 Childs Way, Los Angeles, CA 90089; matthew.dean@usc.edu).

Female choice, the ability of a female to bias paternity in favor of certain males, is a strong evolutionary force that has probably played an important role in shaping molecular evolution of reproductive genes. Although female choice can be demonstrated experimentally, its molecular basis remains poorly characterized. To begin dissecting the biochemical pathways that females deploy in response to mating, we compared whole genome RNA-seq data from four recently mated versus two unmated (but estrus) female brain and uterus tissues, using mice as an experimental model. The brain transmits important endocrine signals necessary for successful implantation of fertilized oocytes. From over 15,000 genes detected, we found 50 that were strongly differentially regulated in response to mating in female brains and may represent the molecular basis for female choice. One of these genes, prolactin releasing hormone receptor, is responsible for priming a female’s uterus for implantation. We discuss ongoing experiments testing whether males vary in their ability to induce upregulation of such genes.

122 Human Stem Cells from Single Blastomeres Reveal Pathways of Embryonic or Trophoblast Fate Specification, TAMARA ZDRAVKOVIC, OLGA GENBACEV, LOUISE LAURENT2, JEANNE LORING2, and SUSAN FISHER2* (*Department of Obstetrics, Gynecology, and Reproductive Sciences, University of California San Francisco, 35 Medical Center Way, San Francisco, CA 94143; 2Department of Chemical Physiology, The Scripps Research Institute, La Jolla, CA 92037; sfisher@cgl.ucsf.edu).

There are major mechanistic differences among species in how initial cell fate decisions are made in embryos. To gain insights into lineage allocation in humans, we derived ten human embryonic stem cell lines from single blastomeres of four 8-cell embryos and one 12-cell embryo from a single couple (UCSF1-10). Compared to lines from blastocysts, they exhibited unique gene expression patterns and significant DNA hypomethylation. At a transcriptional level, UCSFB lines from different embryos were often more closely related than those from the same embryo. As predicted by the transcriptomic data, immunolocalization of Eomes and T showed differential expression among blastomeres of 8-12-cell human embryos. The UCSFB lines formed derivatives of the three germ layers and CDX2-positive progeny from which we derived the first human trophoblast stem cell line. Thus, the UCSFB lines mirror heterogeneity among early-stage blastomeres and have unique properties, suggesting a more immature state than lines derived from blastocysts.

123 Master Regulators of Early Lineage Formation in Mammalian Embryos, JASON KNOTT (Department of Animal Science, Michigan State University, East Lansing, MI, 48824; knottj@msu.edu).

The causes of preimplantation embryo failure and early miscarriage in women who have undergone assisted reproductive technologies (ART) are poorly understood. Research in the Knott laboratory is focused on elucidating the fundamental transcriptional and epigenetic mechanisms that facilitate preimplantation development and lineage formation in blastocysts. This talk will focus on a key regulator of transcription that controls blastocyst formation in mice.

Note: Program continues on Friday. Please refer to page 123 of these Proceedings for those abstracts.

**World War II Anthropology: Austrians and Germans in Poland; Japanese in Asia; Anthropological Research and the Search for Survivors**

Thursday at 1:20 p.m. in HUB 367

124 Continuity and Discontinuity seen in the Japanese Anthropological Tradition : A Case of Dr. Utsurikawa, Nenozo, YUKO MIO (Professor of Anthropology, Institute for Languages and Cultures of Asia and Africa, Tokyo University of Foreign Studies, Tokyo, 183-8534 Japan; ymio@aa.tufs.ac.jp).

This presentation will shed light on the work of Dr. Utsurikawa, Nenozo to discuss the continuity and discontinuity seen in the Japanese anthropological tradition. He was one of the first Japanese who took the PhD in cultural anthropology at Harvard University.

(1) The Ethnology (Cultural Anthropology) course in Taihoku Imperial University (TIU) was founded in 1928 at Taihoku (modern-day Taipei). It is a landmark in the development of Japanese cultural anthropology because professional
education was begun by professional anthropologists in a “Japanese” territory for the first time. The recently found letter to Utsurikawa from Mr. Mori, Shinosuke shows a major turning point of the history of anthropology in Taiwan. Mori was the most talented amateur anthropologist, but unfortunately “disappeared” on the ship in 1926. He told Utsurikawa in his letter that his role as a researcher would change (or end) after the foundation of the Ethnology course. (2) Utsurikawa returned to Japan in December 1945. However, he couldn’t establish his influence over the Japanese academic world. One reason is that he died suddenly in 1947. Another reason is that his post after the war wasn’t the same as other young scholars. They took their jobs at the Civil Information and Education Section (CIE) under General Headquarters of the Supreme Command Allied Powers in Tokyo and absorbed anthropological knowledge from American anthropologists working there and from American academic journals. Although the academic knowledge accumulated by Utsurikawa was taken over partly by his student Mabuchi, Toichi, cultural anthropology in Japan was newly established by those who studied “general anthropology” at CIE.

125 Anthropological Researches done by Japanese Scholars during WWII: A Case of Keijo Imperial University, KYUNG-SOO CHUN (Professor of Anthropology, Department of Anthropology, Seoul National University, Seoul, 151-746 Korea; korancks@hotmail.com).

Keijo was a capital city of the colonial Korea under the Japanese rule. Keijo Imperial University (KIU) was established 1926 and anatomy department was initiated by a physical anthropologist named Imamura Yutaka graduated from Kyoto Imperial University and trained under Edwin Fisher in Germany. Imamura’s group collected human bones and measured them in the Imperial Japan for 20 years and tried to set up a world-best bone museum in Keijo without success for the defeat of the war. They had also worked with other scholars like cultural anthropologists in the university. I would like to review what they had done in terms of collection and research under the colonial rule and military expansion of the Imperial Japan. This presentation will cover fairly completely their works at Manchuria, Korea, and Papua in terms of documentation of their works. I have conducted fieldworks on those areas without systematic framework and visited occasionally Orochon and Kor eans in Manchuria as well as Papuans in New Guinea for asking questions with survivors about their experiences of the war under the Japanese military rule. I hope I will show some photos of the Japanese scholars done those researches and videos with those people whom I have interviewed at the fields. There is however one question remained. The whole collections were disappeared with the end of the war. Where are those bone collections?

126 The Institut für Deutsche Ostarbeit: Lessons Learned, GRETCENN E. SCHAFFT (Public Anthropologist in Residence, The American University; 1222 Noyes Drive, Silver Spring, MD 20910; gschafft@verizon.net).

The Institut für Deutsche Ostarbeit (IDO), or the Institute for German Work in the East, was one of many ventures over decades spanning the 19th and 20th centuries, in which Germany attempted to examine the potential of using resources from the lands to its east to fulfill its own ambitions. (see Michael Burleigh, Germany Turns Eastward). The occupation from 1939 to the end of World War II, unlike previous attempts, allowed the German Nazi regime to organize the rape of Poland from inside the country, a very large advantage to the efficiency and effectiveness of the exploitation.

The IDO was headquartered in Krakow beginning in 1940 and quickly developed its organizational plan based on the ideology of race and necropolitics. Non-human resources were confiscated and exploited by the availability of an unending supply of slave and impressed labor. The IDO developed systems of hierarchical classification that attached to clear-cut decision-making regarding the placement of individuals or categories of individuals into slots. No Polish citizen was destined for a future based on his or her own agency, but rather on a scale from immediate death to mindless labor for the Third Reich as determined by Nazi functionaries.

The post-war find of primary data regarding the details of the workings of the IDO’s Section on Race and Racial Investigation, provided the information needed to better understand the motivations of the researchers and their ambitions. It also showed how far short they fell from any attempt to conduct their research in regard to scientific principles. The outcomes of studying these primary materials show today’s social science researchers the nature of the relationships between the German invaders and their acquired subjects, the intraoffice politics that influenced the extent to which human rights were observed, the contradictions between ideology and practice, and the degree to which war objectives were diverted into xenophobic searches for fictive ethnic homogeneity brutally carried out in the name of science.

127 We Were Scared... Nazi Racial Examinations in Memory of Polish Highlanders from Podhale Region, STANISŁAWA TREBUNIA-STASZEL (Associate Professor, Institute of Ethnology and Cultural Anthropology, Jagiellonian University, 9 Golebia Street, Cracow 31-007, Poland; s.stasz@iphils.uuj.edu.pl).

The paper focuses on anthropological research conducted by the Sektion Rassen und Volkstumsforschung of Intitute fur Deutsche Ostarbeit (SRV-IDO) among Polish Highlanders called Gorale from Podhale region. I choose this group because it occupied special place within Nazi ethnopolicy (German’s plan was to create new nation of Gorals). When the SRV-IDO records moved to Poland in 2008, the group of ethnologists from Jagiellonian University initiated the research on these documents. The first step was to look through all documents, and select materials that
refer to Podhale. It appeared that from the whole collection of 73,000 units over 22,000 concerned Gorale. The second task was to reach the people who are still alive and who were put through Nazi racial examinations. We wanted to record their relations in order to learn how the Nazi research was stored in their memories. Until now we found and interviewed about 60 witnesses from Podhale. The conversations showed that, although so many years have passed, some documents from SRV bring back events that still cause a lot of emotions and fears. During our meetings with witnesses, many of them provided us with others episodes from their life – sometimes very dramatic stories.

In my talk I am going to present results of contemporary fieldwork research among the witnesses from Podhale, concentrating on their memories from WW II. I will try to show, that such subjective data appear to be important source of knowledge about Nazi policy and people’s everyday life under Germans occupation in Poland.

128 The Work of the Section of Racial and National Traditions Research (SRV) of the Institut für Deutsche Ostarbeit in the Lemkivshchyna Region in South-Eastern Poland, PATRYCJA TRZESZEZYNSKA-DEMEL (Associate Professor, Institute of Ethnology and Cultural Anthropology, Jagiellonian University, 9 Golebia Street, 31-007 Cracow, Poland; patrycja.trzeszczynska@gmail.com).

The survey carried out by the Section of Racial and National Traditions Research of the Institute of German Work in the East (SRV IDO) covered, among other places, the Lemko Region in Low Beskids, Poland. The Ethnicity Research Department regarded the survey on the ethnicity of Slavic ethnic groups of the General-Gouvernement as comparative to searching for traces of Germanness. The work of the commission consisted in “measuring and describing the people”, medical examinations, psychotechnical tests, filling in the sociological survey forms. In a village of Komancza, e.g., in 1942 there was prepared the following documentation: anthropological, sociological, psychological, medical and racial, survey forms as well as skull outlines. Ethnographically, it is a Lemko village, the inhabitants of which strongly identified with the Ukrainian nation.

The specificity of the IDO research in Komancza, covering the subjects aged between 20 and 60, influences contemporary research on the memory about the work of the Nazi commission. In 1946, a significant part of the population left the village and was deported by the communists and located in two Western districts of the Ukrainian Soviet Socialist Republic. In 2009-2011 it succeed to conduct few dozen interviews with Komancza inhabitants and refugees in Ukraine, themselves or their families. The memory about the IDO commission survey conducted in Komancza among the descendants of the subjects has been preserved as incomplete and inconsistent.

The research has not been completed yet. Due to the archive query some traces and links lead to Lviv, Vienna, Berlin and Warsaw.

129 The Institut für Deutsche Ostarbeit (IDO): Using Anthropometric Data to Gain an Appreciation of the Polish Population Before, During, and After World War II, ALICJA K. LANFEAR (Post-doctoral Research Assistant, Forensic Institute for Research and Education, Middle Tennessee State University, Box 89, Murfreesboro, TN, 37132; Alicja.Lanfear@mtsu.edu).

The goal of this study was to use the anthropometric data contained in the records of the Institut für Deutsche Ostarbeit (IDO) to assess regional variation and secular trends (change over time) before, during, and after World War II. There has been a significant amount of research in secular trends of the Polish population; however, only from 1955 to present. In Poland as in many European countries, there is a significant deficit of data for individuals during the period leading up to and during the two World Wars. This is a compelling argument for why the data of the IDO needed to be analyzed using a modern anthropological approach. Without this analysis we cannot appreciate the impact of this time period on the people of Poland or provide context for later secular trends and regional variation.

In this study significant regional variation was observed at all levels of analysis and did not differ significantly between the sexes. The most significant secular trend in body dimensions was observed as an increase in height. This is surprising as it has been consistently demonstrated that as living conditions improve, the height of a population increases. Cranial vault dimensions did not follow the trend observed in height. Rather, cephalic index underwent an increasing trend (associated with less favorable conditions) until the birth year of 1901 where it plateaus and then begins to decline in individuals born after 1926. The agrarian crisis (period of severe crop failure) that occurred during the late 19th century in Poland and World War I may be responsible for the pattern observed in cephalic index. It is hoped that by demonstrating significant population structure in the Polish population more research into regional differences will be conducted and that the secular trends of the more recent past can be placed in the context of these historical data.

Genetics of Adaptation – From Spiders’ Silk to Marathon Mice
Thursday at 1:20 p.m. in HUB 379

130 Born to Run: Genotype-Phenotype Mapping and the Evolution of Locomotor Activity, THEODORE GARLAND, JR. (Department of Biology, University of California, Riverside, Riverside, CA 92521; tgarland@ucr.edu).

Our laboratory uses a replicated artificial selection experiment with laboratory house mice to study the coadaptation of behavior with morphology, physiology, biochemistry, and neurobiology. Beginning from a base population of 220 outbred Hsd:ICR mice, eight separate lines were created.
In four lines, designated High Runner or HR, mice are bred for high voluntary wheel running on days 5&6 of a 6-day period of wheel access when young adults. Four additional lines are maintained in identical fashion, except that breeders are chosen without regard to wheel running. Each line has a minimum of 10 breeding pairs per generation, and within-family selection increases the effective population size (Ne) to ~35 per generation. All four HR lines responded to selective breeding with a rapid increase in wheel running, then reached a plateau at generation 16-28, with some variation among lines and between the sexes. Quantitative-genetic analyses using the “animal model” approach through the first 31 generations of selection indicate that additive genetic variance for wheel running remained in at least 3 of the 4 lines when they had reached an apparent selection limit. Simulation results suggest that neither phenotypic epistasis in the components of wheel running (motivation and ability for speed and/or duration) nor genetic dominance is likely to explain the maintenance of additive genetic variance, which suggests that epistatic interactions among alleles at loci that affect wheel running may be important. SNP genotyping and whole-genome sequencing are now being used to identify chromosomal regions that have been important in the response to selection.

131 How Fast Is Mendelian Adaptation? MICHAEL R. ROSE*, LARRY G. CABRAL, THOMAS T. BARTER, GRANT A. RUTLEDGE, JAMES N. KEZOS, MARK A. PHILLIPS, LAURENCE D. MUELLER, LEE F. GREER, and JOSEPH L. GRAVES, JR (Department of Ecology and Evolutionary Biology, University of California, Irvine, CA 92697; joint email addresses; mrose@uci.edu).

Experimental evolution allows sustained and well-replicated selection, but in Mendelian populations problems of space and time often constrain the magnitude and duration of selection experiments. We have sustained specific selection regimes in our Drosophila laboratories for as many as 1,000 generations, among the longest well-replicated selection experiments in Mendelian evolutionary genetics. We have performed a wide variety of phenotypic assays of these long-evolved populations, covering patterns of life-history, development, phenotypic plasticity, physiological performance, morphology, and so on. Recently, we have started to employ genome-wide sequencing to characterize the genetic effects of such long-sustained selection. Moreover, we have newly imposed three of our long-standing selection regimes, in order to observe the more immediate phenotypic and genetic effects of our selection protocols. We were surprised to find that selection durations of about one-tenth that of our long-standing selection regimes were sufficient to achieve much of the phenotypic and genome-wide differentiation that longer-term selection produced. We will illustrate this pattern using life-history, developmental, and physiological phenotypes as well as genome-wide single-nucleotide polymorphisms.

132 Molecular Evolution of Spider Silk: Genetics of Functional Repetitive DNA, CHERYL Y. HAYASHI (Department of Biology, University of California, Riverside, CA 92521; cheryl.hayashi@ucr.edu).

While silk production has arisen numerous times within Arthropoda, spiders (Araneae) are renowned for their unsurpassed reliance on silk for critical ecological functions, including reproduction, prey capture, predator avoidance, and aerial dispersal. Some of the most spectacular aspects of spider biology are the extensive innovations in silk use that have evolved over the past 300 million years. All spiders possess multiple silk glands, and in the majority of species, the silk glands are differentiated into distinct types, with each type secreting a task-specific fiber or adhesive. Fine-tuned by natural selection, spider silks are remarkable, high performance materials that compare favorably with, and in some cases exceed, the best manmade fibers in terms of strength and toughness. Spider silks are made almost entirely of proteins, with the overwhelming majority of proteins encoded by the spidroin multi-gene family (spidroin is a contraction of “spider fibroin”). Spidroins are enormous molecules (often >250kDa). A spidroin monomer is thousands of amino acids in length, over 90% of which is constructed from tandemly-arranged repeats, and monomers dynamically interconnect to form fibers. Paralogs of the spidroin gene family can dramatically differ from each other in the length and amino acid sequence of their constituent repeat units. Furthermore, attributes of the repeat units are functionally linked to the extraordinary mechanical properties of spider silks. Gene cloning has revealed that spidroin genes contain vast arrays of minisatellite-like nucleotide sequences and insights regarding the molecular evolutionary consequences of functional, highly repetitive DNA will be presented.

133 Molecular Evolution of Tooth Genes in Toothless Vertebrates: Deciphering Evolutionary History from Pseudogenes, MARK SPRINGER (Department of Biology, University of California, Riverside, CA 92521; mark.springer@ucr.edu).

Functional genes are maintained by both positive and negative (purifying) natural selection. In some cases, strong purifying selection has resulted in nearly identical copies of orthologous genes that diverged hundred of millions or billions of years ago. By contrast, inactivated copies of formerly functional genes (pseudogenes) evolve in the absence of purifying selection, rapidly accumulate substitutions and frameshift mutations, and in some cases are excised from the genome. Importantly, pseudogenes retain signatures of their former functional history and inactivation times. Methods
based on shared frameshift mutations, rates of frameshift mutation, and dN/dS ratios can be used to reconstruct patterns of evolutionary change, and to predict the occurrence of morphological transitions in the fossil record. Edentulism, or the absence of teeth, has evolved on multiple occasions in vertebrates. Multiple independent iterations of tooth loss, the occurrence of tooth-specific genes, and the hardness of bones and teeth, make edentulism a model system for integrating data from “dead genes” with the fossil record. Here, we employ the pseudogenic remnants of several tooth-specific genes (ENAM, AMEL, AMBN, MMP20) with information from the fossil record to reconstruct patterns of tooth loss in several clades of edentulous vertebrates including baleen whales, pangolins, and the extinct Steller’s sea cow, which was extirpated in the 18th century. In every case, molecular and fossil data are concordant and together combine to yield more synthetic perspectives on macroevolutionary transitions within Vertebrata than would be possible with only genomics or fossil data.

134 Genomics of Convergently and Experimentally Evolving Populations of Guppies (Poecilia reticulata). BONNIE A. FRASER1, AXEL KUNSTER2, DAVID N. REZNICK2, CHRISTINE DREYER1, and DETLEF WEIGEL1
(1Department of Molecular Biology, Max Planck Institute for Developmental Biology, Spemannstrasse 37, 72076, Tübingen, Germany; 2Department of Biology, University of California, Riverside, Riverside, CA 92521, USA; bonnie.fraser@tuebingen.mpg.de).

Convergent evolution represents one of the best lines of evidence for adaptation but there are few cases where we know how convergent evolution of phenotypes is reflected at the genetic level. Guppies inhabiting the northern mountain range of Trinidad are a classic example of convergent evolution, where adaptation to low or high predation environments has been found for a variety of phenotypes. This system offers advantages over other convergently evolving species because their natural history facilitates long-term experimental studies in nature; researchers have transplanted fish from high predation sites, to areas without guppies or predators. We used genome scans of guppies from natural high and low predation populations, and from experimentally established populations to examine whether convergent evolution occurs at the genome level. We used population genetic modeling approaches to reconstruct the demographic history and migration among sampled populations. Surprisingly, we found that naturally colonized low predation populations showed signatures of population growth since colonization, while introduction populations showed signatures of decrease, consistent with recent natural selection. We found only a small number of regions across the genome that showed signatures of selection in all natural populations. However, the two experimental populations shared many genomic regions with signatures of selection, suggesting convergent evolution in these populations. Our results indicate that identifying the signature of convergent evolution at the genome level requires sampling at the appropriate timescale or from populations colonized with high genetic variation; otherwise neutral processes or population-specific selective forces may have a larger effect than convergent evolution.

135 The Genetics of Floral Adaptation: Flower Color, Shape and Organ Identity. SCOTT A. HODGES*, NATHAN J. DERIEG, and EVANGELINE S. BALLERINI (Department of Ecology, Evolution and Marine Biology, University of California, Santa Barbara, CA 93106; hodges@lifesci.ucsb.edu).

The columbine genus, Aquilegia, is known for its remarkable diversity of floral forms, with species differing across a suite of traits related to pollinator interactions. Adaptation to major classes of pollinators has generated patterns of phenotypic divergence and convergence. For example, independent shifts from bee to hummingbird, and hummingbird to hawkmoth pollination consistently involve increases in petal nectar-spur length matching the tongue length of the new pollinator. Shifts in flower color are similarly predictable and repeated. We are using whole genome and whole transcriptome sequencing to study the molecular genetic basis of these adaptive shifts. Sequencing of floral transcriptomes from species representing all of the color shifts in North American Aquilegia reveals frequent convergence at the gene expression level, even to the level of similar cis-regulatory changes, thus indicating that the genetic outcome of natural selection is repeatable. We have also used the fact that species of Aquilegia are interfertile to create hybrid populations for studying quantitative trait loci (QTL) underlying phenotypic differences. Because the evolution of nectar spurs appears to have been crucial for pollinator specialization, we have crossed the only spur-less columbine, A. ecalcarata, with a spurred species, to fine-map a single QTL of major effect. Lastly we have found a population that has lost petals due to a single gene, which will allow us to further understand how and when petals, and their spurs, are adaptations.

Mechanisms of Tumor Progression and Cancer Therapy
Thursday at 1:25 p.m. in MS&E 0113

136 Bone Metastatic Microenvironment: Oncostatin M Promotes Osteolytic Bone Degradation and Breast Cancer Metastasis. KEN TAWARA*, CELESTE BOLIN, CALEB SUTHERLAND, JEFF REDSHAW, PATRICK ARANDA, JIM MOSELY, ROBIN ANDERSON, and CHERYL L. JORCYK (Department of Biological Sciences, Boise State University, 1910 University Drive, Boise,
137 Antitumor Activity of a Polypryidyl Chelating Ligand: In Vitro and In Vivo Inhibition of Glioblastoma, CLEMENT N. DAVID\(^1\), ELMA S. FRIAS\(^2\), CATHERINE C. ELIX\(^2\), AMEAE M. WALKER\(^2\), JACK F. EICHLER\(^2\), and EMMA H. WILSON* (\(^1\)Division of Biomedical Sciences, School of Medicine, University of California, Riverside, Riverside, CA 92521; \(^2\)Department of Chemistry, College of Natural and Agricultural Sciences, University of California, Riverside, CA USA 92521; emmaw@ucr.edu).

Glioblastoma multiforme is an extremely aggressive and invasive form of central nervous system (CNS) tumor commonly treated with the chemotherapeutic drug Temozolomide (TMZ). Unfortunately, the median survival is still less than 18 months. In this study, we tested the anti-tumor capability of a phenanthroline-based ligand, 2,9-di-sec-butyl-1,10-phenanthroline (SBP). In an effort to assess the anti-tumor capabilities of SBP, \emph{in-vitro} studies were considered using rodent GL-26 and C6 glioma cells and human U-87, and SW1088 glioblastomas/astrocytomas. \emph{In-vivo} studies were done using mice in which a glioma was established by an intracranial injection of GL-26 cells using a stereotactic mouse frame. SBP injections were given intravenously through the retro-orbital route on day 1, 7 and 13 post tumor implantation. Tumor size and SBP toxicity was quantified. SBP demonstrated strong \emph{in-vitro} activity against GL-26, C6 and SW1088 cells, with little toxicity towards non-tumorigenic primary murine and human astrocytes. \emph{In-vivo} experiments demonstrate a significant reduction in tumor growth with administration of SBP alone, with mild toxicity observed in healthy tissues. Furthermore, \emph{in-vitro} and \emph{in-vivo} TUNEL stain suggests that SBP induces apoptosis in gliomas. These experiments suggest SBP is effective in slowing CNS glioblastoma progression and should be considered as a potential compound for future anticancer drug development.

139 Immune Responses and Racial Disparities in Colon Cancer, KATHLEEN L. McGUIRE\(^1\), MOHAMMAD W. KHAN*, and JOHN M. CARETHERS\(^2\) (\(^1\)Department of Biology, Molecular Biology Institute, San Diego State University, 5500 Campanile Drive, San Diego, CA 92182-4614; \(^2\)Division of Gastroenterology, Department of Internal Medicine, University of California, San Diego, CA 92103; kmcgurk@sdsu.edu).

Oncostatin M (OSM) belongs to the interleukin-6 (IL-6) family of inflammatory cytokines. Here we investigate the role of OSM in the formation of bone metastases \emph{in vivo} using the 4T1.2 mouse mammary tumor model in which OSM expression was knocked down using shRNA (4T1.2-OSM). 4T1.2-OSM cells were injected orthotopically into Balb/c mice, resulting in an almost complete elimination of spontaneous metastasis to bone. Intratibial injection of these same 4T1.2-OSM cells also dramatically reduced the osteolytic destruction of trabecular bone volume compared to control cells. Furthermore, in a tumor resection model, mice bearing 4T1.2-OSM tumors showed an increase in survival by a median of 10 days. To investigate the specific cellular mechanisms important for OSM-induced osteolytic metastasis to bone, an \emph{in vitro} model was developed using the RAW 264.7 pre-osteoclast cell line co-cultured with 4T1.2 mouse mammary tumor cells. Treatment of co-cultures with OSM resulted in a 3-fold induction of osteoclastogenesis using the TRAP assay. We identified an OSM induced factor, amphiregulin (AREG) which increased osteoclast differentiation. Our results suggest that one mechanism for OSM-induced osteoclast differentiation is via an AREG autocrine loop, resulting in decreased osteoprotegerin secretion by the 4T1.2 cells. These data provide evidence that OSM might be an important therapeutic target for the prevention of breast cancer metastasis to bone.

ACR RSG-09-276-01-CSM, Susan G Komen KG100513, NIH/NCRR P20RR016454 and P20GM103408, NIH/NCI R15CA137510, and NASA NNX10AN29A.

183 Antimaia Inhibits Breast Cancer Metastasis through Effects on Both Tumor and Immune Cells, KUAN-HUI E. CHEN, TOMOHIRO YONEZAWA, MRINAL K. GHOSH, and AMEAE M. WALKER* (Division of Biomedical Sciences, University of California, Riverside, CA 92521; ameae.walker@ucr.edu).

Several lines of evidence support a role for prolactin (PRL) in the development and progression of cancers of the ovary, prostate and breast. PRL receptors (PRLR) are differentially spliced to produce a variety of transmembrane proteins that initiate different signaling cascades. Previous work has implicated the long form of the PRLR in cancer progression. We have developed a splice-modulating oligomer that specifically and dose-dependently knocks down the long PRLR \emph{in vivo}. For ease of description, we have named the oligomer, Antimaia. Using both the 4T1 mouse syngeneic and a human xenograft breast cancer model, we have shown that Antimaia markedly inhibits metastatic spread to the liver and lungs. Some inhibition is due to direct effects of Antimaia on tumor cells, including a reduction in the number of cancer stem cells. Other effects are on immune cell recruitment to metastatic sites, resulting in reduced monocytes and increased tumor-specific cytotoxic T cells. Despite increased numbers of cytotoxic T cells, inflammatory damage in metastatic sites was reduced with Antimaia treatment, perhaps the result of cytokine-specific effects in tumor T regulatory (Treg) cells viz. inhibition of production of TGFβ, but not IL-10 or IL-2. When tumor cells were co-cultured with Tregs from control tumors, PRL induced a more epithelial phenotype, whereas Tregs from Antimaia-treated animals were used, PRL induced a more mesenchymal phenotype, as it did in the absence of Tregs. We conclude that Antimaia has great potential for the treatment and prevention of metastatic disease.

Supported by CBCRP 17IB-0053 and NICHD 065099.
Immune responses have been recently shown to have a significant impact on cancer development, progression and metastasis. Patient outcome may be dependent upon the balance of pro- and anti-tumor immune responses in malignancy. That anti-tumor immunity can significantly protect patients has been well demonstrated in colorectal cancer (CRC). CRC is the third leading cause of cancer deaths in the US and African Americans have more CRC and higher fatality than Caucasians. CRC can be caused by chromosomal instability (CIN) or microsatellite instability (MSI). MSI is the result of mismatch repair defects leading to tumors that contain strong immune responses and are less aggressive than CIN tumors. We now have evidence that African Americans have fewer MSI tumors than Caucasians. EMAST, an instability of specific tetranucleotide repeats, appears to be a marker for aggressive CRC, and we have evidence that African Americans have more EMAST positive rectal cancer. EMAST positive tumors are also characterized by heavy immune infiltrate, but it is presumably pro-tumor, leading to the increased aggressiveness. A more recent study of over two hundred CIN tumors has shown that African Americans overall have poorer anti-tumor immune responses in their colon tumors than Caucasians. Taken all together, these data suggest genetic changes lead to more aggressive disease in African Americans and show that immune responses may contribute to the racial disparity observed in CRC.

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140 Promoting Breast Cancer Metastasis: A Role for the Inflammatory Cytokine Oncostatin M, CHERYL L. JORCYK (Department of Biological Sciences, Biomolecular Sciences Program, Boise State University, 1910 University Drive, Boise, ID 83725-1515; cjorcyk@boisestate.edu).

Oncostatin M (OSM) is an interleukin-6 (IL-6)-family cytokine that has been implicated in a number of biological processes including inflammation, hematopoiesis, immune responses, and development. It is produced by multiple cell types, including activated T cells, macrophages, neutrophils, and tumor cells such as breast. OSM was initially shown to inhibit the proliferation of breast cancer cells in vitro, and was therefore evaluated as a potential cancer therapy. Evidence in the literature and data from our laboratory; however, suggests that OSM promotes tumor invasion and metastasis. In breast cancer cells, OSM induces secretion of proteases important for breakdown of the extracellular matrix during invasion and metastasis, promotes expression of angiogenic factors such as vascular endothelial growth factor (VEGF) and hypoxia-inducible factor 1alpha (HIF1alpha), and induces expression of pro-metastatic inflammatory factors such as cyclooxygenase-2 (COX2). The results from our novel in vivo studies will be presented and may provide evidence that OSM is an important therapeutic target for the prevention of breast cancer metastasis.
methylation within the context of the RdDM pathway and provide the first mechanistic insight into a key initiating step in the RdDM pathway, the targeting of RNA Pol-IV. A better understanding of this early step in the establishment of DNA methylation will aid in our ability to manipulate gene expression patterns, which given the parallels between DNA methylation systems in plants and mammals, has broad implications for both agriculture and gene therapy.

142 Remodeling of Ago2-mRNA Interactions Upon Cellular Stress Reflects miRNA Complementarity and Correlates with Altered Translation Rates, FEDOR V. KARGINOV1# and GREGORY J. HANNON2 (*Department of Cell Biology and Neuroscience, University of California, Riverside, 900 University Ave., Riverside, CA 92521, karginov@ucr.edu; 2Watson School of Biological Sciences, Howard Hughes Medical Institute, Cold Spring Harbor Laboratory, 1 Bungtown Road, Cold Spring Harbor, NY 11724, Hannon@cshl.edu).

When adapting to environmental stress, cells attenuate and reprogram their translational output. In part, these altered translation profiles are established through changes in the interactions between RNA-binding proteins and mRNAs. The Ago2/microRNA machinery has been shown to participate in stress-induced translational upregulation of a particular mRNA, CAT-1; however, a detailed, transcriptome-wide understanding of the involvement of Ago2 in the process has been lacking. Here, we profiled the overall changes in Ago2-mRNA interactions upon arsenite stress by CLIP-seq. Ago2 displayed a significant remodeling of its transcript occupancy, with the majority of 3’ UTR and CDS sites exhibiting stronger interaction. Interestingly, target sites that were destined for release from Ago2 upon stress were depleted in miRNA complementarity signatures, suggesting an alternative mode of interaction. To compare the changes in Ago2 binding patterns across transcripts with changes in their translational states, we measured mRNA profiles on ribosome/polysome gradients by RNA-seq. Increased Ago2 occupancy correlated with stronger repression of translation for those mRNAs, as evidenced by a shift toward lighter gradient fractions upon stress, while release of Ago2 was associated with the limited number of transcripts that remained translated. Taken together, these data point to a role for Ago2 and the mammalian microRNAs in mediating the translational component of the stress response.

143 Fungal Small RNAs Suppress Plant Host Immunity by Hijacking Host RNAi Machinery, ARNE WEIBERG1, MING WANG1, FENG-MAO LIN2, HONGWEI ZHAO1, ZHIHONG ZHANG1, ISGOUHI KALOSHIAN1, HSEIN-DA HUANG2, and HAILING JIN1# (1University of California, Riverside, 900 University Ave., Riverside, CA 92521 USA; weifeng.gu@ucr.edu). Small RNAs (sRNAs) are a class of short non-coding regulators that mediate gene silencing in a sequence-specific manner. Small RNAs have been shown to play an important role in host immune responses against pathogen attacks. Most fungal genomes encode components of RNAi machinery, including Dicer-like proteins and Argonautes (AGO). The role of fungal small RNAs in genome defense, heterochromatin formation, and gene regulation has been demonstrated. However, it was not known whether fungal small RNAs or RNAi are directly involved in pathogenicity. Botrytis cinerea is an aggressive fungal pathogen that infects more than 200 plant species. Genome-wide small RNA profiling from B. cinerea-infected Arabidopsis and tomato has identified a group of small RNAs from B. cinerea that can potentially target important regulatory genes in plant hosts. Genetic and biochemical studies have demonstrated that some B. cinerea small RNAs (Be-sRNAs) can selectively silence host immunity genes by hijacking host RNAi machinery. These Be-sRNAs are loaded into host AGO proteins to silence host genes involved in defense. Deviated from the conventional pathogen protein effectors that suppress host immunity in plants and animals, we demonstrate that a fungal pathogen transfers “virulent” sRNA effectors into host cells to achieve infection. The implications of this finding may extend beyond grey mold disease or plant fungal diseases in general.

144 A Highly Conserved Protein PIR-1 is Required for Silencing Orsay Virus in C. elegans, WEIFENG GU (Department of Cell Biology and Neuroscience, University of California, Riverside, 900 University Ave., Riverside, CA 92521 USA; weifeng.gu@ucr.edu).

RNA viruses such as flu virus, HIV, and Hepatitis C virus, are among the most deadly threats to human health. Recent studies, including some pioneering work performed here at UCR, have demonstrated that the RNAi machinery plays critical roles in eliminating RNA virus in animals and plants. Central to the RNAi machinery is Dicer, an RNase III like enzyme, which specifically dices double-stranded (ds) RNA generated by viral RNA-dependent RNA polymerase (RdRP) during RNA virus infection. The resulting small RNA, siRNA, is loaded to Argonaute protein, which then targets viral RNA by base-pairing via siRNA. PIR-1, a potential RNA phosphatase or dual specificity protein phosphatase, was identified as a conserved dicer interacting protein. However, the function of PIR-1 in RNAi or anti-virus remains unknown. Using C. elegans and Orsay virus as a model system and collaborating with Mello lab, I have demonstrated that PIR-1 is essential for the biogenesis of dicer/Argonaute-dependent viral siRNA as well as endogenous primary siRNA, both of which initiate secondary siRNAs (22G) required for silencing. Currently we are investigating if PIR-1 is a protein phosphatase or RNA phosphatase.

145 The Arabidopsis PHD-Finger Protein EDM2 Controls Plant Innate Immunity by Modulating Levels of the Epigenetic Transposon-Silencing Mark H3K9me2, THOMAS
**EUGLEM*, TOKUI TSUCHIYA, and YAN LAI** (Center for Plant Cell Biology, Institute for Integrative Genome Biology, Department of Botany & Plant Sciences, University of California, Riverside, CA 92521, USA; thomas.eulgem@ucr.edu, tsuchi_gst@yahoo.co.jp, yan.lai@ucr.edu).

The *Arabidopsis thaliana* PHD-finger protein EDM2 controls silencing states of transposable elements (TE) by modulating levels of dimethylated lysine 9 of histone H3 (H3K9me2), a suppressive post-translational histone modification (PHM). Insertion of EDM2-controlled TEs into clusters of disease resistance (*R*) genes recruited an epigenetic factor to the regulation of plant immune responses. We show that EDM2-dependent modulation of H3K9me2 at a TE in the 1st intron of *RPP7* controls expression of this *R* gene by affecting alternative polyadenylation. Varying levels of this PHM shifts the balance between full-length RPP7 transcripts and prematurely polyadenylated non-RPP7-coding transcripts. Additional *R* genes that are closely associated with TEs also appear to be affected by EDM2-dependent H3K9me2 levels. Our work illustrates one of the first direct *in vivo*-demonstrations for co-option of a TE-associate histone mark to the epigenetic control of pre-mRNA processing and establishes a unique mechanism of plant *R* gene expression. We further show the PHD-finger module of EDM2 to recognize histone H3 bearing certain combinations of three distinct PHMs. Our results suggest that targeting of EDM2 to specific genomic regions is mediated by the histone-binding selectivity of its PHD-finger domain.

**146 Regulation of Innate Immunity to the Fungal Pathogen Fusarium oxysporum by MicroRNAs in Tomato, SHOUQIANG OUYANG,1, GYUNSOON PARK1, HAGOP ATAMIAN2, CLIFF S. HAN3, JASON E. STAJICH1, ISGOUHI KALOSHIAN2, and KATHERINE A. BORKOVICH** (*1Department of Plant Pathology and Microbiology, 2Department of Nematology, Institute for Integrative Genome Biology, 900 University Ave., University of California, Riverside, CA 92521, 3Bioscience Division, MS M888, Los Alamos National Laboratory, Los Alamos, NM 87545; katherine.borkovich@ucr.edu).

MicroRNAs (miRNAs) are important regulators of growth and development in plants. Several miRNA families target genes encoding nucleotide-binding site–leucine-rich repeat (NB-LRR) plant innate immune receptors. The fungus *Fusarium oxysporum* f. sp. lycopersici causes vascular wilt disease in susceptible tomato plants. We explored a possible role for miRNAs in tomato defense against *F. oxysporum* using comparative miRNA profiling of susceptible (Moneymaker) and resistant (Motelle) tomato cultivars infected with *F. oxysporum*. The results revealed that slmiR482f and slmiR5300 were repressed during infection of Motelle with *F. oxysporum*. Northern analysis confirmed that two predicted miRNA targets each of slmiR482f and slmiR5300 exhibited increased expression in Motelle and the ability of these four targets to be regulated by the miRNAs was confirmed by co-expression in *Nicotiana benthamiana*. A virus-induced gene silencing approach in the resistant Motelle cultivar revealed a role in fungal resistance for all four targets. All four genes encode proteins with full or partial nucleotide-binding (NB) domains. One slmiR5300 target, Solyec09g018220, is *tm-2*, a susceptible allele of the *Tomato Mosaic Virus* resistance gene. However, the observation that none of the targets correspond to *I-2*, the only known resistance (*R*) gene for *F. oxysporum* in tomato, supports roles for additional *R* genes in the immune response. Taken together, our findings reveal microRNAs that mediate resistance to *F. oxysporum* in tomato, implicate miR5300 in plant immunity and support functions for a viral resistance gene (*tm-2*) in immunity to a fungal pathogen.

**Molecular Reproduction and Development**

**Friday at 8:10 a.m. in HUB 355**

Note: Program continues from Thursday. Please refer to page 114 of these *Proceedings* for those abstracts.

**147 Developmental Regulation of Heparan Sulfate Proteoglycan Synthesis, LINE HOFMANN, DOUGLAS BORNEMANN and RAHUL WARRIOR** (*Department of Developmental and Cell Biology, 4219 McGaugh Hall, University of California, Irvine, Irvine, CA 92697-2700; rwarrior@uci.edu).

Heparan Sulfate Proteoglycans (HSPGs) are extracellular matrix and cell surface macromolecules found on virtually every cell type in all multicellular animals. They consist of a protein core covalently attached to long, unbranched glycosaminoglycan (GAG) sugar chains that are extensively modified. HSPGs play key roles in development and disease by affecting the transport, stability and signaling activity of multiple growth factors/morphogens. While HSPGs were believed to be expressed ubiquitously in metazoans, we have found that HSPGs are absent from early Drosophila embryos due to inhibited translation of GAG synthetic enzyme mRNAs. Transcripts for the Drosophila GAG chain co-polymerase Tout velu (Ttv; EXT1 in vertebrates) and the N-deacetylase/sulfotransferase (NDST) Sulfateless (Sfl) contain internal Ribosome Entry Sites (IRESs) that are negatively regulated during the first three hours of development. Relief of this inhibition leads to expression of the proteins and HSPG chain synthesis. Homologous transcripts in other species have similarly complex 5'UTRs, and we find that human EXT1 can also mediate temporally regulated translation in the early fly embryo. This exciting finding argues that these regulatory mechanisms may be evolutionarily conserved, and that cis-elements and trans-acting factors identified in Drosophila could be relevant to understanding the basis of the human diseases Multiple Hereditary Exostoses.
that result from loss of a single copy of the human EXT1 or EXT2 genes.

148 A Role for Dynein in Germline Stem Cell Maintenance in C. elegans. XIAOBO WANG1, EKATERINA VORONINA1*, DOMINIQUE RASOLOSON2, and MARIAH MALEY1 (1Division of Biological Sciences, University of Montana, 32 Campus Dr., Missoula, MT 59812; 2Department of Molecular Biology and Genetics, Johns Hopkins University School of Medicine/HHMI, 725 N. Wolfe Street, Baltimore, MD, 21205; ekaterina.voronina@umontana.edu).

Germline stem cell maintenance in C. elegans depends on the activity of PUF domain RNA-binding proteins FBF-1 and FBF-2, which are similar but functionally distinct. Localization and function of FBF-1, but not FBF-1, depends on the integrity of P granules, perinuclear RNA granules of germ cells. Using a combination of mass-spectrometry and genetic screens, we identified a dynein component DLC-1 as a functional cofactor of FBF-2, but not FBF-1. DLC-1 is an LC8-type light chain, a cargo-binding component of dynein motor complex. Dynein traffics organelles, proteins, and mRNAs toward the minus ends of microtubules. Knockdown of DLC-1 by RNAi in the sensitized background leads to loss of repression of FBF-2 target reporter in the mitotic stem cell region and animal sterility. Localization of FBF-2 to P granules at nuclear periphery is lost after dlc-1(RNAi), even when perinuclear P granules are not affected. By contrast, FBF-1 localization is not affected by DCL-1 knockdown. In vitro, DCL-1 interacts with FBF-2, but not FBF-1, suggesting that the specific contribution of DCL-1 to FBF-2 function is based on the selective protein-protein interaction.

We hypothesize that DCL-1 binds to FBF-2 and promotes its localization to P granules, which is important for FBF-2-mediated translational regulation and stem cell maintenance. Dynein motor complex has been implicated in formation, transport, and dynamics of RNA granules in other cell types. Our findings suggest that dynein may directly regulate recruitment of specific components to the RNA granules in addition to regulating RNA granule dynamics in a general way.

149 Developmental Robustness in the C. elegans Embryo. MORRIS MADURO1*, HAILEY CHO12, CASSANDRA BENNETT1, FRANCISCO CARRANZA2, FARHAD GHAMSARI1, GINA BROITMAN-MADURO1, and GURJOT WALIA1 (1Department of Biology and 2Graduate Program in Cell, Molecular and Developmental Biology, University of California, Riverside, Riverside, CA 92521; mmaduro@ucr.edu).

The 20-cell intestine of juvenile C. elegans nematodes is derived from a single cell, the embryonic blastomere E. The paradigm for E specification is that a cascade of transcription events, started by the maternal factor SKN-1, causes transient activation of the gut specification factors end-1 and end-3. These reach a threshold of expression to activate elt-2, which maintains its expression by autoregulation and drives the commitment to gut differentiation. We have created strains in which end-1 and/or end-3 are mutated for particular cis-regulatory sites. In such strains, embryos make variable numbers of apparently normal-sized gut cells, suggesting that specification has become subject to stochastic variation, and that commitment to a gut fate can occur later in the E lineage. Counting of embryonic elt-2 transcripts by single-molecule FISH suggests that activation of elt-2 is more graded in these strains, as opposed to an all-or-none mode as was previously reported for SKN-1-depleted embryos (Raj et al., 2010). As these effects are confined to the E lineage due to the nature of the strains constructed, we are also able to evaluate adults derived from embryos in which functional guts were made. We find that such adults store lipids at significantly higher levels and display other variable pleiotropic phenotypes, suggestive of primary defects in gut function. Together, these results build a picture in which specification of gut is not an all-or-none event, and that in animals that do make an intestine, the endoderm differentiation network is not fully self-correcting for partially compromised specification.

150 Deciphering the Role of EMP2 in Trophoblast Invasion and Placental Vascular Remodeling. MADHURI WADHERA1*, CARMEN J. WILLIAMS2, WENDY N. JEFFERSON2, DEEPTHI SUDHAKAR2, ELIZABETH PADILLA-BANKS3, and NEVIL KHURANA1 (1Department of Pathology and Laboratory Medicine, 4525 MacDonald Research Laboratories, Geffen School of Medicine at UCLA, Los Angeles, CA 90095; 2Reproductive Medicine Group, Laboratory of Reproductive and Developmental Toxicology, National Institute of Environmental Health Sciences, National Institutes of Health, Research Triangle Park, NC 27709 USA; mwadhera@mednet.ucla.edu).

In pregnancy, it has been shown that the interaction between uterine natural killer (uNK) cells, the dominant leukocytes in early human and mouse decidua, and trophoblasts have essential roles in the initiation of decidual spiral arterial modification as well as in regulating trophoblast invasion. One novel protein that may play an important role in this cross-talk is the tetraspan protein epithelial membrane protein-2 (EMP2). EMP2 has high expression in human cytotrophoblasts as well as interstitial trophoblasts, and it is expressed in all subsets of murine trophoblasts. Previous studies have shown that EMP2 has an important role in receptor-mediated cellular behavior, and it is believed to curate molecules at the cell surface that are brought into engagement with specific signaling complexes. In human trophoblasts, EMP2 physically associates with and regulates the activity of integrin-FAK signaling complexes. This coalescing of molecules at the surface has a number of consequences including an increase in trophoblast invasion as well as a concomitant release of stimulatory angiogenic
factors and subsequent vascular remodeling. Consistent with this finding, preliminary studies analyzing the expression of EMP2 in pregnancy associated disorders show a marked reduction in protein levels in IUGR placentas. Pathological processes such as IUGR and preeclampsia are believed to be the ultimate manifestations of a disease process which can begin in trophoblasts or in the regulation of uNK cells. While EMP2 knockout mice are able to produce viable offspring, these mice reveal a novel regulation of uNK cell function influenced by EMP2 in the trophoblast.

151 Germline Development in the Colonial Ascidian, Botryllus schlosseri, ADAM LANGENBACHER, ALESSANDRO DE MAIO, DELANY RODRIGUEZ, SUSANNAH KASSMER, and ANTHONY W. DE TOMASO* (Department of MCD Biology and Marine Science Institute, University of California Santa Barbara, Santa Barbara, CA 93106; detomaso@lifesci.ucsb.edu).

Botryllus schlosseri is a colonial ascidian that undergoes a 14-day budding cycle during which all somatic and germine tissues are regenerated, a process called blastogenesis. We are studying the source and mechanisms of germine regeneration during blastogenesis, and have found that long-lived germine stem cells (GSCs) are specified during embryogenesis and contribute to germine formation each week for the life of a genotype (6 mo- >2 yrs). However, following metamorphosis, colonies undergo 6-12 budding cycles prior to the appearance of gonads, and in addition adults often cycle between fertile and infertile states in both laboratory and natural populations. We are prospectively isolating these cells using FACS and have defined an enriched population based on cell surface phenotype and gene expression profiles. GSCs isolated from juvenile or non-fertile colonies can contribute to germine formation immediately following transplant to a sexually mature recipient, suggesting that GSCs are always present, and fertility is based on a colony-wide cue which causes these precursors to differentiate into mature gonads. To characterize these cues, we have carried out mRNA-seq on each stage of blastogenesis, identifying a number of differentially expressed genes. One of these is a TGF-b family member that is expressed in cells associated with GSCs in both fertile and infertile colonies, and also during early development of both testes and eggs. TGF-b expression may define a population of cells that act as a mobile niche, and have allowed us to characterize the dynamics of GSC migration during blastogenesis. Current results will be discussed.

152 Neonatal Estrogen Exposure Alters Global Epigenetic Marks in the Female Reproductive Tract, CARMEN J WILLIAMS*, WENDY N. JEFFERSON, ELIZABETH PADILLA-BANKS, H. KARIMI KINYAMU, TIANYUAN WANG, and WEICHUN HUANG (National Institute of Environmental Health Sciences, PO Box 12233, MD E4-05, Research Triangle Park, NC 27709; williamsc5@niehs.nih.gov).

Neonatal exposure to the phytoestrogen genistein or diethylstibestrol (DES) results in abnormal reproductive tract morphology, female infertility and uterine cancer in mice. These treatments also cause altered gene expression in the female reproductive tract that persists into adulthood. The permanent upregulation of sine oculis-related homeobox 1 homolog (Six1) is of particular interest because this important developmental gene is upregulated in numerous cancers. The mechanisms underlying Six1 upregulation were explored by performing chromatin immunoprecipitation (ChIP) analysis to determine whether specific modified histones were associated with regulatory genomic regions of Six1. Mice were treated with genistein or DES on neonatal days 1-5 and uterine tissues were collected either on day 5, on day 22 (prepubertal), or in adulthood following ovariectomy. ChIP was then performed using antibodies against modified histones. Acetylation of histone H3 at lysine 9 (H3K9Acet) and methylation of histone H3 at lysine 4 (H3K4m3), both generally associated with active transcription, were increased at several regions of Six1 on day 5 in treated female mice, and some of these histone marks were permanently altered in adult mice. These findings indicated that epigenetic modifications likely play a role in the permanent upregulation of Six1 expression. ChIP-seq analyses of DES-treated and control mice on day 5 and day 22 also revealed global changes in histone H3 lysine 27 methylation and H3K4m3 marks. These findings indicate that neonatal estrogenic chemical exposure permanently alters the epigenetic landscape of the adult uterus.

153 Molecular Determinants of Oocyte Competence, GEORGE W. SMITH (Laboratory of Mammalian Reproductive Biology and Genomics, Departments of Animal Science and Physiology, Michigan State University, East Lansing, MI 48824; 517-432-5401 smithge7@msu.edu).

Oocyte developmental competence is a limiting factor in pregnancy success in livestock species and humans, but inherent phenotypic characteristics of competent oocytes are not well understood. Oocytes gradually and sequentially acquire developmental competence during folliculogenesis by synthesizing and accumulating transcripts and proteins critical for successful meiotic maturation, fertilization, and early embryogenesis. We have conducted fundamental studies using the bovine model to elucidate differences in oocyte transcriptome associated with poor oocyte competence and the functional significance and therapeutic utility of such results. One finding was a positive association of follistatin mRNA abundance with oocyte competence in two distinct bovine models. Follistatin treatment of bovine embryos during initial stages of in vitro culture increased proportion of embryos developing to the blastocyst stage and numbers of blastocyst trophoectoderm cells. Comparative studies in the rhesus monkey model demonstrated stimulatory actions of
exogenous follistatin on rates of blastocyst development and support potential clinical relevance of results in the bovine model. Complementary loss of function studies in early embryos established a functional role for follistatin in bovine blastocyst development and cell allocation. Current studies are focused on understanding the mechanism of action of follistatin in mediating its above described embryotropic actions and impact of follistatin treatment during embryo culture on pregnancy rates following embryo transfer. Such studies are critical to understanding the functional significance of follistatin to early embryos, and translation to improvements in clinical and applied reproductive technologies.

154 The Terra Incognita of Male Fertility: Flagellar Ion Channels and Their Function, POLINA V. LISHKO*, MELISSA MILLER, STEVEN MANSELL, and SARA S. A. CHOO (Department of Molecular and Cell Biology, Life Sciences Addition 221A, University of California, Berkeley, CA USA 94720; Lishko@berkeley.edu).

On its route to the egg mammalian spermatozoa encounter multiple barriers: viscous mucus, the narrow lumen of the uterotubal junction, the sticky and complex maze formed by the epithelial folds of the Fallopian tubes, and finally the protective shields of the egg. In order to overcome these numerous barriers, the sperm cell must sense the cues released by the egg and change its swimming behavior. Sperm can achieve this by increasing the amplitude and driving force of their tail beating, changing their direction of movement, and releasing special enzymes to dissolve the egg’s protective vestments. Such sperm responses depend upon electrical activity of the sperm ion channels that open in response to environmental cues within the female reproductive tract. This in turn changes conductance of the sperm plasma membrane and sperm behavior. In addition, ion channels are organized in clusters and are positioned on the flagellum to provide fine-tuned regulation of its motility. It is possible that many cases of idiopathic male infertility can be attributed to malfunctioning of sperm ion channels. Infertility affects ~4 million men in the United States alone, and the cause of male infertility can be diagnosed and treated in less than 20% of those cases. Here we present electrophysiological and pharmacological characterization of three main ion channels of human sperm: the proton channel Hv1, the potassium channel K$\text{Sper}$ and the calcium channel CatSper. We will also discuss how these channels work in a concerted manner and what are their differences and similarity between sperm of different species.

155 Molecular Pathways Involved in Oocyte Developmental Competence, MARCO CONTI*, FEDERICA FRANCESCHI, HAKAN CAKMAK, and SHILA MANANDHAR (Center for Reproductive Sciences, University of California, San Francisco, 513 Parnassus Ave., HSW1656, Box 0556, San Francisco CA 94143-0556; contim@obgyn.ucsf.edu).

In mammals, profound changes in both somatic and germ cell compartments of the ovarian follicle are induced during the periovulatory period. The cells of the somatic compartment prepare for ovulation by acquiring new endocrine and paracrine functions. At the same time, the oocyte undergoes nuclear and cytoplasmic maturation. Whereas the events associated with nuclear maturation are well described and quantifiable, little is known about the molecular changes associated with oocyte cytoplasmic maturation. This transition is essential for the oocyte competence to develop as an embryo upon fertilization, and this developmental competence is critical for successful assisted reproduction technologies. Here we have tested the hypothesis that developmental competence is acquired through a program of mRNA translation executed during oocyte maturation. Polysome-array analysis of oocytes at different stages of maturation revealed a highly reproducible pattern of mRNA association and dissociation with the translation machinery in synchrony with the different stages of meiosis. Although qualitatively this program is executed when oocytes are no longer in contact with the surrounding somatic cells, quantitative analysis shows that somatic inputs are necessary for optimal translation of key oocyte transcripts. Mouse models of compromised developmental competence also show defects in the oocyte translation program. Developmental competence and enhanced translation require activation of the AKT/mTOR pathway in the gamete. Thus, these findings demonstrate that this translation program is required for oocyte cytoplasmic maturation and provide a novel and quantifiable assessment of developmental competence.

156 Cracking the Eggshell: Assembly of Protective Barriers Following Fertilization of the C. elegans Embryo, SARA K. OLSON (Department of Biology, Pomona College, 175 West 6th Street, Claremont, CA 91711; sara.olson@pomona.edu).

In metazoans, fertilization triggers the assembly of an extracellular coat that protects the embryo from environmental dangers. In nematodes, this coat is the eggshell, which provides mechanical rigidity, prevents polyspermy, and is impermeable to small molecules. Using electron and fluorescence microscopy approaches, we recently demonstrated that the multi-layered eggshell is assembled in a step-wise and hierarchical manner that requires chondroitin proteoglycans and glycolipids. A subsequent RNAi screen identified several new proteins required for eggshell formation, and our current work investigates the role of these proteins in cellular processes as diverse as cortical granule trafficking, glycolipid biosynthesis, and scaffolding of the extracellular matrix. A better understanding of nematode eggshell assembly not only provides insight into fertilization and the formation of protective barriers, but may also allow the identification of new therapeutic targets to combat parasitic nematode infections that impact more than 30% of the world’s population.
157 How Attractive is the Fish Egg’s Micropyle? GARY N. CHERR* and RYUZO YANAGIMACHI* (University of California Davis Bodega Marine Laboratory, PO Box 247, Bodega Bay, CA 94923; gcherr@ucdavis.edu; 2Institute for Biogenesis Research, Department of Anatomy, Physiology, and Biochemistry, University of Hawaii Medical School, Honolulu, HI; yana@hawaii.edu).

Most teleost fish sperm initiate motility upon dilution in water and the mechanisms and duration of this activation differ depending on the salinity of the spawning environment. An exception to this is the Pacific herring (Clupea pallasi) where sperm are immotile upon dilution in water across a wide range of salinities. In herring, a chorion glycoprotein surrounding the micropyle region initiates sperm motility and is required for fertilization. An increase in intracellular Ca++ occurs in sperm from both freshwater and marine fish at motility initiation and this is also the case with herring sperm. Continued increases in intracellular Ca++ in fish sperm are known to result in asymmetric flagellar bending and may be involved in directed motility at the micropyle opening.

While there has been no evidence of sperm attraction to the micropyle at a distance, we have recently shown that once sperm are near the outer opening of the micropyle, they exhibit directed movement towards it. Selective staining of the micropylar region of the egg can be detected using protein and carbohydrate probes in eggs from a variety of fish, and sperm attraction to the micropyle can be removed by protease treatment suggesting that a glycoprotein may be responsible. Attraction to the opening of the micropyle appears to be species specific, is dependent on extracellular Ca++, and induces increases in sperm intracellular Ca++ and directed motility for increasing fertilization efficiency. Insect egg micropyles also show a distinct staining of the region surrounding the opening, suggesting a there may be similar sperm attraction function.

158 Converging Calcium Waves Occur as Drosophila Oocytes Activate, TARO KANEUCHI1, CAROLINE V. SARTAIN2, SATOMI TAKEO1, VANESSA L. HORNER1, TOSHIRO AIGAKI1, and MARIANA F. WOLFNER2* (1Department of Biological Sciences, Tokyo Metropolitan University, Tokyo 192-0397, Japan; 2Department of Molecular Biology and Genetics, Cornell University, Ithaca, NY 14853, USA; 3Graduate School of Life and Environmental Sciences, University of Tsukuba, Ibaraki 305-8572, Japan; mfw5@cornell.edu).

Egg activation is the essential process by which a mature oocyte becomes capable of supporting embryo development. In vertebrates and many invertebrates, activation is induced by fertilization. Molecules introduced into, or turned on by, the fertilizing sperm trigger progressive release of intracellular calcium stores in the oocyte. The resultant calcium wave(s) that spread through the oocyte induce completion of meiosis, new macromolecular synthesis, and modification of the vitelline envelope to prevent polyspermy. However, arthropod eggs activate without fertilization: in the insects that have been examined, egg activation occurs as the oocyte moves through the female’s reproductive tract. Here, we show that a calcium wave is, nevertheless, characteristic of egg activation in Drosophila. This wave is caused by influx of calcium from the external environment and is induced as the egg is ovulated. Pressure on the oocyte (or swelling by the oocyte) can induce this wave through the action of mechanosensitive ion channels. Interestingly, the wave initiates at both poles of the oocyte and moves towards the center, prefiguring the way that waves of mitosis traverse the embryo during the syncytial stages of embryogenesis. Our data demonstrate that although a fertilizing sperm is not necessary for egg activation in Drosophila, the characteristic of increased cytosolic calcium levels persists. Additionally, many downstream signaling effectors are conserved in Drosophila and other species. Taken together, Drosophila offers a unique perspective of egg activation events due solely to maternal components that may also be applied to the study of this process in other organisms.

159 Sugar Coated Genomes – Sperm Sialome and Sexual Selection, PASCAL GAGNEUX (Department of Cellular and Molecular Medicine, and Glycobiology Research and Training Center, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA 92093; pgagneux@ucsd.edu).

Why does it take millions of sperm to fertilize one egg? The answer to this simple question remains elusive. Spermatozoa face the unique task of shuttling a haploid genome towards the ovum they encounter in the reproductive tract of another individual. As allogeneic cells, sperm face substantial threats along the female reproductive tract. Female cellular and humoral immunity exert strong selection on sperm in mammals, allowing just a few out of millions of spermatozoa to reach the fallopian tubes. The mammalian sperm glycolectin includes copious decorations with tens of millions of terminal sialic acid molecules. These are acquired during spermatogenesis, epididymal maturation, and from seminal fluid components during ejaculation. Sperm sialic acids act as self associated molecular patterns (SAMPs) promoting tolerance by female immune factors including antibodies, neutrophils, macrophages, and complement. For unexplained reasons, before fertilization sperm undergo dynamic remodeling of their sialome, mediated by sperm sialidases. Lack of sialidase activity and mismatches between sperm sialic acids and female immune response can affect fertility in mouse model systems and possibly in humans.
160 **Claiming Citizenship and Heritage: Bay Area Ethnic Communities at the Panama-Pacific International Exposition**, ABIGAIL MARKWYN (Associate Professor of History, Carroll University, 100 N. East Ave., Waukesha, WI 53186; amarkwyn@carrollu.edu).

San Francisco welcomed almost 19 million visitors to its awe-inspiring Panama-Pacific International Exposition between February and May of 1915. Local fair boosters won the right to hold the 1915 Panama-Pacific International Exposition in part by promising to fund the fair with local monies. Fair officials therefore worked hard in the years before the fair to convince local ethnic groups to participate, both financially and practically, in the fair. They even involved prominent community leaders in recruiting foreign governments to commit to sending exhibits. For their part, local ethnic groups, ranging from Germans to Irish to African Americans and Chinese perceived the fair as a significant place from which to assert their claims to American citizenship, and in some cases, their pride in their ethnic heritage. The result was an event that showcased local ethnic groups alongside other displays and offered groups a platform for asserting their own visions of community and identity. This paper explores the variety of ways in which Bay Area ethnic groups appropriated the grounds of the fair to their own ends, revealing the socio-political dynamics of Progressive Era San Francisco.

161 **The Argonaut’s Palace: Mining at the Panama-Pacific International Exposition, 1915**, JEFF BARTOS (Ph.D. Candidate, History, Department of History, Philosophy, and Religious Studies, Montana State University, Wilson 2-154, P. O. Box 17230, Bozeman, MT 59717; jeffrey.bartos@msu.montana.edu).

At the 1915 Panama-Pacific International Exposition (PPIE), the mineral extraction industries represented their commodities and technologies in the Palace of Mining and Metallurgy, under the aegis of the PPIE’s Bureau of Mining. The Palace showcased a model mine, finished mineral products from various states and nations, a miniaturized representation of the Standard Oil Fields of California, a daily rescue demonstration, and other exhibits. These displays provided a sanitized and glorifying vision of the mining industries, purposefully downplaying the social, economic, and environmental costs of mineral extraction through misleading statistics, industrial paternalism, allegorical sculpture and art, and palliative safety measures. As the PPIE celebrated the opening of the Panama Canal and American Empire, the Palace of Mining and Metallurgy celebrated the integral nature of the extractive industries to the American industrial-capitalist system.

162 **Chinese Pagoda**, WILLIAM H. MA (Ph.D. Candidate, History of Art, History of Art Department, University of California, Berkeley, 1728 Parker Street, Berkeley, CA 94703; william_h_ma@gmail.com).

One of the most enduring images of China at the 1915 Panama-Pacific International Exposition, other than a replica hall from the Forbidden City sent by the newly founded Republic of China, was the Shanghai Catholic Orphanage exhibit in the Palace of Education. Greeted first by a life-size elaborately ornamented Chinese gateway (pailou), visitors to the exhibit were then channeled into a narrow space filled with large pieces of teakwood furniture and screens with carved Chinese motifs. As an added bonus, they were also treated to a tour of China through one of its most famous and iconic monuments: the pagodas. Meticulously reduced in size and accurately reproduced in wood, the 86 pagodas were made by Chinese teenage orphans under the direction of a German Jesuit at the Tushanwan orphanage workshops on the outskirt of Shanghai.

Using a recently rediscovered document at the Jesuit California Province Archives from the Santa Clara University, this paper focuses on this particular exhibition and a specific set of objects (the pagodas) in order to illuminate issues of display and identity at the intersection of commerce, art, education, religion, and science. From the conceptualization to the execution and reception of the exhibition, competing voices on both sides of the Pacific: Chinese, Americans, Europeans, government officials, immigrants, businessmen, Protestants, Catholics, etc., debated on how to best introduce the two-year-old Chinese Republic to the world; some of this debate was captured by the exhibition and in some of the objects in it. How was this done? What was the content of the claims? How was it received by the American public? Who or what was on display? The orphanage? The Jesuit mission? The Chinese? Finally, this is also a somber look at the limitation art objects and exhibition display as didactic instruments of persuasion.

163 **Chinese Women and the Panama Pacific International Exposition**, CHUIMEI HO (Chinese in Northwest America Research Committee, PO Box 19090, Bainbridge Island, WA 98110; cmho@cinarc.org).

San Francisco’s PPIE marked a major step forward in the liberation of Chinese American women. The PPIE offered all ethnic women a chance to survey the progress that had been made since the Chicago Exposition’s epochal Congress of Women. For Chinese women it opened up new vistas in the city that formed the demographic and cultural heart of Chinese America. In China, Sun Yat-sen’s revolution of 1911 had sown the seeds of democracy. Chinese women in California, where women won voting rights in the same year, had begun to exercise their franchise. Some had started to assert marital property rights, abetted by favorable laws in the State. Others seized the chance to overturn the ancient
customs that restricted their freedom in and beyond the Chinese social world.

As examples, an athletic Chinese girl from Colorado, heading a visit to the PPIE by a national student group, became a media sensation. The respectable daughter of a Chinatown businessman inaugurated the Chinese Village at the Exposition and allowed a glamorous picture to appear in local newspapers. And, astonishingly, San Francisco’s Chinatown so far forgot its traditional values as to sponsor a beauty contest. The idea of a contest featuring only respectable Chinese girls was astonishing. In China, women of the middle and upper classes lived in rigorous seclusion, barred from appearing in public before and even after marriage. In San Francisco they were parading themselves brazenly in front of strangers while their fathers looked on with approval.

The paper discusses how this was possible. As in other societies, age-old Chinese masculinist ideals had put restrictions on female freedom at the core of social identity, status, and morality. Confucius would have been horrified. In San Francisco they were casting aside the rules that, in hard-core Confucian eyes, constituted the very essence of Chineseness. What was going on? Did Chinese men not see the menace that feminine immodesty imposed? Did Chinese women see behavioral freedom as part of a package of women’s rights? How could college-educated daughters be kept under control? Were beauty queens more likely to reject parental marriage arrangements and prejudice in favor of brothers. And, would they object to inheritance laws that gave everything a husband owned to his family rather than his wife?

164 Ethnographic Showcases at the California Fairs of 1915, MATTHEW BOKOVOY (Senior Acquisitions Editor, Native American and Indigenous Studies and Southwestern Borderlands, University of Nebraska Press, 1111 Lincoln Mall, 4th Fl., Lincoln, NE 68588-0630; Mbokovoy2@unl.edu).

My talk will focus on the participation of Native American peoples at the California World’s Fairs of 1915, and to analyze their socio-historical experiences at these events, beginning with the premise that during American Indian modernity, Native peoples were curious to seek opportunities outside their locales and see the wider world. This is a motif that is central to firsthand accounts of Native peoples at World’s Fairs and in other similar exhibitionary contexts in the first half of the 20th Century.

The talk will then briefly move through categories and layers of meaning that scholars use to interpret ethnographic showcases in the period 1876-1915. This will shed light on the cultural/psychological investments that both fair audiences and Native performers made in these highly popular performances and exhibitions at world’s fairs.

165 Hrdlicka and the Museum of Man, TORI D. RAN-DALL (Curator, Department of Physical Anthropology, San Diego Museum of Man, 1350 El Prado, San Diego, CA 92101; trandall@museumofman.org).

Ales Hrdlicka, born in Eastern Bohemia in 1869, is known as America’s “Father of Physical Anthropology.” As Curator in the Department of Physical Anthropology at the Smithsonian Institution, he was responsible for assembling the most ambitious physical anthropology exhibition ever attempted for the 1915 Panama-California Exposition. Hrdlicka’s exhibit covered the entire field of physical anthropology: human evolution, growth and development, human variation, and pathologies and death. He enlisted the expertise of international scholars and sent expeditions to Siberia, Alaska, Peru, the Philippines, and Africa. Hrdlicka himself collected an enormous amount of skeletal material from vandalized ancient cemeteries in Peru and visited the major museums of Europe to obtain casts of ancient human fossils. It took three years to complete the project. All materials not needed for the Exposition became the property of the U.S. National Museum.

The Exposition opened to the public on January 1, 1915. There were many significant results of Hrdlicka’s exhibition. It allowed Hrdlicka the opportunity to collect specimens for the U.S. National Museum; it promoted physical anthropology and gave the public the most comprehensive compilation of knowledge of our species which had ever been exhibited; it was the first presentation of the relationship of Siberian peoples to Native Americans; and it formed the nucleus of a permanent museum of anthropology in San Diego with a collection of lasting scientific value.

Challenges for Implementing Vision and Change in Science Classrooms

Friday at 8:35 a.m. in HUB 269

166 Colored Cards to Coursera: The Role of In-house Education Research in Supporting Instructional Innovation, DIANE K. O’DOWD* and ADRIENNE E. WILLIAMS (Department of Developmental and Cell Biology, University of California Irvine, Irvine, CA 92697-1280; dkodowd@uci.edu).

Our biology education research, funded by an HHMI-Professor grant, originally focused on developing strategies for engaging students and faculty in large lecture halls. We have identified activities that can 1) be implemented incrementally by research faculty, 2) result in significant increases in learning and attitudes and 3) be used in large lecture halls. Recently, there has been widespread interest in increasing the use of digital learning tools and online coursework in higher education. We are currently conducting studies to evaluate the effectiveness of a number of digital tools in online instruction and in enhancing face-to-face lectures. I will discuss our research on lecture podcasts, flipped classes, online classes, and MOOCs and how this has influenced our
face-to-face teaching and interactions with other faculty on campus. Finally, I will discuss progress in coordinating scientific teaching efforts across disciplines and institutionalizing these programs to support sustained innovation in higher education.

167 Re-Considering Biology Student Assessment: Development of a Biology Card Sorting Task in Alignment with Vision and Change, Kimberly D. Tanner1*, Julia I. Smith1, Elijah D. Combs1, Paul H. Nagami1, Valerie M. Alto2, Henry G. Goh2, Muryam A. A. Gourdet2, Christina M. Hough2, Ashleigh E. Nickell2, Adrian G. Peer2, and John D. Coley3 (1San Francisco State University, San Francisco, CA; 2Holy Names University, Oakland, CA; 3Northeastern University, Boston, MA; kdtanner@sfsu.edu).

How do biology experts structure their thinking and how might this differ from how students organize biological ideas? Understanding and measuring biological expertise are strongly tied to accomplishing the goals put forward in Vision and Change for Undergraduate Biology Education. While there are widespread aspirations to focus undergraduate biology education on teaching students to think conceptually like biologists, there is a dearth of assessment tools designed to measure progress from novice to expert biological conceptual thinking. We present the development of a novel assessment tool, the Biology Card Sorting Task, designed to probe how individuals organize their conceptual knowledge of biology. While modeled on tasks from cognitive psychology, this task is unique in its design to test two hypothesized conceptual frameworks for the organization of biological knowledge: 1) a surface feature organization focused on organism type, and 2) a deep feature organization focused on fundamental biological concepts. In this initial investigation of the Biology Card Sorting Task, each of six analytical measures showed statistically significant differences when used to compare the card sorting results of putative biological experts (biology faculty) and novices (non-biology major undergraduates). Consistently, biology faculty appeared to sort based on hypothesized deep features, while non-biology majors appeared to sort based on either surface features or non-hypothesized organizational frameworks. Results suggest that this novel task is robust in distinguishing biology experts and novices and may be an adaptable tool for biology programs interested in tracking emerging biology conceptual expertise among students, as described in Vision and Change.

168 Providing First-Year Undergraduate Scientific Research Experiences in the Teaching Laboratory, James M. Burnnette III (Neil A. Campbell Science Learning Laboratory and Dynamic Genome Program, University of California, Riverside, Riverside, CA 92521; james.burnnette@ucr.edu).

Engagement in scientific research in the freshman year can result in persistence in a STEM major. Large research colleges struggle to place the hundreds of first-year students in faculty labs. Additionally graduate students, post-docs, and faculty need training to effectively mentor students. To address these needs UCR established the Neil A. Campbell Science Learning Laboratory to develop effective course based research experiences.

Renovated with a major donation from Rochelle Campbell in recognition of Dr. Campbell’s dedication to education, the facility contains two teaching laboratories outfitted with state-of-the-art equipment, a bioinformatics lab, a break-out room, and a preparation room. The facility was personalized by Ms. Campbell with photographs and “Campbell Biology” textbook artwork. The facility is used by: 1. First-year students to learn how to conduct scientific research and conduct research projects by taking the Dynamic Genome course, providing a portal into research labs. 2. Faculty and post-docs who develop research projects based on their research and offer sections of the DG course. 3. Modules are developed, assessed, and published for use by any college. At capacity, eight sections/quarter will be offered serving up to 400 students/year. Many of these well-trained students will enter faculty labs and become productive researchers. The facility is also used for community STEM outreach. The Campbell lab serves as a model to effectively engage many students and faculty in productive research experiences based on active research programs. Examples of research projects will be presented along with evaluation data that demonstrate effectiveness.

169 Strategies for Implementation of Vision and Change at Community Colleges, Pamela Pape-Lindstrom (Everett Community College, 2000 Tower Street, Everett, WA 98201; ppape@everettcc.edu).

Nationwide, about 46% of undergraduates are enrolled in community colleges, which have become integral to improving affordability and access to higher education. Students at community colleges are more likely to be those historically under-represented in STEM fields, relative to students at four year schools. Accordingly, ensuring success of all STEM students at community colleges is vital if the scientific community is to achieve the goal of one million additional STEM college graduates in the next decade as called for in the PCAST 2012 report Engage to Excel. The recommendations of this report coincide with those of the 2011 Vision and Change report, in that both focus on increasing the use of evidence based pedagogy in the science classroom. Challenges at community colleges include substantial teaching loads and limited resources for faculty development. However, the smaller class size of the traditional community college classroom can become an advantage as faculty incorporate student-centered teaching practices, inquiry based labs and authentic research experiences for their students. This presentation will introduce some effective approaches for improving the pedagogy of individual instructors. Additionally, low cost approaches to systems-level modifications at
the departmental level which enable long-term transformational change achievable in a community college environment will be emphasized.

170 The Change in Demographics and STEM: How PULSE Strategies Can Increase URM participation in STEM Careers, EDWIN J. BAREA-RODRIGUEZ* and DANIELLE GORDON (Department of Biology, University of Texas at San Antonio, San Antonio, TX 78249; Edwin. Barea@usta.edu).

The U.S. population is diversifying so quickly that by 2060, underrepresented minorities (URMs) will represent 50% of the population. Concurrently, STEM-based jobs will also grow rapidly (17% over the next 10 years). Although the URM population is growing, they are not entering STEM careers at the same rate as whites. Altogether, this may portend a decline in the STEM workforce, impacting the economic vitality of the U.S. The disproportionate number of URM students in STEM careers is not due to lack of interest. Many begin pursuing college degrees but are deterred after taking introductory STEM courses. Recently, AAAS published the Vision and Change in Undergraduate Education: A Call to Action. The report advocated for inclusion of active learning techniques to engage students in life sciences courses (and applied in all STEM disciplines). Unfortunately, very little changes have occurred in pedagogy even though studies have shown that URM students particularly benefit from active learning techniques in the classroom. To support and promote these changes, NSF, NIH, and HHMI created the Partnership for Undergraduate Life Science Education (PULSE) and identified a cadre of 40 Vision & Change Leadership Fellows who were charged with developing strategies to promote adoption of the recommendations in the report. Here we will argue that, when implemented, the strategies developed by the PULSE fellows will result in an increase number of URM students succeeding in STEM careers, thus making a positive impact on the number of the URMs expected to be represented in STEM careers in the future.

171 A Partnership for Undergraduate Life Science Education (PULSE): An Initiative to Promote Vision and Change, GARY REINESS (Department of Biology, Lewis & Clark College, Portland, OR 97219; reiness@lclark.edu).

The Howard Hughes Medical Institute, National Institute of General Medical Sciences, and National Science Foundation formed the Partnership for Undergraduate Life Science Education (PULSE) to promote the recommendations in the 2011 AAAS report “Vision and Change in Undergraduate Biology Education: A Call to Action”. With over 1200 current members of the national PULSE community (pulsecommunity.org), this initiative promises to have a powerful impact on the teaching of life sciences in the United States.

In 2012, HHMI, NIGMS, and NIH selected 39 Leadership Fellows from a diverse range of locations and institutions types—community colleges, liberal arts colleges, comprehensive universities, and research universities—and charged them with designing programs to foster the implementation of the recommendations of Vision and Change. I will report on the activities and projects that have been designed, and in some cases carried out, by the PULSE Leadership Fellows in the last two years to promote departmental-level change in life science education for undergraduates. These include online workshops and a toolkit, regional workshops for departmental teams, a rubric for assessing a department’s alignment with Vision and Change, a Certification program, and an Ambassadors program to help guide departments through the process of transforming their curricula to align with the Vision and Change recommendations. There will be time for discussion of ways in which individuals and departments can engage with the PULSE initiative.

Libraries and Learning
Friday at 8:35 a.m. in HUB 265

172 Technology Impact on New Adult Behavior about Health Information, LESLEY S. J. FARMER (California State University Long Beach, Department of Advanced Studies in Education and Counseling, 1250 Bellflower Blvd., Long Beach, CA 90840; lesley.farmer@csulb.edu).

New adults, those millennials between 18 and 25 years old, need and want information about health issues. They are likely to be sexually active, and may be parents; they might also have contracted a sexually-related disease. While increasing numbers live with their parents, the majority have struck out on their own by age 25, and so are more likely to make decisions independently, or seek advice from outside the family. Even though new adults tend to prefer asking people for help, increasingly they access digital resources because of the Internet’s availability, affordability, and anonymity. Health information interests vary by age, gender, social situation, and motivation. Several concerns also impact how new adults access and seek that information. This presentation discusses several issues related to new adult technology use for seeking health information, and offers recommendations to insure optimal community education and services to address health information needs of all new adults.

173 Video Incorporation in Scientific Publishing: New Roles for Libraries to Consider, JULIA GELFAND* and LYDIA FLETCHER* (University of California, Irvine, Ayala Science Library 228, Irvine, CA 92623-955; jgelfand@uci.edu).

The role of video has a powerful impact on demonstration, teaching, and learning.

Within three years, video traffic will be 67% of all consumer web traffic. Currently YouTube is the second most visited website in the world with over 6 billion hours watched
each month, indicating a 50% growth over the previous year and reaches more young adults than any cable network. Science publishing is no exception incorporating the role of video in its peer reviewed content as video increasingly plays a role in illustration and demonstration powerfully depicting how things appear, work and function. Video suggests the fast maturation in creating scenarios and case studies, conducting interviews, covering conferences and new releases, enhancing text and other documented sources, and providing a new mode of information exchange in very visual ways. Scholarly scientific publishing has refined the role of video in recent products that promote additional ways to conduct instruction, learning, and best practices. This paper will show several recent examples of how video resources have contributed opportunities for libraries and users to build out their collections and resources. More journals now have video components, distance education depends on video for explanation, conference proceedings are being released with video links, laboratory set up is shared, primary sources are captured in video, and academic users fulfill assignments by creating videos using smartphones and other hand-held devices. Information products that will be introduced include SciVee (AAAS), JoVE (Journal of Visualized Experiments), Engineering Case Studies (Alexander Street Press), Bates Visual Guide to Physical Examination, and other examples that demonstrate how video is contributing to science publishing and library resources.

174 It Takes a Village: A Collaborative Model for Cultivating and Diversifying Librarianship, PATRICIA SMITH-HUNT*, JESSICA DAVILA GREENE*, and TIFFANY K. CHOW* (Preservation Department, University of California, Riverside, Orbach Science Library, P.O. Box 5900, Riverside, CA 92517-5900; 2Special Collections and University Archives, University of California, Riverside, P.O. Box 5900, Riverside, CA 92517-5900; 3Alliant International University, 1000 South Fremont Ave., Unit 5, Alhambra, CA 91803; Jessica.greene@ucr.edu).

The IE LEADS initiative is a collaborative mix of more than a dozen public, special, community college, county and academic institutions. Together we successfully recruited 38 MLIS students representative of the ethnically and culturally diverse communities unique to the Inland Empire. These students are enrolled at a variety of library schools around the country and to date 26 have graduated. In addition to receiving financial support, students engage with partner libraries through mentorships, internships and an assortment of professional development opportunities. This initiative is changing lives and educating a new generation of information specialists, but could we have accomplished this alone? Due in large part to the inherent diversity of our partner and affiliate institutions, IE LEADS Fellows are afforded a much richer and comprehensive experience than may have been possible had a single institution undertaken such a project alone. Having the opportunity to network, engage with, and intern with professionals from a broad array of library settings greatly enhanced our capacity to provide fellows with a well-rounded academic and ‘hands-on’ learning experience. Moreover, the inherent diversity and collective expertise of this partnership serves as a tremendous resource and allows us to be far more innovative.

175 How Hard Can I Snuggle My King Penguin Without Waking Him? And Other Fun, Engaging, and Hands-on Ways of Bringing Information Literacy Skills Into a First Year Science Class, AMY BESNOY (Copley Library, University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; abesnoy@sandiego.edu).

This presentation is a case study and discussion of innovative, engaging activities brought into a series of freshman Biology classes to introduce information literacy skills. The presentation will outline, address, and consider the ACRL information literacy standards but, in the classroom, they take backseat to the actual learning so that students are engaged in the learning without knowledge or care of the actual standards.

176 Field of Dreams: Employing Special Collections in the Classroom, MATTHEW COOK (John Spoor Broome Library, California State University Channel Islands, One University Drive, Camarillo, CA 93001; matthew.cook@csuci.edu).

The “build it and they will come approach” is a largely accepted proposition in the library community, particularly in the area of Special Collections. There is, at times, little critical analysis given to collection development, digitization efforts, or Information Literacy Instruction in regard to how these hard to serve but research rich materials might be used in the classroom. Instead, there exists a benevolent know-it-all expert determining which collections warrant preservation, digitization, acquisition and, ultimately, attention. At CI, the user--teachers and students--is the focus of all Special Collection activities and we’ve devised innovative ways to both encourage students and faculty to engage these materials as well as foster their appreciation, awareness and use on campus.

There are three primary ways that we accomplish this task: Librarians co-teach an archive based, inter-disciplinary class with a Political Scientist; a Librarian offers an upper-division 498 independent study class that is focused and based on students using archival collections housed in the Library, and; we pay students to use the collections.

The proposed presentation would share in greater details the methodologies, successes, and issues with these three Special Collections programs.

177 Information Literacy at the Freshman Level: Observations and Experiences from Three First-Semester Engineering Courses, FRANK JACOBITZ* and AMY
Information literacy is an essential skill set which promotes critical thinking habits in undergraduate students. Over the past three years, information literacy skills were developed in undergraduate engineering students by embedding a librarian into the classroom. This approach was chosen to teach fundamental information literacy skills while learning the subject material in an iterative process. Information literacy principles were included within basic research assignments in the first semester and continued within the context of an in-depth study during the second semester of the freshman year. The students researched a topic, e.g., creativity, critical thinking, or problem solving in engineering, prepared and delivered a lecture to peers, as well as assessed student knowledge and understanding of that topic. The students then performed an in-depth analysis of the results in their sophomore year as part of an independent study course, presented their findings at conferences, and submitted a journal publication. This presentation will discuss the course structure and assigned materials, but also focus on the progression of students’ information literacy skills over a two-year process.

178 Critical Thinking and Information Literacy Skills in Teaching Research: Embedded Librarian Model, CAROLE HUSTON1*, HUGH BURKHART2*, and PAULA KRIST3 (1College of Arts and Sciences, Dean’s Office F-114, University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; 2Copley Library, University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; 3Office of Institutional Research and Planning, University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; huston@sandiego.edu).

One great challenge in undergraduate education is teaching students how to effectively engage the research process. By using a case-study approach, a research team investigated the ways in which the “embedded librarian” model might be used to increase effectiveness in acquiring critical thinking and information literacy skills in upper and lower division courses from several different disciplines that required research methods’ applications. In lower division courses, students were given short-term assignments that helped to develop the relationship between critical thinking and information literacy. At upper division levels, critical thinking and information literacy were interwoven into several course lectures shared by the instructors and librarians, preparatory assignments (e.g., annotated references and project drafts), and the students’ final research projects. These were assessed following the end of the semester. Additionally, the research team observed librarians and faculty working together in class and interviewed each for perceptions of the effectiveness of the team approach. This presentation will discuss the process and results of this investigation.

179 Using Open Educational Resources to Develop Adaptable Online Library Instruction Modules for a Learning Management System, CHRISTINA MUNE, CRYSTAL GOLDMAN*, SILKE HIGGINS, LAUREL EBY, EMILY K. CHAN, and LINDA CROTLY (King Library, San Jose State University, One Washington Square, San Jose, CA 95192-0028; crystal.goldman@sjsu.edu).

Academic institutions increasingly use learning management systems (LMS) to teach courses and programs in hybrid or online-only formats. Thus, librarians must be prepared to deliver information literacy instruction in these emerging digital environments. To ease this transition to embedded librarianship, during the 2013-2014 academic year, a task force of librarians at San José State University (SJSU) developed a suite of AAC&U Information Literacy Value Rubric-aligned online modules that could be adapted to any academic discipline.

In the first phase of the project, the task force designed basic-level modules geared toward lower division students. The task force utilized open educational resources (OER) almost exclusively to build the various components of these self-contained, customizable modules, which were embedded within the campus LMS. In the second phase of design, advanced elements were incorporated into the modules, and the open source tutorial platform Guide on the Side was employed to additional tutorials, which were then released as OERs available to anyone who wished to use them. This case study showcases the task force’s process and initial outcomes, which can serve as a model for librarians interested in developing and implementing similar online information literacy projects.

180 Analyzing Results from an Online Learning Assessment to Improve Information Literacy Teaching and Learning, TRISH STUMPF GARCIA* and MICHELE POTTER (Science Library, University of California, Riverside, P.O. Box 5900, Riverside, CA 92517-5900; michele.potter@ucr.edu).

In order to avoid significant grading burden and to save a considerable amount of paper, the Science Library moved the assessment for one of their 2 major information literacy classes online in 2012 (as a Blackboard quiz). One of the unexpected and useful outcomes of this change is the ability to get statistical performance data for each question of the assessment. This was not feasible before, since we have as many as 900 students per quarter go through this session. Since many of the questions require the students to walk through the process of finding resources, we are able to assess where the students might be stumbling in the process. We have decided to make targeted changes to the teaching methodology between Winter and Spring quarter 2014, based on patterns that have
emerged in the last two quarters, to see if there is a change in the student performance on these questions.

181 Panel Discussion: Faculty and Librarian Perspectives on Embedded Librarianship, Assessment, Information Literacy, and the New ACRL Framework, AMY BESNOY*, CRYSTAL GOLDMAN*, CAROLE HUSTON**, FRANK G. JACOBITZ**, MICHELE POTTER** (Copley Library, University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; Dr. Martin Luther King, Jr. Library, San Jose State University, One Washington Square, San Jose, CA 95192; College of Arts and Sciences, University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; Mechanical Engineering Department, Shiley-Marcos School of Engineering, University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; Jacobitz@sandiego.edu; Orbach Science Library, P.O. Box 3900, University of California, Riverside, CA 92517).

This panel discussion focuses on both teaching faculty and librarian perspectives for embedding librarians and information literacy principles into the classroom, how best to assess student learning of information literacy and critical thinking, and how library instruction programs and partnerships with teaching faculty will shift based on the new Association of College and Research Libraries (ACRL) Framework for Information Literacy for Higher Education, which is set to replace the Information Literacy Competency Standards for Higher Education adopted by ACRL in 2000.

Biotic Invasions: Impacts on Natural and Urban Communities and Ecosystems
Friday at 8:35 a.m. in HUB 379

182 Impacts of Plant Invasions: Pervasive Examples, Elusive Generality, JEFFREY M. DIEZ (Department of Botany and Plant Sciences, University of California, Riverside, CA 92521; jeffrey.diez@ucr.edu).

Plant invasions can have impacts on a wide range of ecological processes across levels of organization. Over the last several decades many convincing case studies have demonstrated the potential for non-native invaders to influence native plant species, above- and below-ground food webs, and ecosystem processes. Nonetheless, few generalities of how invasive species impact communities and ecosystems have been derived, complicating efforts at prediction and development of broad management guidelines. Instead, research shows how the impacts of plant invaders can be context-dependent, varying across ecosystems and subject to the particular match between invader and native species. In addition, efforts to quantify impacts are notoriously subject to the same challenges of spatial and temporal scale that permeate ecological research. For example, although experiments have shown that invasive plants can reduce native species’ performance, native and non-native species diversity tend to be positively correlated at some spatial scales and few if any native species have become extinct due to plant invaders over observed timeframes. In this talk, I present a review of current efforts to conceptualize and quantify the impacts of plant invasions on communities and ecosystems. I then outline how recent advances in ecological theory and methods may offer new hope for understanding the conditions under which we should expect particular impacts.

183 Human-mediated Movement of the Bacterium Xylella fastidiosa has Resulted in a Range of Plant Diseases that Affects the Urban, Agricultural, and Native Environment, LEONARD NUNNEY (Department of Biology, University of California, Riverside, CA 92521; leonard.nunney@ucr.edu).

The human-mediated movement of live plant material can result in the introduction of pathogens exhibiting very limited dispersal into entirely new geographical regions. The plant pathogen Xylella fastidiosa provides examples of just how devastating the results can be. This bacterium infects xylem vessels and causes scorch and dwarfing diseases in many plant species, including many trees. It is native to the Americas, but limited regional movement has resulted in the evolution of distinct geographical subspecies over the last >20,000 years. Using genetic data, we have evidence of human-mediated movement from Central America to North America, from North America to South America, from South America to Central America, and from the Americas to Europe and Asia. Moreover, genetic data suggest that each of these invasions may have been due to a single introduction. In some cases, the results were predictable from plant hosts in the native range, such as the devastating effect of Pierce’s disease of grapevines in the US following the introduction X. fastidiosa subsp. fastidiosa from Central America; but in other cases they were not, such as the current die-off of olive trees in southern Italy due to the South American X. fastidiosa subsp. pauca. Complicating the story further is evidence that following a new subspecific introduction in the Americas there can be large scale intersubspecific homologous recombination events that create bacteria with chimeric genomes capable of invading novel hosts, as exemplified by the infection of mulberry trees across the US.

184 Invasive Beetles as Vectors of Invasive Diseases: Threats to Urban and Native Forests, T. D. PAINE (Department of Entomology, University of California, Riverside, CA 92521; timothy.paine@ucr.edu).

Movement of wood, wood products, and living plant material with increased global trade has also resulted in the movement of wood-infesting beetles into new environments. Some of these species (e.g., Asian longhorned borer and emerald ash borer) have become very serious threats to native and urban forest systems in North America because of the direct feeding damage to infested trees. Other invasive species have been recognized as serious threats not
because of direct damage, but rather because they introduce fungal pathogens into the host tree. The walnut twig beetle is native to the southwestern US and was previously considered innocuous. However, it has recently become associated with a fungal pathogen that is now transmitted between host walnut trees by the beetle. The new association represents a significant threat to native and commercial walnut species. Apparently native to Southeast Asia, the polyphagous shot hole borer is a new invasive insect that is killing host trees in California. It an ambrosia beetle that is associated with at least three different fungal symbionts. The beetle attacks more than 200 tree species, the fungi can colonize more than 100 species, and the insect can reproduce in more than 20 host species, including important agricultural species, urban landscape hosts, and native forest species. The interfaces between these three different environments and corridors of hosts within the environments facilitate movement of the beetles and increase the risks of tree mortality.

185 Usurpation of Plant - Pollinator Mutualisms by Introduced Ants, DAVID A. HOLWAY (Division of Biological Sciences, MC 0116, University of California San Diego, La Jolla, CA 92093; dholway@ucsd.edu).

Ant invasions are a geographically widespread and ecologically disruptive phenomenon. The establishment and spread of introduced ants result in the displacement of native ants, the disruption of dispersal and protection mutualisms, and the erosion of habitat suitability for some vertebrate species. Introduced ants often visit flowers to obtain nectar and could thus also affect plant-pollinator interactions, but surprisingly few experimental studies address the effects of floral visitation by introduced ants. The first part of this presentation will summarize three recently completed studies that each show reductions in seed set for plants experiencing floral visitation by the introduced Argentine ant. These results suggest that negative effects of floral visitation by introduced ants are likely more widespread than previously thought. Plant species may vary with respect to their susceptibility to floral visitation by introduced ants. The second part of this presentation will thus synthesize the results of existing studies to draw general conclusions regarding the circumstances under which floral visitation by introduced ants will be most likely to compromise plant reproduction.

186 Multi-trophic Effects of an Invasive Generalist on Endemic Arthropod Communities, ERIN W. RANKIN1*, DAVID J. FLASPOHLER2, TADASHI FUKAMI1, CHRISTIAN GIARDINA4, JESSIE L. KNOWLTON2, and DANIEL S. GRUNER3 (1Department of Entomology, University of California, Riverside, CA 92521; 2School of Forest Resources and Environmental Science, Michigan Technological University, Houghton, MI 49931; 3Department of Biology, Stanford University, Stanford, CA 94305; 4US Forest Service, Hilo, HI 96720; 5Department of Entomology, University of Maryland, College Park, MD 20742; erin.wilson@ucr.edu).

Biological invasions, one of the main drivers of global environmental change, disrupt species interactions and can contribute to the collapse of trophic systems. Consequently, there is growing interest in how such trophic cascades drive community and ecosystem processes. While there has been much interest in the effects of individual factors such as fragmentation and introduced predators on ecosystem stability and trophic function, we are interested in assessing the interactive effects as well. In a naturally fragmented Hawaiian forest system, we are investigating the trophic effects of an invasive omnivore (Rattus rattus), which links detrital and higher grazer resource pools within endemic communities that evolved in the absence of any functional analog to rats. Thus invasive rats with their broad diet spanning multiple channels may indirectly impact key services within invaded ecosystems, such as decomposition and nutrient cycling. Specifically we (i) assessed how forest fragmentation alters arboreal arthropod food web structure and the vertical distribution of canopy arthropods, and (ii) quantified the predator pressures exerted by native and invasive predators on these arboreal arthropod communities.

187 Sahara Mustard, Brassica tournefortii: Trophic Impacts on a Desert Sand Dune Community, CAMERON W. BARRIOS (Center for Conservation Biology, University of California, Riverside, Riverside, CA 92521; cbarrows@ucr.edu).

Invasive species are believed to be one of the leading threats to biodiversity, but not all weeds impacts are equal. Informed triage, providing managers decision tools to focus weeds with the greatest negative impacts is critical.

Sahara mustard, Brassica tournefortii, was noted in southern California’s Coachella Valley in 1927. From that introduction it spread throughout the southwest. Along roadsides, agriculture margins, and areas of high aeolian sediment transport, Sahara mustard can become dominant. In 2005 I established a mustard removal experiment on 15 0.1 ha plots. Those data demonstrated that the mustard inhibits reproductive success in native annual plants; after multiple years the seed bank of the natives can become depleted, increasing dominance of the mustard. The loss of desert wildflowers has financial cost on desert communities whose economies benefit from people coming specifically to see the colorful blooms. Beyond those costs, there is an environmental question: what is the impact of the mustard on other trophic levels? Does a loss in annual plant diversity really matter to primary consumers, detritivores and their predators?

Long-term data have shown that arthropod species richness and abundance have declined on those sites with high and/or increasing mustard densities. Annual plant diversity does matter, due to a loss in seed size diversity and due to a change in the structure of the detritus accumulations, both critical resources to the detritivore-granivore based
arthropod community. Current analyses have revealed population growth in arthropod predators, specifically a threatened endemic lizard, is inhibited by mustard dominance as well.

Boise Extravaganza in Set Theory (BEST)
Friday at 9:30 a.m. in HUB 260

Note: Program continues from Thursday. Please refer to page 110 in these Proceedings for those abstracts.

188 Descriptive Graph Combinatorics and Countable Borel Equivalence Relations, ANDREW MARKS (Department of Mathematics, California Institute of Technology, Pasadena, CA 91125; marks@caltech.edu).

Descriptive graph combinatorics is the study of problems from classical graph combinatorics such as coloring and matching, but where we put definability restrictions on both the graphs we consider and the witnesses to their combinatorial properties. We discuss some relationships between this study and Borel reducibility of countable Borel equivalence relations.

189 Productive Properties and Infinite Games, RODRIGO R. DIAS and MARION SCHEEPERS* (1Department of Mathematics and Statistics, University of Sao Paulo, Brasil; 2Department of Mathematics, Boise State University, Boise, ID 83725; mschepep@boisestate.edu).

It is a significant problem to characterize for certain topological properties P the spaces X such that the product of X with any space Y having property P, also has property P. In this talk we present some game theoretic results related to this topic.

Climate Change through the 20th and 21st Centuries
Friday at 1:25 p.m. in HUB 379

190 Climate Change and California's Mountain Snow Pack—How Much Could be Lost? DANIEL R. CAYAN (Scripps Institution of Oceanography, University of California San Diego and U.S. Geological Survey, Nierenberg Hall, Room 201A, 8810 Shellback Way, La Jolla, CA 92037; dcayan@ucsd.edu).

An important part of California’s water supply has traditionally derived from mountain snowpack, but with projected climate warming in future decades, it is likely that the snow pack will diminish. Historically, in response to fluctuations in precipitation, the snow pack has varied considerably between years—VIC hydrological model representation of spring snow water over snow-laden areas of California varies by nearly a factor of 10 (highest to lowest). In today’s climate, the variation in spring snow pack is only incrementally affected by seasonal variations in temperature. In the future, an ensemble of downscaled climate model simulations under two emissions scenarios exhibits +1°C to more than +3°C warming by 2100 over the California snow region. Precipitation over the region shows considerable variability but little trend. While precipitation fluctuations continue to contribute strongly to the year-to-year variation in snow pack, the temperature influence in diminishing spring snowpack becomes substantial in future decades. Under these simulations, achieving California spring snow water volume that meets or exceeds historical median fades to much smaller odds while the occurrence of historically light spring snow pack grows considerably higher.

191 Evidence for Climate Change in the Satellite Cloud Record, JOEL R. NORRIS1*, AMATO T. EVAN1, ROBERT J. ALLEN2, MARK D. ZELINKA3, CHRISTOPHER W. O’DELL4, and STEPHEN A. KLEIN3 (1Scripps Institution of Oceanography, University of California at San Diego, La Jolla, CA 92093, USA; 2Department of Earth Sciences, University of California, Riverside, Riverside, CA 92521, USA; 3Program for Climate Model Diagnosis and Intercomparison, Lawrence Livermore National Laboratory, Livermore, CA 94551, USA; 4Cooperative Institute for Research in the Atmosphere, Colorado State University, Fort Collins, CO 80523, USA; jnorris@ucsd.edu).

Clouds play a key role in the climate system and are intimately tied to the hydrological cycle. They reflect solar radiation back to space and restrict the emission of thermal radiation to space. They are also one of the biggest uncertainties in our understanding of climate change. Depending on how the location, fractional coverage, height, and thickness of clouds change, global warming can be exacerbated or mitigated. Previously, global climate models and observational datasets disagreed over what cloud changes have occurred in recent decades due to inconsistencies among models and spurious variability in the observations. After removal of observational artifacts, we show that several satellite records exhibit similar regional patterns of cloud change between the 1980s and 2000s. Moreover, the observed cloud changes resemble those produced by the majority of model simulations of the late 20th century climate and for a doubling of CO2. Observed and simulated cloud change patterns are consistent with expansion of subtropical dry zones, increasing cloud optical thickness at high latitudes, and increasing height of the highest cloud tops at all latitudes. These results indicate that cloud changes robustly predicted by global climate models are currently occurring in nature.

192 Vegetation and Urban Climate in a Changing World, G. DARREL JENERETTE (Department of Botany and Plant Sciences, University of California, Riverside, Riverside, CA 92512; darrel.jenerette@ucr.edu).

Urban surface temperatures vary greatly in space and time. This variation is in part regulated by impervious surface
characteristics, vegetation, water availability, and regional climate changes. The effects of urban surface temperature variation can influence distributions of urban risks and when moderated by potential coping can lead to drastically different vulnerabilities. To better understand future vulnerabilities we conducted two analyses focused on the Phoenix, AZ metropolitan region, a model system of a high temperature urban environment with potentials for limitations in water availability. First, we examined microscale variation in surface temperature patterns and compared these with parcel level variation for a subset of more than 30 neighborhoods. Temperatures of each parcel and different land covers within the parcel were compared within and across neighborhoods. We are linking these data with interviews conducted for a subset of residents within each neighborhood. These studies are showing a strong relationship between neighborhood variation and surface temperature patterns. We extend this research by evaluating potential scenarios of future land cover, social stratification, and climate to identify potential future patterns of vulnerability to urban warming. These scenarios suggest different future trajectories of land surface temperatures depend on interactive changes in these dominant drivers. Together these studies highlight the both the microscale variation and potential future variation in vulnerability to extreme surface temperature in this hot arid metropolitan region.

193 The Importance of Anthropogenic Aerosols to Recent Precipitation Trends in the Southwest United States, MAHESH KOVILAKAM* and ROBERT J. ALLEN (Department of Earth Sciences, University of California, Riverside, Riverside, CA USA; mvarma@ucr.edu).

Perhaps the most important component of the hydrological cycle is precipitation, particularly for the semi-arid Southwest United States. Observations indicate the region has experienced significant multi-decadal precipitation variability, with an increase from 1950 to ~1980, followed by a decrease since. Model simulations from the Coupled Model Inter-comparison Project v5 (CMIP5) also yield similar changes, with anthropogenic aerosols accounting for nearly all of the simulated response and about 1/3 of the observed trends. Moreover, aerosol only simulations reproduce the observed Sept-Oct-Nov maximum in SW U.S. precipitation trends. Consistent with these precipitation changes, both observations and models forced with anthropogenic aerosols yield a reversal in the trend of the leading pattern of sea surface temperature variability in the North Pacific, the Pacific Decadal Oscillation. By modulating the Pacific Decadal Oscillation and its associated atmospheric teleconnections, our results suggest that anthropogenic aerosols have perturbed Southwest US precipitation and have significantly contributing to the recent—and perhaps future—drying trend.

194 An Analysis of Future Changes in Precipitation and Tropical Cell Width Through the 21st Century using CAM3, OSINACHI AJOKU* and ROBERT J. ALLEN1 (Department of Earth Sciences, University of California, Riverside, Riverside, CA 92521, USA; oajok001@ucr.edu).

For this work, anthropogenic aerosols are compared to GHGs to measure the effects each may have in perturbing the planet’s hydrological cycle and tropical cell width. The effects of anthropogenic aerosols and greenhouse gases (GHGs) on Earth and its environment remain a growing concern. As future emissions of anthropogenic aerosols and GHG’s are projected to change, so will the resulting impact. More importantly, anthropogenic aerosols carry a dynamic influence on the planet’s hydrological cycle through an alteration of the planet’s surface radiation budget. If changes in rainfall intensity and distribution are substantial, they pose one of the most serious risks associated with climate change including an increase in extreme weather events and reduced precipitation in sub-tropical areas. As an invaluable natural resource, from uses in agriculture and daily consumption, an understanding of changes in water distribution is essential for the global economy. Furthermore, future changes in anthropogenic aerosols, including a progressive decrease in sulfates (SOx) pose the highest risk of expanding tropical cell width due to its negative radiative forcing in the atmosphere. As future emissions are projected to change, this work has quantified resulting perturbations to precipitation and tropical cell width due to anthropogenic aerosols and GHG’s. Our results show that future changes in GHG’s and sulfates significantly expand the width of the tropics. Moreover, the expansion associated with sulfate emissions is as large as GHG’s in the northern hemisphere.

195 Re-assessing the Role of Forests in Climate and Water Security, B. LARRY LI*, ANASTASSIA MAKARIEVA, and VICTOR GORSHKOV (Ecological Complexity and Modeling Laboratory, University of California, Riverside, CA 92521-0124; bai-lian.li@ucr.edu).

The effects of forest ecosystems on climate are often viewed solely in terms of moisture recycling. That is, evaporation from the forest returns moisture to the atmosphere where it can increase local rain. However, our recent studies indicate that vegetation, especially forested landscape, influences rainfall patterns more than is generally recognized. Here we argue that the existing global circulation models cannot be used for evaluation of the climatic effects of deforestation because of their inability to reproduce various phenomena that we have ascribed to a new mechanism we have termed the “biotic pump” - by this mechanism forests generate large-scale pressure gradients that cause winds to flow and bring moisture from oceans to land, and forest cover plays a major role in maintaining rainfall. We also show that studying vegetation will have an increasing role in understanding climate and its vulnerability to changes in land use/cover.
Applications of 3D Printing
Friday at 1:30 p.m. in HUB 268

196 The Design Technology Pathway at Pasadena City College, SALOMÓN DÁVILA (Career and Technical Education, Pasadena City College, 1570 E. Colorado Blvd., Pasadena, CA 91106-2003; sgdavila@pasadena.edu).

The Design Technology Pathway in the School of Career + Technical Education at Pasadena City College is now in its third year. Students are achieving strong results as the innovative program continues to lead the way by integrating academic, professional and technical skills in a meta-major focused on career exploration. Designed for recent high school graduates with an interest in design and technology related careers the Design Technology Pathway (DTP) at Pasadena City College offers a fully supported college transition into a full two year program in Design Technology leading to certificates, degrees and transfer.

The pathway features coordinated high school transitions, priority enrollment, dedicated resources including coaches, counselors and tutors, state of the art fabrication and computer labs, and access to all college services. Using a broad range of technologies from CAD to laser cutting, 3D scanning and printing, robotics and social media production, students develop design prototyping techniques. The meta-major approach to college education allows students to critically evaluate their career interests through exploration of Career Clusters, groups of convergent or related careers within an economic region. Real time Labor Market Information and career development support give students an understanding of life long learning strategies for long term career planning. Understanding that the jobs of the future have yet to emerge, Design Tech Students are poised to take advantage of opportunity through a highly developed sense of entrepreneurship.

197 3D Printing as a Curricular Tool in Design and Engineering for the Secondary Curriculum, SIMON P. HUSSI1*, REGINA RUBIO1, and JOAN HORVATH2 (1Science Department, Windward School, 11350 Palms Blvd., Los Angeles, CA 90066, shuss@windwardschool.org; 2Deezmaker 3D Printers, 290 N. Hill Ave., Pasadena, CA 91106, joan@deezmaker.com).

Over the course of an academic school year, Deezmaker 3D printing technology was used to facilitate and augment design instruction in a variety of curricular and extracurricular settings at Windward School, an independent 7-12 grade school in West Los Angeles. Three distinct examples are detailed in this presentation: a 3D printing middle school elective course, an individual 3D design project for a Principles of Engineering survey course, and an independent campus-wide engineering application. In all cases, successes and challenges in incorporating readily available 3D printing technology into the curriculum and the anecdotal learning outcomes are discussed. Expansion of the program to include 3D scanning technology and the development of a prototype maker space are also detailed.

198 Open-Source 3D Printing Projects as Multidisciplinary Learning Tools, KRISTIAN WITTMAN (Mechanical Engineering Department, Shiley-Marcos School of Engineering, University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; krwittman@sandiego.edu).

Open-source projects involving filament deposition modeling 3D printing offer rich and diverse learning opportunities for students. The assembly, set-up, and use of a 3D printing kit can provide a broad range of educational opportunities relating to several prominent STEM topics. These include: manufacturing, assembly, electronics and circuits, programing, vibration, mechatronics, heat-transfer, plastics and extrusion, modeling and design, and most importantly, critical thinking and troubleshooting. 3D printing, as a teaching tool or learning module, can create an engaging, multidisciplinary environment for students to expand their knowledge and skills. From Fall 2012 through Spring 2013, presenter Kristian Wittman worked with a team of 4 other mechanical engineering seniors at the University of San Diego to build and design improvements for an open-source 3D printer. Through this endeavour, each member of the team developed skills involving all of the above topics. The fall semester was spent assembling and analyzing an open-source 3D printer purchased online. The team focused on designing improvements for this printer, while simultaneously seeking to bring the original model online. In the spring, the team attempted to build a second 3D printer based on their designs. In addressing the many technical obstacles and frequent setbacks of the project, the team was provided with a rich and challenging learning experience.

199 3D Printing Nautical History at the MIT Museum, JOAN HORVATH1*, DIEGO PORQUERAS1, KURT HASSELBACH1 (1Deezmaker 3D Printers, 290 N. Hill Ave., Pasadena, CA 91106, joan@deezmaker.com, deezmaker@gmail.com; 2MIT Museum, 265 Massachusetts Ave., Building N51, Cambridge, MA 02139, kurt@mit.edu).

The Hart Nautical Collections at the MIT Museum contain many drawings of historic ships and their components. However, plans on aging paper can be difficult to visualize. This paper will describe the process used to go from drawings in the Hart Collection to 3D printed versions using a small consumer-level fused filament fabrication 3D printer. Items replicated include an 1890 cleat from a ship designed by the legendary nautical architect and mechanical engineer Nathanael Green Herreshoff and a hull by yacht designer William Hand.

Translating the drawings into a 3D-printable computer aided design file required some interpretation and some knowledge of the assumptions that a shipbuilder would
have made when reading the drawings. A presentation of the drawings, the resulting 3D prints, and a live demonstration of printing some of the historical objects are all planned to occur at the MIT Museum during the April 2014 Cambridge Science Festival. The authors will discuss the visitor reactions, the lessons learned, and future plans for making history rise from the page with small consumer 3D printers.

**200 Designing DNA Nanosystems through 3D Printing, MATT GETHERS*1, SI-PING HAN1, LISA SCHERER2, JULIAN VOSS-ANDREAE3, WILLIAM A. GODDARD III1 (1Materials and Process Simulation Center, California Institute of Technology, Pasadena CA 91125, mgethers@caltech.edu, si-ping@wag.caltech.edu, wag@wag.caltech.edu; 2City of Hope, 1500 East Duarte Road, Duarte CA 91010; lscherer@coh.org; 3Julian Voss-Andreae, 1517 SE Holly St., Portland, OR 97214, info@JulianVossAndreae.com).**

DNA nanotechnology has proved to be a powerful approach to nanoscale engineering by self-assembly, the ability to adopt varied geometries, and precise arrangement of molecules by utilizing the natural spacing of DNA bases. This has stimulated interests by a large number of researchers from disparate fields. However, the small size of DNA makes it difficult to visualize the structures being designed. This is unfortunate since visualization is critical for design, especially for systems with many components and complicated geometries where the mind’s eye is insufficient. Computer modeling provides an indispensable tool in addressing this challenge, but it too has limitations, typically requiring specialized and expensive software, and limiting the designer’s creative expression to whatever functionalities were included in the software. We proposed that 3D printing can help the critical visualization of design in a number of ways. 3D models are not hampered by the limitations of the computational interface, so the designer can freely and rapidly test new ideas. Further, by physically handing the model, the designer gets an intuitive feel for the relative shapes and sizes of the system. Importantly, a physical model of the target system also facilitates collaborative discussions. In this presentation, I will present some of the DNA systems being studied by our group and will show how we have used 3D printing to aid in the design of those systems. Financial support of this ODISSEI project was provided by the National Science Foundation (EFRI-1332411).

**201 3D Printing Protocols for Tissue Printing in an Academic Setting: A Strategy for Printing a Human Cornea, ANDREW BARAJAS*1, KEVIN KIM1, LEEOR ZIBER-MINTZ1, PAUL SCHUBER2, JOEL WEST2, and ANNA HICKERSON1 (1Biomedical Engineering, 2The Business of Bioscience, Keck Graduate Institute School of Applied Life Sciences, 535 Watson Drive, Claremont, CA 91711; abaraj14@students.kgi.edu).**

The objective of this project was to devise tissue printing protocols, that utilized commercial 3D printing technology, in order to artificial print and grow a cornea. This research includes strategies in converting an open source 3D printer to allow for cell scaffold printing, as well as procedures in growing tissue and establishing focal adhesion onto printed scaffold structures, in an academic setting.

A machined aluminum mold was developed in CAD that contained various cornea sizes simulating the basic curvature and form of corneas seen in humans and various types of animals. A specially formulated poly(ethylene glycol) diacrylate (PEGDA) hydrogel was developed, that was extruded using a syringe pump, to create cell scaffolding within each mold to all allow for cell growth. Cornea cells were then implanted on each scaffold and allowed to grow digesting the scaffold and taking the shape of the mold. The optical properties of the artificially grown corneas, as well as the cell viability, where then tested in comparison with naturally grown corneas.

Utilizing these protocols, the Keck Graduate Institute (KGI) hopes to further develop its 3D printing program with its focus on medical applications. It is the belief that such a program would allow KGI students to continue to pursue research in the area of regenerative medicine and develop new, innovative uses for 3D printing technology in a biological setting.
but it was introduced in a female cadaver through a ureteral access sheath. Fourth generation 9Fr stents were printed and deployed in a porcine model using standard Seldinger technique. The printed trocars were functional for the maintenance of pneumoperitoneum and instrument passage. The printed trocars had a larger superficial defect area (p<0.001) and length (p=0.001) compared to Karl Storz, and Ethicon trocars (29.41mm², 18.06mm², and 17.22mm², respectively and 14.29mm, 11.39mm, and 12.15mm, respectively).

CONTRIBUTED ORAL PRESENTATIONS

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JOINT ORAL SESSION 1

EDUCATION
Wednesday at 8:25 a.m. in HUB 367

203 Ethics Education for Students Engaging in Undergraduate Biological Research, ALEXANDRA QUACKENBUSH* and AMELIA J. AHERN-RINDELL.(Department of Biology, University of Portland, 5000 N Willamette Blvd., Portland, OR 97203; quackenb15@up.edu, ahernrin@up.edu).

Scholarship in one’s discipline is perhaps the most valuable learning experience for students to have as undergraduates. In order to be successful, students must possess an understanding of what constitutes acceptable and unacceptable research behavior, in addition to acquiring the technical knowledge required in their major. Currently, there are no widespread standards about the ethical training of undergraduates. We pose the question as to whether intentional training is necessary or if students will pick up the appropriate behaviors they need based solely on observing and imitating their mentors. To this end, we developed a survey for biology majors that presented behavioral scenarios covering the topics of collaboration, mentoring, data management, plagiarism, authorship and acknowledgments, experimental design, safety, and peer review. Students were asked to judge the acceptability of each scenario. If students knew all they should about ethical research practices, there would be no variance in answers. However, the responses displayed strong variability with no question answered correctly by every student. The areas of authorship, data management, and experimental design proved to be particularly troublesome for students. These results strongly suggest that students, and potentially their faculty mentors, are unaware of acceptable behavior in certain situations. This lack of knowledge should be remedied by standards for ethical research training for undergraduates and their mentors. Further, the changes in federal funding requirements by the National Science Foundation and the National Institutes of Health make the need for intentional ethical training a necessity.

204 Complexity of Information Literacy in our 21st Century and the STEM Undergraduate Curriculum, DANIELLE MIHRAM* and G. ARTHUR MIHRAM. (*Leavry Library, University of Southern California, Suite 113, 650W 35th Street, Los Angeles, CA 90089-2571; 2P. O. Box 1188, Princeton, NJ 08542-1188; dmihram@usc.edu).

University undergraduate students use a simplistic approach to finding information on the Internet, and, consequently, they are not always proficient at recognizing incorrect or misleading information. The 2000 Information Literacy Competency Standards [IL Standards], created for higher education by the Association of College and Research Libraries [ACRL], have been used internationally in academic programs since 2000.

However, in our contemporary environment of rapid technological change, proliferating information resources, and social media, the availability of information through multiple media (including graphical, aural, and textual) poses new challenges for individuals in evaluating and understanding the complexity of information literacy itself in our 21st century. Consequently, those Standards are currently under review so as to highlight the need for educators to rethink the concept of information literacy in the context of the critical analysis of information by students.

This paper provides an overview of the revisions of the Standards which move from a formulaic approach to an all-encompassing framework, one that positions IL as a set of concepts and practices integral to student learning in any discipline. Examples from the STEM disciplines illustrate this new approach to information literacy as a student’s transformational lifelong learning experience. We underscore this via a number of examples on specific disciplines’ conceptual ‘thresholds’.
205 An Experimental Study of the Efficacy of Game Augmentation Learning Effects on Computer Aided Instruction (CAI) of Physics Science Tasks, MICHAEL ELIOT (Department of Physics, Huntington Beach High School, 16033 Bolsa Chica St., 104, Huntington Beach, CA 92649; physics.hbhs@gmail.com).

Web-based online gaming and simulations have a great potential to serve as an enhancing adjunct to traditional Computer Aided Instruction (CAI) for improving student academic achievement on physics science learning tasks. An experiment was designed and performed to study the efficacy of game augmentation learning effects in a CAI physics science instructional context. Experimental subjects consisting of high school physics students were divided into a control group and an experimental group. Both groups used traditional CAI to learn a new physics task involving electrical circuit design. The experimental group additionally used an aligned web-based online game (the treatment) to further learn the same physics task. The subjects were administered a pre-test and a post-test to assess their physics task learning outcomes. Using a two-tailed T-test at the 0.05 significance level, the results indicated that there was a statistically significant difference between the outcome of the control group and the experimental group, and the experimental group had greater learning outcomes than the control group. This result provides support for the efficacy of using web-based online games as an adjunct to CAI for the learning of physics science tasks.

SOCIAL, ECONOMIC, and POLITICAL SCIENCES
Wednesday at 9:30 a.m. in HUB 367

206 Experience Culture to Better Understand Others, DEBORAH KISSINGER (Department of Psychiatry, John A. Burns School of Medicine, University of Hawaii, 1356 Lusitania Street, 4th Floor, Honolulu, HI 96813; kissinger@dop.hawaii.edu).

The fluid global business, education, scientific, and medical communities allow individuals to meet and interact with people from diverse groups. Now that we can easily access each other, how do we interact? Cultural competency attempts to address some of the issues of global community interactions. As appealing as the cultural competency concept may appear, it is largely presented as an acquired cognitive understanding of other people’s cultures. This presentation provides an understanding of cultural adjustment concepts, informed by G.R. Weaver’s recommendation that an experiential aspect must supplement cultural presentations. Together, the operationalized experiential component and didactic presentation are interwoven into a broad understanding designed to increase participants awareness of the ambiguity, frustration, and uncertainty an individual might experience when confronted with a new culture. Placing focus on experiencing culture beyond cognition has a more important function in light of Weaver’s “Iceberg Analogy” of culture, which proposes a split between the iceberg tip and body. The visible iceberg tip represents a mere 10% of all cultural information. The hidden unseen body of the iceberg holds 90% of cultural matters and is more difficult to access. Alarmingly, 90% of meaningful cultural information may be concealed and missed because we lack an awareness of it. Knowing another individual may be experiencing far more than the observer perceives opens the awareness to ask more questions and to strive to be more accommodating. The purpose of this presentation is to increase an appreciation for “hidden” cultural information to improve communication and thoughtful action.

207 When Railroads Blow Up: The Development of Regulations for Shipping Hazardous Cargo, 1903-2013, MARK ALDRICH (Department of Economics, Smith College, Northampton, MA 01038; MALdrich@Smith.Edu).

The recent and spectacular oil train disasters at Lac-Megantic, Quebec and Casselton, North Dakota have once again brought into focus the dangers of shipping hazardous materials by rail. The response by regulators has been rapid and significant. Their ability to respond with alacrity and effectiveness did not just happen, for this is not the first time such problems have arisen. As this paper will argue, the modern regulatory response grew out of over a hundred years of experience devising rules for shipping hazardous products. More than a century ago, in 1903, a series of disastrous wrecks involving explosives led the railroads to seek federal regulation, which for half a century successfully reduced those hazards. In the 1960s, however, new dangers arose from new hazards. Railroad hazmat accidents skyrocketed leading to public outcry that created the modern apparatus for regulating all forms of railroad safety, including the shipments of hazardous materials.

SCIENCE and the ARTS and HUMANITIES
Wednesday at 10:30 a.m. in HUB 367

208 Designing Comics and Multi-Media Narrative for the Exploration of and Audience Engagement with the Southern California Spiny Lobster Fishery, VICTORIA MINNICH (Independent Scholar, 4015 Havenhurst Ave., Riverside, CA 92507; stokastika@gmail.com, accidentalanthropologist@gmail.com, ohtheotheraa@gmail.com).

A multitude of methodologies exist for collecting data and composing “rigorous” narratives on human-environmental systems, but various academic departments spanning from the sciences to the humanities have been largely locked into very peculiar institutions of “objective” and “unbiased” storytelling, which ultimately constrain the potential scope
of readership and audience engagement with the projects of “expert” scholars. Very few disciplines emphasize the value of visualizing or even personalizing complex, and often esoteric human-environmental problems, which has been shunned as a “non-rigorous” pursuit of the arts. “Lobster Mania” is a comics-driven, multi-media article and campaign that explores and potentially demonstrates the value of comics as a research and education tool to visualize and personalize the operations of the southern California spiny lobster fishery. The story is intended to provide thought-provoking information for fishermen, scientists, non-profits, and seafood consumers alike. “Lobster Mania” can serve as a case-study narrative delving into the “new media” possibilities of how stories can be told of systems of study often scrutinized by academics, but can generate collective meaning to a diverse and broad suite of audiences beyond the reaches of the university.

HISTORY and PHILOSOPHY of SCIENCE
Wednesday at 10:50 a.m. in HUB 367

209 The Pendulum and Three Standards that Measured the Ancient World, ROLAND A. BOUCHER (Independent Scholar, 11 Deerspring, Irvine, California 92604; rolandfly@sbcglobal.net).

We will show how a simple pendulum can be used to create a uniform, easily replicable system of measurement and how the Ancient Mesopotamians in the third millennium BCE developed standards of measurement which are entirely consistent with one based on the length of a one-second pendulum.

Just as the metric system would establish similar length-based standards 5000 years later, the Sumerians used the length of this pendulum to create all their standards of length, distance, volume, and weight. It appears that the Egyptians improved on the accuracy of this concept by using the stars to time their pendulum. Later the Minoans on Crete would use the planet Venus when in opposition as their clock.

These three concepts spread throughout the Ancient world from Britain in the West to China and Japan in the East. Examples of the first standard can be found in China, and in France as well as in Mesopotamia. Examples of the second can be found in Phoenicia and early Rome, as well as in Egypt. Examples of the third can be found not only on Crete but in Okinawa Japan, and in medieval England where they are immortalized in the Magna Carta of 1215. The old saying “a pint a pound the world around” had been true for over 3000 years.

Later cultures would mix and match these three standards resulting in a confusion of methods of measurement which obscured the magnificent achievements of these civilizations from so long ago.

210 Evolution is Both True and Inevitable, LAWRENCE H. WOOD (Physicist, Retired, 8433 Camano Loop NE, Lacey, WA 98516; marylar@comcast.net).

This presentation demonstrates that Evolution is the inevitable result of genetic changes occurring at three stages: mitosis; meiosis and alternate splicing (AS) in the reproductive process. Evolution’s truth is then demonstrated by examining the three reproductive cycle stages in detail. The three stages will be described with emphasis on AS, the source of new, unique genes necessary for significant phenotypic changes, viz. our rapid frontal lobe expansion. AS’s role is a relatively new finding. In 2012, Barbosa-Morais et al discovered AS increases with decreasing time to present over the past 300 million years. Hadas Keren et al show that “AS is a major mechanism for the enhancement of transcriptome and proteome diversity.” The output of reproduction, a totally random process, is a bell shaped distribution which explains the bell shaped distribution of all human characteristics; especially adaptability. The bell shaped adaptability distribution also explains evolution’s inevitability. Apoptosis – programmed cell death is shown to be an additional requirement for evolution’s occurrence; makes room for new and improved species.

1 Masters of the Planet, Ian Tattersall, Macmillan, 2012, p. 94.

211 Mathematics, a Language, is Not Science: Nor does the Scientific Method Mime the Mathematician’s Theorem-proving Process, G. ARTHUR MIHRAM* and DANIELLE MIHRAM (PO Box 1188, Princeton, NJ 08542-1188; Leavey Library, University of Southern California, Suite 113, 650W 35th Street, Los Angeles, CA 90089-2571; dmihram@usc.edu).

Science is that human activity devoted to the search for the very explanation for (i.e., for the truth about) any particular naturally occurring phenomenon. The Scientific Method, inferred from the history of science [TEOREMA 28/2: 35-44. 2009], is an isomorphic mimicry of natural model-building [Nature’s process for ensuring biological survival, first chemico-genetic, then chemico-neural]. Two points connecting mathematics and science: (1) Mathematician Quinn [AMS NOTICES, 59(1): 31, 2012] concludes that the criterion for validity (of a model, explanation) differs, respectively: internal for mathematics, yet external for Science; (2) Further, Science does not mime mathematical theorem-proving [assumption(s); logical deduction; conclusion], except whenever theorem-proving is used as one alternative in further confirming the validity of a previously established scientific model/explanation.

LT More (Dean, Cincinnati University), while expressing (1915) the longstanding belief that “mathematics is the only true science”, he nonetheless concluded therein
JOINT ORAL SESSION 2

EVOLUTION, ORGANISMAL BIOLOGY, and BIODIVERSITY
Wednesday at 9:05 a.m. in HUB 265

212 Patterns of Genetic, Morphological and Physiological Trait Variation among Native and Introduced Populations of Bromus rubens. MATTHEW R. O’NEILL,1* NORMAN C. ELLSTRAND2, LOUIS S. SANTIAGO2, and MICHAEL F. ALLEN1 (1Department of Botany and Plant Sciences, University of California, Riverside, 900 University Ave., Riverside, CA 92521; 2Department of Biology, University of California, Riverside, 900 University Ave., Riverside, CA 92521; monei003@ucr.edu).

The evolution of increased invasiveness hypothesis posits that genetic differentiation between introduced and native populations contributes to the success of exotic species. Mechanisms responsible for differentiation are founder effects, adaptation to novel environments, and admixture of previously separated populations. Evidence for the former mechanisms suggests that losses of genetic diversity are transient events ameliorated by multiple introductions that increase the adaptive potential of introduced populations. We quantified patterns of genetic, morphological and physiological variation among introduced and native populations of an important invasive grass, Bromus rubens, to test for the occurrence of these mechanisms.

Introduced populations displayed 23% greater genetic diversity and a 17% increase in gene diversity relative to native populations. Ten unique haplotypes were identified. Three were shared among introduced and native populations. Two of these were found coexisting in a single California population, but never co-occurred within native populations. Analyses of molecular variance reflected this pattern of strong population differentiation among native populations ($\phi_{ST} = 0.84, p < 0.001$), but not among introduced populations ($\phi_{ST} = 0.08, p < 0.17$). Shoot height and relative growth rate of the introduced populations were larger than the native populations by 28% and 25%, respectively (shoot height: $F = 148.63, p < 0.0001$; relative growth rate: $F = 82.23, p < 0.001$). These data indicate that evolutionary change toward more invasive behavior has occurred in the introduced populations. The genetic data suggests that increased genetic diversity in introduced populations resulted from multiple introduction events, followed by admixture of previously isolated haplotypes.

213 Host Plant Affects Mate Choice in a Plant-Eating Beetle, KATHERINE GOULD (California State University, Northridge, Department of Biology, 18111 Nordhoff St., Northridge, CA 91330-8303; katherine.gould.870@my.csun.edu).

Host plant choice can have significant effects on leaf-eating insects, including driving differentiation between populations feeding on different plant species and even leading to speciation. The beetle Triphabia eriodictyon lives on two shrubs with different plant defenses: Eriodictyon crassifolium has hairy leaves; E. trichocalyx has sticky leaves. The relationship between these plants and the leaf-eating beetles that depend on them has been unstudied until now. In choice tests, larvae and adults showed unexpected feeding preferences, with larvae from E. crassifolium showing no preference and those from E. trichocalyx preferring E. crassifolium. Adults all strongly preferred eating E. trichocalyx. Mating trials showed that the only difference in preference involved males from E. trichocalyx, which were far more attractive to females on E. crassifolium than males on the same host. Finally, females laid more eggs if they ate E. trichocalyx than E. crassifolium, even if they had started life on the latter. It is clear that E. trichocalyx provides benefit to both males and females, but the beetles are not differentiating. The plant defenses, which appear dramatically different to humans, are unimportant to the beetles.

214 A New Hypothesis Explaining the Reversed Sexual Size Dimorphism in Raptors, HARTMUT S. WALTER (Department of Geography, UCLA, 1255 Bunche Hall, Box 951524, Los Angeles, CA 90095-1524; lswalter@g.ucla.edu).

At least 14 different hypotheses have been proposed over many centuries trying to explain the often astonishing size differences between males (smaller) and females (larger) in many birds of prey and owls. None has found universal acceptance so far and new data concerning RSSD are still being published. In this paper I will briefly review the main hypotheses and classify features of raptor life habits and anatomy as proximate components of RSSD. Is there a single causal factor responsible for the evolution of extreme RSSD in some bird-hunting hawks, falcons and owls? I have previously called for a holistic approach to the RSSD phenomenon (Walter 1979) and can now present more specific
data and rationales pointing indeed to a single physiological process underlying the evolution and adaptation of RSSD. The medulla of the leg bone in birds generates the calcium needed for eggshell formation. It is this bone that is uniquely stressed during the impact of a bird-hunting raptor when impacting their prey. No other birds face this often violent event because only raptors hit and grab prey with their feet. My thesis postulates that raptor females have grown larger than their males in order to better protect the fragile nature of the medulla anatomy and the entire reproductive apparatus.

ECOLOGY, ENVIRONMENTAL SCIENCES, and SUSTAINABILITY
Wednesday at 10:30 a.m. in HUB 265

215 American Kestrel (Falco sparverius) Breeding Success In Human-modified Landscapes, NICHOLAS J. NOVERO, KELSEY R. BROWN, and RICHARD W. VAN BUSKIRK* (Environmental Studies, Pacific University, 2043 College Way, Forest Grove, OR 97116; vanbuskirk@pacificu.edu).

Data from diverse sources including the Breeding Bird Survey, Christmas Bird Counts, nestbox monitoring programs and migration counts indicate that American Kestrel (Falco sparverius) populations are in decline across a significant portion of North America. Some hypothesized causes include exposure to second-generation rodenticides, increases in predator populations and habitat fragmentation/alteration on a landscape level. This project investigates the effect of habitat type on breeding success by examining the relationship between land use surrounding kestrel nesting sites and the number of offspring produced. Working with natural and artificial nest sites located in rural and exurban regions of Washington County, OR in 2013, we characterized habitat types in the highest use foraging region immediately adjacent to each nesting location by visiting each site and recording landscape characteristics on a map. Transferring the data to ArcGIS, we determined the percentage of each habitat type within a circular half-mile radius region surrounding each nesting location. Finally, we used the number of nestlings produced (~10-20 days old) in each age of each landscape type adjacent to each nesting location. Finally, we used the number of nestlings produced (~10-20 days old) as a measure of reproductive success and regressed this against the percentage of each landscape type adjacent to each nesting location. Our results indicate that some habitat types are strongly associated with low nesting success. By learning more about the relationship between variation in land use and nesting success, we might be better able to predict the effect of land use changes on kestrel numbers and consider options to mitigate these effects.

216 A Vegetative Survey in the Marsh Flats of the Ballona Wetlands to Determine the Occurrence of Non-Native Plants, T. KIM*, E. CLEMENTF, and J. DORSEY3

217 Modeling the Dynamic Pattern of Household-based Forest Use Driven by Labor Availability in Rural Communities of Developing Countries, ZHIYUAN SONG1*, WILLIAM S. CURRIE1, ARUN AGRAWAL1, and ALLISON STEINER2 (1School of Natural Resources and Environment, University of Michigan, 440 Church Street, Ann Arbor, MI 48109; 2Department of Atmospheric, Oceanic and Space Sciences, University of Michigan, Space Research Building, 2455 Hayward Street, Ann Arbor, MI 48109; zysong@umich.edu).

Invasive species have become a pernicious ecological threat in degraded wetland ecosystems. They can competitively exclude native plants for resources, causing widespread biotic homogenization, altered nutrient cycles, and lowered biodiversity. The objective of this investigation was to assess the percent of native and invasive plant spe-ies diversity across lower and upper salt-marsh habitats at the Ballona Wetlands, and to characterize some chemical and physical parameters that could control differences in plant diversity. The percent cover of plant species was det-ermined along four 30-meter transects; two transects were positioned in the low marsh areas adjacent tidal channels and inundated by water during periods of high tide, and two in the upper marsh areas seldom wetted by tidal flows. Along each transect plants were surveyed in five randomly placed 1 m² quadrates. Three soil samples were collected from each transect and tested for salinity (ppt), percent organic matter, and grain size (%clay, % silt, % sand). Preliminary results indicated that no non-native plants occurred in the surveyed areas. Soils comprised mostly fine sediments with percent silts and clays usually ranging from 46.8% to 90.87%. Organic matter content varied, ranging from 2.3% to 30.46% while soil salinity was quite variable, ranging from 15 to 88 ppt. Future work will census the plant assemblage in wetland areas of slightly higher elevation where non-native species become abundant, and link soil characteristics to plant diversity through multivariate analytic techniques.

218 Decisions on forest use are sensitive to the labor availability of the common resource and the welfare of local households. Traditional forest use by rural households in developing countries, unlike large scale tree-logging harvest in industrial forestry, implements less destructive, but more labor-intensive forms: lopping foliage and gathering fuelwood among them. The intensity of forest use in a given area and the area over which it occurs are important variables that co-determine the sustainability of the common resource and the welfare of local households. Decisions on forest use are sensitive to the labor availability
in each household, which is affected by labor outflows to urban areas, seasonal migrant work, and the schooling of children. Our paper develops a mathematical model and uses agent-based simulations to investigate the coevolution of household-based decisions on the area and intensity of forest use which are shaped by collective social norms. We find that adherence to social norms is necessary to prevent the tragedy of the commons. As labor availability declines, the total area of forest use decreases, but the average intensity of use increases. Depending on intensity of use relative to regrowth, this produces a zone of unsustainable forest use close to the settlement. Socioeconomic heterogeneity among households leads to increasing intensity of forest use. The household-based forest use also affects the physical structure of the forest such as leaf area index, which can alter forest evapotranspiration and local temperatures.

ATMOSPHERIC and HYDROSPHERIC SCIENCES
Wednesday at 11:30 a.m. in HUB 265

218 From Passive Samplers to Estimates of Dry Nitrogen Deposition in the Western United States, ANDRZEJ BYTNEROWICZ1*, WITOLD FRACZEK2, ROBERT JOHNSON3, MARK FENN4, LEIMING ZHANG5, and DARREL JENERETTE6,7 (1USDA, Forest Service, Pacific Southwest Research Station, 4955 Canyon Crest Drive, Riverside, CA 92507; 2Environmental Systems Research Institute, 380 New York Street, Redlands, CA 92373; 3Center for Conservation Biology, University of California, Riverside, CA 92521; 4Air Quality Research Division, Environment Canada, 4904 Dufferin Street, Toronto, Ontario, M3H 5T4, Canada; 5Department of Botany and Plant Sciences, University of California, Riverside, CA 92521; abytnerowicz@fs.fed.us).

Passive samplers have been used for determinations of concentrations of nitrogenous (N) air pollutants such as nitrogen oxides (NOx), nitrogen dioxide (NO2), ammonia (NH3), and nitric acid vapor (HNO3). Their increasing use has led to greater understanding of the distribution of air pollutants in topographically complex landscapes, such as mountain ranges. Pollution distribution in the Sierra Nevada Mountains (including Sequoia & Kings Canyon National Parks and the Lake Tahoe Basin), the San Bernardino Mountains, Joshua Tree National Park, and the wildland-urban areas of southern California has been illustrated by maps developed with ArcGIS Geostatistical Analyst (ESRI, USA). A GIS-based empirical inferential method (GIS-EIM) has been developed specifically for estimation of dry and total N deposition in arid and semi-arid areas. Our methodology is based on concentrations of gaseous N air pollutants determined with passive samplers, empirical values of surface deposition velocity for NH3 and HNO3; empirically and literature-based values of stomatal conductance for NH3, NO2 and HNO3; satellite information on leaf area index (LAI); and detailed landscape cover data. Comparison of summer-time measurements with those from the Community Multi-scale Air Quality (CMAQ) model allowed for extrapolation to annual N deposition values. Information on N deposition distribution helps to estimate exceedances of N deposition critical loads needed for better understanding of potential threats of N air pollution to ecosystem health and services. This new modeling approach will be illustrated by an example from the San Bernardino Mountains of southern California.

JOINT ORAL SESSION 3

PHYSICS and MATERIALS SCIENCE
Wednesday at 1:25 p.m. in HUB 265

219 Electrochemical Impedance Spectroscopy of Ti-6Al-4V Containing Boron Additions in Hanks Balanced Salt Solution, OBED VILLALPANDO*, TRAVIS VOORHEES, MORGAN WONG, MATTHEW BORGIALLI, HANNAH LEU, and VILUPANUR RAVI (California State Polytechnic University, Pomona, 3801 W Temple Ave., Pomona, CA 91768; ovillalpando@csupomona.edu).

Titanium and its alloys have been one of the leading materials used for medical implants, not only because of their superior specific mechanical properties, but also for their excellent corrosion resistance and biocompatibility. By using boron as an alloying element in titanium, the strength of the resultant alloys is higher than that of the base alloy. It has been shown that even small additions of boron (in the 0.1 – 1.2 wt% range) decreases grain size which in turn increases the yield and tensile strengths of Ti-64 alloys when compared to the base alloy. Understanding the effect of this alloying addition (boron) on corrosion resistance is equally important in environments such the human body. Research at Cal Poly Pomona has been focused on evaluating the corrosion behavior of these unique alloys through electrochemical impedance spectroscopy (EIS). In order to characterize the corrosion behavior of our alloys, EIS was conducted in Hanks Balanced Salt Solution (HBSS) at various exposure times. Our data has shown that, in general, at increased exposure times, Ti-64 with varying boron additions forms a double-layered passive oxide film. This presentation will review the results of the electrochemical impedance spectroscopy tests on these Ti-64 alloys in HBSS and discuss them with relevance to their chemical composition.

220 High Temperature Oxidation Behavior of Aluminized Austenitic Stainless Steel, CORY GAINES*, NICHOLAS AGEE-ACOSTA, MICHAEL CASPER, MATTHEW DOWNS, BRANDON ELLEDGE, BETTY LEUNG, and
VILUPANUR RAVI (California State Polytechnic University, Pomona, 3801 West Temple Ave., Pomona, CA 91768; cbgaines@csupomona.edu).

High temperature oxidation of metallic alloys is a complex phenomenon involving multiple processes, e.g., arrival of gaseous species at the surface of the materials, solid state diffusion, creation and movement of defects in the material, initial oxidation state, etc. One of the limitations in using stainless steels for high temperature service is the formation of a volatile, non-protective chromium oxide scale at temperatures above 900°C. For these elevated temperatures, alloys that form aluminum oxide scales afford better protection due to their higher stability and slower growth rates. Simulating high temperature service environments through lab-scale experiments enables the development of insights into the formation and stability of oxide films on metallic substrates.

In this project, we are examining the oxidation behavior of aluminized and uncoated type 304 stainless steels (UNS 30400) in air. Aluminized coatings were obtained by pack cementation processes using UNS 30400 substrates at 750°C. Coated and uncoated samples were then subjected to isothermal and cyclic oxidation testing under atmospheric pressure at 1000°C for various time intervals. Macro-photography, mass change data, X-ray diffraction, and optical microscopy were conducted to evaluate the stability of the coating.

Furthermore, different methods of examination are being conducted to help better understand the formation of oxides on metal substrates. Currently, work is being conducted on optical reflectivity methods for examining the initial oxide growth on steel. Testing suggests that each testing temperature results in a surface oxide layer with a unique wavelength at maximum light reflectance.

221 Effect of Activator in Pack Aluminizing Type 304 Stainless Steel, ARMANDO CORONADO*, SHAHAN KASNAKIJAN*, SUTINE SUJITTOSAKUL*, MICHELL ARANDA*, CHRISTOPHER CALLE* and VILUPANUR RAVI (California State Polytechnic University, Pomona, 3801 W Temple Ave. Pomona, CA 91768; arcoronado@csupomona.edu, shahanks@gmail.com, sujittosakul@csupomona.edu).

Stainless steels are frequently used in applications requiring high strength materials that can withstand moderately high temperatures and corrosive environments. However, applications with harsher operating conditions, e.g., specific components in nuclear, coal, and biomass power plants, require more corrosion-resistant materials. One of the key approaches for enhancing the operating lifetimes of metallic components under high temperature conditions is by using protective coatings. Diffusional aluminide coatings applied by the halide activated pack cementation (HAPC) process is one approach to achieve protection against corrosion at these elevated temperatures. The nature of the coatings applied by the halide activated pack cementation method is affected by processing variables such as temperature, time, and type of activator.

In this study, type 304 austenitic stainless steel (UNS 30400) was coated at 650, 750, and 850°C for 9 hours under an inert atmosphere. Different activators, namely aluminum chloride, ammonium chloride, sodium chloride, sodium fluoride, sodium hexafluoroaluminate (cryolite) and aluminum fluoride were used to study the effects of pack composition on the coating. After coating, sample microstructures were analyzed using optical microscopy. Mass change and micro-hardness were measured to further characterize the coating. NaCl, NaF, and Na3AlF6 produced coatings less than 5 µm thick when coated at 650°C, while AlCl3, AlF3, and NH4Cl produced average coating thicknesses of 25, 10, and 25 µm, respectively, when coated at the same temperatures and time. When coating temperatures were increased, significant increases in coating thickness were observed for all activators.

ENGINEERING, TECHNOLOGY, and GENERAL SCIENCE
Wednesday at 2:30 p.m. in HUB 265

222 Role of Matrix Stiffness in the Mechanochemical Regulation of Endothelial Inflammation, HARRY A. SCOTT*, XIAO YANG, SOROUSH ARDEKANI, and KAUST-ABH GHOSH (Department of Bioengineering, University of California, Riverside, 217 MSE 900 University Ave., Riverside, CA 92521; hscot003@ucr.edu, xyang003@ucr.edu, sardek001@ucr.edu, kghosh@engr.ucr.edu).

Chronic inflammation plays a key role in the development of various pathological conditions such as atherosclerosis and emphysema. Chronic inflammation is also a chief characteristic of aging and diabetes, important risk factors for cardiovascular diseases. Importantly, in such pathological conditions, the sub-endothelial matrix stiffness is also significantly altered. However, whether a causal relationship exists between abnormal matrix stiffness and endothelial inflammation remains unclear. Our studies using synthetic matrices that mimic matrix softening (200 Pa), normal sub-endothelial matrix (1000 Pa) and matrix in stiffer (aged) vessels (4000 Pa) reveal that excessive matrix stiffening or softening alone can significantly enhance leukocyte-endothelial cell (EC) adhesion, an early step in endothelial inflammation. Notably, this preferential endothelial inflammation on soft (200 Pa) and stiff (4000 Pa) matrices correlates inversely with levels of nitric oxide (NO), a major anti-inflammatory factor but directly with activation of NF-kB, a key inflammatory transcriptional factor. To more closely mimic inflammation seen in vivo, EC monolayers were grown on various synthetic matrices and leukocytes added to them at a shear flow rate of 2 dynes/cm². Findings from this shear flow study
recapitulated the biphasic trend in endothelial inflammation where significantly greater number of leukocytes adhered to ECs grown on the soft and stiff matrices. These findings that elucidate a key regulatory mechanism of endothelial inflammation through matrix stiffness-mediated eNOS/NO expression implicate matrix stiffness as a potential therapeutic target for immunomodulation and cardiovascular normalization.

223 Synthesis and Characterization of Novel Nitroglycerin Nanoformulation for Superior Anti-Inflammatory Therapy, SOROUSH GUPTA1*, HARRY SCOTT1, SHAHRAZ GUPTA2, SHANE EUM3, XIAO YANG1, UMAR MOHIDEEN2, and KAUSTABH GHOSH1 (1Department of Bioengineering, University of California, Riverside, 217 Materials Science and Engineering, 92521, sarde001@ucr.edu, hsco003@ucr.edu, seum002@ucr.edu, xyang003@ucr.edu, kghosh@engr.ucr.edu; 2Department of Physics and Astronomy, University of California, Riverside, Physics Building, 92521, umar.mohideen@ucr.edu; 3Department of Biosciences and Biomedical Engineering, Indian Institute of Technology, Indore, India, sgupta.ucr@gmail.com).

Reduced bioavailability of endothelial-derived nitric oxide (NO) is characteristic of many inflammation-mediated diseases such as atherosclerosis, ischemia-reperfusion injury, and pulmonary hypertension. Thus, restoring NO bioavailability represents a feasible immunomodulatory strategy. Nitroglycerin (NTG), an FDA-approved drug that enhances endothelial NO production, has been used extensively for vasodilation and amelioration of chest pain. Its anti-inflammatory effects, however, remain unknown. Our in vitro studies reveal that NTG exhibits potent anti-inflammatory properties associated with enhancement of endothelial NO production and inactivation of pro-inflammatory transcription factor, NF-kB. These newly identified properties of NTG advocate its use as an anti-inflammatory drug. However, long-term NTG treatment using conventional formulations (sublingual, transdermal, intravenous) causes NTG tolerance and endothelial dysfunction. To address these limitations associated with high NTG doses, we incorporated NTG within ~150 nm diameter nanoliposomes and demonstrate that the NTG nanotherapeutic (NTG-NL) exhibits ~85-fold greater anti-inflammatory effect when compared with free NTG. This remarkable immunosuppressive effect of NTG-NL correlates with significant inhibition of NF-kB activation. Importantly, unlike free NTG, NTG-NL did not enhance endothelial mitochondrial superoxide production, a reliable indicator of NTG-induced tolerance and endothelial dysfunction, even when used at a dose 20-fold greater than its therapeutic dose. These remarkable characteristics of NTG-NL can be leveraged for superior therapeutic management of inflammation-mediated pathologies where conventional therapies exhibit high risk/benefit profiles. Work is currently underway to modify the surface of NTG-NLs with site-targeting moieties such that they can selectively home to sites of vascular inflammation and deliver low drug doses to achieve targeted immune suppression with minimal side effects.

224 Corrosion Behavior of Titanium Alloys Containing Boron Additions in Simulated Physiological Environments, TRAVIS VOORHEES*, OBED VILLALPANDO, MORGAN WONG, MATTHEW BORGIALLI, HANNAH LEU, and VILUPANUR RAVI (California State Polytechnic University Pomona, 3801 West Temple Ave., Pomona, CA 91768; tjvoorhees@csupomona.edu).

Titanium and its alloys are known for their specific strength and excellent corrosion resistance. Due to these properties, titanium has become one of the leading materials for biomedical implants, specifically Ti-6Al-4V (wt %). Ti-6Al-4V (Ti-64) is a α+β alloy and is thus expected to exhibit traits from both the alpha (α) and beta (β) phases. Commercially pure titanium (CPTi), is an α alloy that exhibits excellent corrosion resistance. Ti-5Al-5V-5Mo-3Cr (Ti-5553) is a β alloy that has promising mechanical properties. Recently, a new class of titanium alloys containing boron as an alloying element has been investigated for improvements in specific strength with minimal increases in specific stiffness. It has been shown that the addition of boron in the 0-1.2 wt.% range decreases the grain size of the alloy and increases its mechanical properties. Our research has been focused on evaluating the corrosion behavior of these alloys through multiple electrochemical testing procedures including direct current polarization tests. The data from these tests show that the addition of ultra-low concentrations of boron to these alloys caused changes in the corrosion potentials, corrosion current density, protection potential, passivation potentials, and resistance polarization. These data show that our alloys are strong candidates for implants and have advantages over the base alloys. This presentation will review the results of the electrochemical corrosion tests on advanced titanium alloys containing varying additions of boron in multiple physiologically-relevant solutions and discuss them with relevance to their chemical composition.

JOINT ORAL SESSION 4

CELL and MOLECULAR BIOLOGY
Wednesday at 1:25 p.m. in HUB 355

225 The Role of AlgX Carbohydrate-binding Module during Alginate Biosynthesis in Pseudomonas aeruginosa, DANH C. DO1*, BRANDON GALLAHER2, ZIED GAIEB3, DAMITRIS MORIZIK4, and NEAL L. SCHILLER1 (1Division of Biomedical Sciences, 2Department of Biochemistry, 3Department of Bioengineering, University of
Cystic fibrosis is a chronic, progressive, and often fatal genetic inherited disease caused by mutations in the gene that encodes the cystic fibrosis transmembrane conductance regulator (CFTR). Alginate or mucoid encapsulated *Pseudomonas aeruginosa* is the causative agent of respiratory insufficiency and failure in patients with cystic fibrosis. We have previously reported that AlgX is a protein required for alginate biosynthesis. Recently, AlgX has been reported to play a role in the modification of alginate through acetylation. In this study, we show that the absence of AlgX resulted in the loss of mucoidy due to the degradation of nascent alginate by the alginate lyase, AlgL. Using computational molecular docking studies and alginate affinity assay, we show that AlgX binds alginate via the carbohydrate-binding module located in the C-terminal region. Alanine mutations of the predicted amino acid residues that interact with alginate suggest that K338, R370, T372, and R380 are important for alginate binding. Alginate rescue assay by *in trans* expression of mutant AlgX in a chromosomal algX deleted *P. aeruginosa* mutant confirms the importance of these amino acid residues during alginate biosynthesis. In summary, these studies suggest that AlgX protects the alginate polymers from AlgL degradation, binds alginate via the carbohydrate-binding module, and is conceivably located in the biosynthetic scaffold serving as an appendage to the alginate acetylation machinery. In conclusion, AlgX binds alginate via the carbohydrate-binding module and is required for alginate biosynthesis and modification.

**226 Disposable Electronic Cigarettes and Electronic Hookahs: Evaluation of Performance**, SANJAY GHAI*, MONIQUE WILLIAMS, and PRUE TALBOT (Department of Cell Biology and Neuroscience, 2320 Spieth Hall, University of California, Riverside, Riverside, CA 92521; talbot@ucr.edu).

Introduction: The purpose of this study was to characterize the performance of disposable button-activated and disposable airflow-activated electronic cigarettes (EC) and electronic hookahs (EH).

Methods: The airflow rate required to produce aerosol, pressure drop, and aerosol density were measured during smoke-outs of nine disposable products. Three units of each product were tested in the smoke-out experiments. Results: Button-activated models generally required lower airflow rates to produce aerosol and also produced lower density aerosol than the airflow-activated models. Pressure drop was low across button-activated models in contrast to airflow-activated products which had variable and higher pressure drops. With the exception of two units out of 27 tested, airflow did not have to be increased during smoke-out to maintain aerosol production, unlike cartridge and cartomizer models examined in prior studies. Three products from two brands had uniform performance characteristics with respect to all parameters examined. However, three of the brands had at least one product that did not function like the other two suggesting a defect in operation/manufacture. Button-activated models lasted about 150 puffs or less, while EH airflow-activated models often lasted over 400 puffs, but none of the models lasted as long as their advertisements claimed.

Conclusion: The performance of button-activated and airflow-activated disposables was quite different with respect to the parameters examined. However, within the button-activated or airflow activated groups, performance was similar. Data suggest some brands have better quality control in manufacturing than others.

**227 Role of LOX-dependent Matrix Stiffening in Diabetic Retinal Endothelial Inflammation**, XIAO YANG*, HARRY SCOTT, SOROUSH ARDEKANI, and KAUSTAB GHOSH (Department of Bioengineering, University of California, Riverside, 900 University Boulevard, Riverside, CA 92521; yang003@ucr.edu, scott003@ucr.edu, sarde001@ucr.edu, kghosh@engr.ucr.edu).

Diabetic retinopathy (DR) is a degenerative eye disease that leads to progressive loss of vision. Current DR treatments, which focus only on the late stage that is characterized by abnormal retinal vessel multiplication, typically produce mild-to-moderate improvement in vision, are very expensive, and require frequent clinic visits. Thus, approaches that can prevent or significantly delay DR progression will likely be very beneficial. One of the earliest events in DR is retinal endothelial inflammation, which leads to leukostasis and blockage of retinal vessels. This, in turn, causes retinal tissue ischemia followed by overcompensatory vessel multiplication. DR is also marked by abnormal remodeling of retinal sub-endothelial matrix. However, whether there exists a causal relationship between aberrant sub-endothelial matrix and early-stage retinal endothelial inflammation remains unknown.

Our *in vitro* findings reveal that high glucose (HG) causes endothelial inflammation by impairing endothelial nitric oxide (NO) levels and activating NF-kB, a key inflammatory transcriptional factor. HG treatment also caused marked thickening of EC-secreted matrix. Immunoblotting and atomic force microscopy studies showed that this HG-induced endothelial matrix thickening correlates strongly with increased activity of lysyl oxidase (LOX), a collagen-crosslinking enzyme, and matrix stiffening. Importantly, pharmacological inhibition of LOX activity caused significant reduction in matrix thickness and stiffness, which led to marked suppression of endothelial inflammation. Finally, our studies using synthetic matrices confirmed that matrix stiffening alone is sufficient to cause retinal endothelial inflammation. Thus, these findings implicate LOX as a potential target for anti-inflammatory therapies that aim to suppress retinal endothelial inflammation and prevent DR progression.
228 Bisphosphonates and Connexin 43: A Systematic Review of Evidence, POOYAN SADR-ESHKEVARI*, SAJJAD ASHNAGAR, ASHKAN RASHAD, and NORA PROCHNOW (Department of Neuroanatomy and Molecular Brain Research, Ruhr University Bochum, 150 44801 Bochum, Germany; nora.prochnow@rub.de).

Background: Bisphosphonates (BPs) are described to inhibit the resorptive function of osteoclasts and to prevent apoptosis of osteoblasts and osteocytes. Connexin 43 (Cx43), a means of signal transduction, is a crucial molecule for basal regulation of bone homeostasis, development and differentiation. There is inconsistency of the outcomes especially within the more recent articles regarding the interaction of BP and Cx43. Methods: we searched CINAHL, Cochrane Library, Web of Science, and PubMed and supplemented the search with manual search through the references of the fond articles. A total of 11 articles met our inclusion criteria. Results: Secondary effects take place in non-resorbing bone cells and can be summarized to Cx43 derived and independent actions. BP uptake and a basal proliferative action appears to be independent from Cx43 in all non-resorptive bone cells, but BP uptake seems to affect opening states of hemichannels via manipulation of Cx-phosphorylation which leads to anabolic and anti-apoptotic signaling. BPs bind and cause changes in the bone matrix, which could also modulate Cx43 expression, hemichannel function and GJIC. Conclusion: It is uncertain whether BPs are able to modulate hemichannel function only, as hemichannels assemble and dissemble transiently to GJs and also changes in Cx43 expression affects both.

229 Metabolic Network Construction Based on the Genome of the Marine Diatom Thalassiosira pseudonana and the Analysis of Genome-wide Transcriptome Data to Investigate Triacylglyceride Accumulation, KAREN PARKER (Moss Landing Marine Labs, San Jose State University, 1079 Leonello Ave., Los Altos, CA 94024; karen.parker2000@gmail.com).

Algal lipids called triacylglycerols (TAGs) are essential compounds in marine ecology and are also used as the basis for commercial production of algal biofuels and omega-3 nutraceuticals. The goal of this research was to elucidate the biochemical processes associated with algal lipid accumulation in diatoms under different environmental conditions. The approach made use of the Mock et al. whole genome tiling microarray gene expression database for Thalassiosira pseudonana and gene annotations derived from the whole genome sequencing work of Armbrust et al. The analytical approach used bioinformatic tools, including Stanford Research Institute’s (SRI) BioCyc Pathway tool and the Joint Genome Institute’s (JGI) Integrated Microbial Genomes/Expert Review (IMG/ER) tool. This analysis has resulted in building the first whole genome BioCyc pathway model for T. pseudonana that includes over three hundred metabolic pathways. The analysis of the Mock transcriptome data in combination with the pathway model illustrated not only the activity of fatty acid and lipid pathways but also the interplay of other pathways that affect the accumulation of TAGs under different environmental conditions.

230 A Video Bioinformatics Approach to Evaluate Cofilin Dynamics, ATENA ZAHEDI*, VINCENT ON, IRYNA ETHELL (Department of Bioengineering; Department of Electrical Engineering; Department of Biomedical Sciences, University of California, Riverside, 900 University Ave., Riverside, CA 92521; azahe001@ucr.edu).

Alzheimer’s disease (AD) is characterized by the abnormal accumulation of β-amyloid (Aβ) peptides, which lead to formation of plaques in the brain that cause irreversible dementia. However, early stages of learning and memory deficits are associated with a pronounced loss of synapses. Actin-severing protein cofilin regulates the remodeling of synapses/dendritic spines in hippocampal neurons, and elevated levels are shown to contribute to synaptic loss. However, the underlying mechanisms that mediate this are still unclear. Previous studies reported the regulation of cofilin activity by phosphorylation, but not much is known about its dynamics in dendritic spines. Here, an optogenetic, multi-channel, video imaging system was developed to track the localization of cofilin, regulate its activity, and modulate synaptic connectivity in cultured hippocampal neurons. A complex signaling network regulates the actin cytoskeleton, making it difficult to effectively target a specific pathway and distinguish its effects. Therefore, a photo-inducible approach allows for immediate probing and acquisition of live changes in cofilin dynamics and subsequent spine remodeling. A photoactivatable Rac1 (PA-Rac1) probe was used to modulate cofilin activity via a Rac1-Pak1-LIMK1-mediated pathway. Live imaging experiments revealed that PA-Rac activation triggers the cyclic export of cofilin in a subset of spines. A video bioinformatics method was developed to track the changes in cofilin localization, in order to differentiate the dynamics of different cofilin mutants based on spatiotemporal changes. By probing and studying the cofilin system, we can gain insights about mechanism underlying the regulation of cofilin activity and translocation, which lead to remodeling of dendritic spines.
MOLECULAR REPRODUCTION and DEVELOPMENT
Wednesday at 3:50 p.m. in HUB 355

231 Expression of the ATP-Binding Cassette Transporter Sp-ABCC5a in Pigment Cells is Required for Sea Urchin Gastrulation, LAUREN E. SHIPP*, ROSE Z. HILL, GARY W. MOY1, TUFAN GOKIRMAK1, and AMRO HAMDOUN ( Scripps Institution of Oceanography, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA 92093-0208; Ishipp@ucsd.edu).

ATP-binding cassette (ABC) transporters have roles in morphogenesis and protection from xenobiotics. In embryos of the sea urchin (Strongylocentrotus purpuratus), one such transporter is Sp-ABCC5a, whose mesodermal expression is required for orientation and development of the endodermal hindgut. Transcripts of ABCC5a are first detected at hatching (21 hpf), most abundant during the gastrula stage (42 hpf), and limited to a subset of aboral non-skeletogenic mesenchyme pigment cells. ABCC5a protein expression is first detected during early gastrulation (34 hpf) and peaks at the prism stage (50 hpf). ABCC5a expression is controlled by Delta-Notch signaling emanating from the skeletogenic mesenchyme, as treatment with DAPT at 3 hpf, but not 17 hpf, blocks its induction. Morpholino knockdown of ABCC5a (~210 kDa) does not appear to affect pigment cell differentiation or echinocochle production, but instead results in abnormal archenteron formation. ABCC5a-morphants develop elongated archenterons and fused mouths, but following gastrulation, their hindguts protrude from the blastopore to form a vegetal/posterior prolapse. This is observed in 90% of knockdown embryos by the late prism stage (~60 hpf). We hypothesize that efflux of signaling molecules, possibly cyclic nucleotides, from ABCC5a is required for complete invagination of the endoderm. In the absence of ABCC5a, hindgut-precursor cells remain on the vegetal pole throughout gastrulation. This would suggest that pigment cells help orient endodermal cells during gut formation. We are currently addressing this hypothesis by further characterizing the ABCC5a-knockdown phenotype with live-imaging and cell-type labeling, and by probing the potential substrates of ABCC5a with efflux and migration assays.

232 Modeling Spermiogenesis in the Water Strider Aquarius remigis, GEORGE OTT*, NICHOLAS SHIRKEY, LEAH HAIMO, RICHARD CARDULLO, and CATHERINE THALER (Department of Biology, University of California, Riverside, Riverside, CA 92521; gott001@ucr.edu).

Post-meiotic sperm development in the water strider species Aquarius remigis occurs in two bilobed testes. Stained sections of resin-embedded A. remigis testis samples of varying ages showed sperm cells at numerous stages of spermiogenesis. The germ cell niche is located opposite the efferent duct, adjacent to the cortex of each testis lobe at the medial region. Developing spermatozoa form bundles of 128 post-meiotic cells that migrate toward the distal ends of the lobe as the flagellum elongates. Subsequently, the bundled flagella fold in on themselves before the cells travel back to the medial region and into the efferent duct.

Taking advantage of the unusual property of an intrinsically fluorescent acrosome, we used fluorescence microscopy to obtain images of developing sperm from larval, young, and mature A. remigis testis samples. By staining nuclei and the F-actin filament that travels the length of the flagellum, and using the acrosome’s intrinsic fluorescence, we acquired a series of images that reveal several key events during spermiogenesis. First, the nucleus condenses and pro-acrosomal vesicles then nucleate to form the acroblast. Subsequently, the flagellum extends, and, finally, the acrosome elongates and the acrosomal matrix protein polymerizes to form a helical filament.

Several events, such as axoneme formation and individualization were not observed in the current study and further investigations will be required to form a more complete understanding of how the events of spermiogenesis in Aquarius remigis relate to each other on a temporal basis.

233 The Phosphatidylinositol-3-kinase/AKT Pathway Controls Mouse Oocyte Development Competence, SHILA MANANDHAR*, FEDERICA FRANCIOSI, and MARCO CONTI (Center for Reproductive Sciences, University of California, San Francisco, 513 Parnassus Ave., HSW1656, Box 0556, San Francisco, CA 94143-0556; contim@obgyn.ucsf.edu).

Molecular changes both within oocytes and with surrounding somatic cells contribute to oocyte maturation. Upon an ovulatory stimulus, follicular cells express EGF-like peptides that trigger the translation of specific mRNA transcripts during oocyte maturation, seemingly by indirect activation of the phosphatidylinositol-3-kinase cascade. We set out to explore the role of PI3K/AKT during oocyte maturation by using a genetic model where phosphatase and tensin homologue (Pten), which negatively regulates PI3K, is specifically ablated in oocytes. Western blots assessing AKT phosphorylation in Ptenfl/fl;ZP3-CRE oocytes revealed high levels of phosphorylation in GV stage oocytes and after 2.5h of culture with or without amphiregulin. Conversely, wild type oocytes showed transient phosphorylation of Akt only after 2.5h culture with amphiregulin. Translational activity measured by luciferase assay after intraoocyte injection of dual luciferase translation reporters showed translation that was no longer dependent on amphiregulin in Ptenfl/fl;ZP3-CRE oocytes. To assess developmental competence, we performed in vitro maturation and fertilization and found higher rates of fertilization when the PI3K/AKT/mTOR pathway was constitutively activated in the Ptenfl/fl;ZP3-CRE oocytes. These developmental rates were similar to
those obtained by incubating cumulus/oocyte complexes with amphiregulin. Given the anabolic role of the PI3K/AKT pathway and its possible effect on activation of key components controlling the meiotic cell cycle, we examined oocyte diameters and kinetics of meiotic resumption. No differences were found between Ptenfl/fl:ZP3-CRE and control oocytes, suggesting no effects on maturation rate. Collectively, our data show that the activation of the PI3K/AKT pathway promotes oocyte developmental competence by regulating the oocyte translational program.

**JOINT ORAL SESSION 5**

**EARTH SCIENCES**

**Wednesday at 1:25 p.m. in HUB 367**

234 Oligocene Volcanism and Intrusions along Soda Mountain Ridge, Western Cascades Volcanic Series, Southwest Oregon, JAD A. D’ALLURA*, KACY CARLSON, and ROBERT BUCKMISTER, II (1Department of Chemistry, Physics, Materials, and Engineering, Southern Oregon University, 1250 Siskiyou Boulevard, Ashland, OR 97520; 2B.S., Geology, University of Oregon, 1Geological Sciences, University of Oregon, 1585 E. 13th Ave., Eugene, Oregon 97403; rockit526@gmail.com).

In southwest Oregon the usual NW-SE outcrop pattern of Oligocene Western Cascade volcanic rocks takes a north-south divergence, the result of mid-Oligocene faulting and differential erosion, persistent ledges of 25.2 Ma andesite flows down-section to the east, magmatic intrusions into weak volcaniclastic rocks, and the presence of large blocks within hot volcanic debris flows that inhibit erosion. Exposed from west to east is an andesite flow unit overlain by thick 24.6 Ma volcaniclastic breccia and minor tuff. The rocks, including tuff, are anhydrous magnetite-bearing two pyroxene (hypersthene and augite) andesites. Commonly two generations of plagioclase phenocrysts, inclusion-free and inclusion-bearing, dominate with groundmass crystallization of more sodic plagioclase. Olivine pseudomorphs occur in the most mafic rocks. Geochemical and petrologic relations are consistent with young continental calc-alkaline trends dominated by fractional crystallization although assimilation of older rock is evident. All rocks have undergone low grade zeolite facies alteration producing celadonite, bowlingite, iron oxides and hydroxides, and zeolites. Geochemically all units are calc-alkaline, typical of young continental volcanism, although the lava unit is characterized by higher HREEs than normal. Intrusions, one of which has a plagioclase age of 24.71 Ma age, form resistant hills on the northern part of the ridge. The youngest intrusions possess a higher Ni + Cr content suggesting derivation for a more primitive source than most rocks in the area. Although the area has been affected by early NE and later NW-trending faults, landslides within weak volcaniclastic rocks beneath hard cap rocks are the primary geologic hazard.

235 Transitioning Towards the Modern Animal Biota: Small Shelly Fossils from the Cambrian of the Himalaya, IAN R. GILBERT* and NIGEL C. HUGHES (Earth Sciences Department, University of California, Riverside, CA 92521; igilb001@ucr.edu, nigel.hughes@ucr.edu).

In terms of its impact on the geological record the Cambrian evolutionary radiation marks one of the most striking events in the history of life on Earth: before it evidence of life is generally cryptic, after it fossils are obvious and plentiful when preserved. At a first order, this transition marks the appearance in the geological record of mineralized skeletons with high preservation potential, however, it is clear that the Cambrian radiation involved more than simply the advent of biosynthetic pathways that made skeletons. Intriguingly, some of the first mineralized animal fossils consisted of separate plates, spines, or scales, rather than fully integrated skeletons, and in some groups, shells may have evolved via the consolidation of these separate plates. We have been studying Cambrian microfossils from Himalayan rocks that fall under the general description of “small shelly fossils”. Identifying the biotic affinities of such fossils can be problematical, and our study shows that prior misidentification of these fossils has lead to incorrect age estimates for the rocks containing them. Our recent analysis reveals new features that allow us to correct the taxonomic affinities of these fossils, and these identifications bring the suggested age of the rocks containing them into register with those ages suggested independently by other kinds of fossils and dating methods. These fossils show a diverse assemblage of Cambrian organisms living in the seas that would later constitute the Himalayan margin, and that these fossils were coeval with others found elsewhere on Earth.

**CHEMISTRY and BIOCHEMISTRY**

**Wednesday at 2:10 p.m. in HUB 367**

236 Medicinal Garlic, Raw or Cooked? KENNETH CHONG1, MARTHA P. ZAMORA2, DILESHTI TILAKAWARDANE2, NANCY E. BUCKLEY2, JAMES A. REGO1, and YAN LIU* (1Chemistry and Biochemistry Department, 2Biological Sciences Department, California State Polytechnic University Pomona, 3801 W. Temple Ave., Pomona, CA 91768; yanl@csupomona.edu).

Garlic or garlic products have long been used in human history to treat wounds, fight cardiovascular diseases, prevent cancers, and improve immune system, besides add flavors to food. Medicinal applications of garlic in the past made scientists wonder which component(s) in garlic contribute to its health benefits. More and more investigations
have revealed that the pharmacologic effects of garlic come from allicin (diallyl thiosulfinate). Interestingly, allicin is present in fresh garlic extract but not in garlic cloves. When garlic cloves are crushed or chewed, the pressure ruptures the cell membranes. S-allyl-L-cysteine sulfoxide inside the cells quickly degrades into allicin via the catalytic action from allinase. It’s been proved that allicin is active against many bacteria and viruses. Preserving the antioxidant activity of allicin in garlic extract/products is highly anticipated. A simple and rapid reversed-phase HPLC-UV method is thus developed to quantify the amount of allicin in garlic extract and to address the thermal and chemical stability of allicin.

Garlic cloves were first crushed, and extracted by using water. The processed aqueous extracts were then analyzed by a HPLC system with a C18 column for the separation and detection of allicin and other compounds. The results indicate that the concentration of allicin in different garlic extract samples varied from 0.356 to 0.445 M. In addition, it was observed that the degradation of allicin occurred under different conditions and the degradation of allicin in aqueous extract is a first-order reaction.

237 **Chemicapacitor Detectors in Gas Chromatography**, W. K. TOLLEY* and SANJAY V. PATEL (Seacoast Science, Inc., 2151 Las Palmas Dr. Suite C, Carlsbad, CA 92011; btolley@seacoastscience.com).

Capacitance-based electronic transducers are used routinely in a number of applications. However, digital hygrometers are the only conventional product to utilize capacitance measurements for chemical detection. In physio-chemical aspects, chemicapacitors behave as other sorbent-based detectors discussed in detail in the literature. The amount of any analyte absorbed from a vapor depends on the polymer’s ability to form chemical bonds with the target analyte. However, when used as a detector in GC’s, the sorption of analyte should be reversible to allow the sensor output to return to baseline readings between peaks. Thus, analyte sorption must be based on weak interactions such as hydrogen bonds, van der Waals bonds, and dipole-dipole interactions.

Two promising carbosilanes show promise as sorbent polymers for chemicapacitors. Both show high affinity to a broad range of analytes. However, when comparing the performance of the two polymers in chromatographs, it quickly became obvious that one polymer provided superior performance. This paper discusses factors affecting chemicapacitors performance as chromatography detectors.

238 **Augmenting NMR Crystallography Through Fragment Methods**, JOSHUAL D. HARTMAN (Department of Chemistry, University of California, Riverside, Riverside, California; jhart005@ucr.edu).

New developments in fragment-based electronic structure methods have brought improved accuracy to crystal structure prediction. Through significant reductions in computational demand, fragment-based chemical shielding calculations make MP2 level results tractable for chemically interesting organic crystals thereby creating new opportunities for combining chemical shielding calculations with NMR measurements to determine crystal structure. In the present work, we explore fragment approaches for NMR shielding in crystals and explore the effects of coupling fragment methods with an electrostatic embedding model based on atom-centered distributed multipole moments. Through coupling raw shielding tensor calculations with standard linear regression techniques we examine the ability of fragment methods with charge embedding to reproduce known experimental chemical shifts in molecular crystals and to discriminate between different molecular crystal polymorphs.

239 **NMR Crystallography in the Enzyme Active Site of Tryptophan Synthase**, BETHANY G. CAULKINS*, BABACK BASTIN1, CHEN YANG1, THOMAS J. NEUBAUER1, ROBERT P. YOUNG1, EDUARDO HILARIO1, LI FAN2, MICHAEL F. DUNN2, MICHAEL J. MARSELLA1, and LEONARD J. MUELLER1 (Departments of 1Chemistry and 2Biochemistry, University of California, Riverside, 900 University Ave., Riverside, California 92521; bcaul001@ucr.edu).

Chemical level details such as protonation and hybridization state are critical for understanding enzyme mechanism and function. Even at high resolution, these details are difficult to determine by X-ray crystallography alone. The chemical shift in nuclear magnetic resonance, however, is an extremely sensitive probe of chemical environment, making solid-state NMR and X-ray crystallography a powerful combination for defining chemically-detailed three-dimensional structures. Here we adopt this combined approach to determine the chemically-rich crystal structure of several intermediates in the pyridoxal-5-phosphate (PLP)-dependent enzyme tryptophan synthase under conditions of active catalysis. Models of the active site are developed using a synergistic approach in which the structures of different catalytic intermediates are optimized using an ab initio computational chemistry in the presence of side chain residues fixed at their crystallographically determined coordinates. Various models of charge and protonation state for the substrate and nearby catalytic residues can be uniquely distinguished by their calculated effect on the isotropic chemical shifts and chemical shift tensors, measured at specifically $^{13}$C- and $^{15}$N-labeled positions on the substrate. Several novel structural and mechanistic hypotheses emerge. For the indoline quinonoid, the predominating structure is found to be the acid form of the substrate, with the protonated acid moiety forming a hydrogen bond back to the Schiff base nitrogen. This structural isomer builds up negative charge at Cα, adding an electric field component along the reaction coordinate and lowering the energy barrier through charge stabilization.
For the internal aldimine, a long-standing hypothesis on the nature of the Schiff-base linkage can be confirmed.

240 Determining Bacterial vs. Viral Infections via Chemiresistive CNT Devices, NUVIA MARIA SAUCEDO1*, YINGNING GAO2, and ASHOK MULCHANDAN1F (1Department of Chemistry and 2Department of Chemical and Environmental Engineering, University of California, Riverside, CA 92521; nsauc001@ucr.edu, adani@ucr.edu).

Bacterial and viral infections are among the top 10 most common reasons for hospital visits [1] yet are often misdiagnosed [2]. There is a need for analytical tools which can distinguish between bacterial and viral infections for their misdiagnosis has high costs on human health. Recently, the CDC has named antibiotic resistance as an immediate threat to human health and has among other actions prescribed improvement of antibiotic use [3]. We report here a carbon nanotube field-effect transistor for the quick, cost-effective and accurate detection of whole bacterial cells.

Carbon nanotubes were immobilized through a drop-cast method, onto gold-patterned Si/SiO2 substrates and functionalized with different lectins, sugar binding proteins, targeting carbohydrates present in the outer membrane of the bacterial cells for capture. This allows for diagnosis of infection on a broader scale. A change in device resistance indicates successful cell capture. Devices incubated with virus do not show a change in resistance. Development of such biosensors which can distinguish between bacterial and viral infections are beneficial to decreasing the number of misdiagnosed infections and antibiotic misuse by providing an empirical test to determine infection type and screen antibiotics for efficacy.


241 Breaking through the Other Side: De novo Designed Peptides that Cross the Cell Membrane for Biomolecule Delivery, I. ABBREY MONEREAL and JONEL P. SALUDES* (Department of Chemistry, Washington State University, Pullman, WA 99164; jonel.saludes@wsu.edu).

Unnatural peptides have attracted great interest for biomedical applications because of their favorable bioavailability profiles and versatility for functionality fine-tuning. Studies in our laboratory are focused on the sugar delta-amino acid N-acetylneuraminic acid (Neu5Ac, sialic acid) as cyclic, pyran-based surrogates of dipeptides. Previously, we disclosed that neutral as well as anionic, chimeric Neu5Ac-derived peptides possess remarkable plasma stability and stable secondary structures. Towards our goal of developing pyran-based cell permeable peptides (CPPs), we discovered that de novo designed Neu5Ac-derived peptides are efficient cargo carriers into the cell where 90% of biologics drugs targets reside. These peptides were designed to be analogous to the charge of well characterized CPPs HIV-Tat and oligoarginine. The peptides were prepared by microwave-assisted solid phase synthesis, characterized by NMR spectroscopy and MALDI-TOF-MS, and investigated for secondary structure folding using circular dichroism. The peptides were labeled with a fluorophore, incubated with HeLa cells, and their membrane permeability monitored using fluorescence activated cell sorting. We found this new class of chimeric, unnatural polycationic peptides to be helical in physiological condition and cross the cell membrane with five to ten times cell uptake efficiency versus HIV-Tat and oligoarginine with no apparent associated cytotoxicity. We envision these peptides as the next generation of proteolysis-resistant intracellular delivery agents for diagnostics and chemotherapeutics.

242 Heat-Induced Coarsening of Gold Nanoparticle-Graphene Oxide Hybrids, HANQING PAN1*, YOHANNE ABATE2, and YOUNG-SEOK SHON1 (1Department of Chemistry and Biochemistry and 2Department of Physics and Astronomy, California State University, Long Beach, Long Beach, CA 90840; ys.shon@csulb.edu).

Glutathione-capped gold nanoparticles of size 1, 3, and 10 nm were synthesized and bonded to graphene oxide to study their coarsening behavior upon heating. Graphene is a planar, single-layer sheet of sp2-hybridized carbon atoms exhibiting extremely high surface area (2600 m2/g). The nanoparticle-graphene hybrid materials were heated up to 300 °C, and the surface nanoparticles would undergo coalescence to become larger particles. UV-Vis results show that gold nanoparticles have a plasmon band at 520 nm, which shifted to higher wavelength after heating. This is due to increased metal-metal interactions among the nanoparticles. Transmission electron microscopy (TEM) results suggested that nanoparticles start to coalesce into bigger particles upon heating at 150 °C and above. Without the presence of graphene oxide, the nanoparticles begin coarsening at 200 °C; but with the presence of graphene oxide, nanoparticles start to coalesce at 150 °C. Since graphene oxide is an excellent thermal conductor, we propose that graphene oxide could transfer heat to the nanoparticles, allowing them to coalesce at a lower temperature. Nanoparticle-graphene hybrid materials were also used to study the effect of covalent and non-covalent interactions between gold nanoparticles and graphene oxide during coarsening. Non-covalent interactions were studied by directly adding graphene oxide to COOH-functionalized gold nanoparticle solutions, and covalent interactions were achieved by the coupling of gold nanoparticles with L-cystine modified graphene oxide. These engineered nanoparticle-graphene hybrid materials were further studied by infrared spectroscopy and apertureless near-field scanning optical microscopy.
Optimizing the Extraction Efficiency of Biologically Active pH Sensitive Steroidal Alkaloids from *Veratrum californicum*. JARED MATTOS*, ROBERTO CRUZ, NICHOLAS BAUGHMAN, PETR MALEK, CHRIS CHANDLER, and OWEN McDOUGAL (Department of Chemistry and Biochemistry, Boise State University, 1910 University Drive, Boise, ID 83725; Jaredmattos@u.boisestate.edu).

*Veratrum californicum*, or “Corn Lily”, grows in the mountains of the northwest United States. The corn lily is a plant rich in steroidal alkaloids. Among the most bioactive of these alkaloids is cyclopamine, a Hedgehog (Hh) pathway inhibitor. This pathway has played a significant role in our understanding of the pathogenesis of many types of cancers, developmental biology, and stem cell differentiation. Traditionally cyclopamine was extracted from the root and rhizome of the plant with benzene. More recently, our lab has used ethanol under alkaline conditions to increase the recovery of cyclopamine. The current work describes alkaloid extraction efficiency as a function of pH and extraction time using Soxhlet reflux. The goal of this research is to determine the optimum extraction conditions to obtain cyclopamine from plants harvested in the Boise National Forest. Alkaloid-containing ethanolic extracts were analyzed by high pressure liquid chromatography coupled to a mass selective detector (HPLC-MS). More recently the degradation of cyclopamine has been identified to include gradation into a set of isomers. These isomers are less biologically active than cyclopamine. Here we describe ethanol extraction of cyclopamine, where the pH, extraction method, extraction time, and biological activity of the product have been taken into account.
246 Proximity-Induced Anomalous Hall Effect in Graphene, ZHIYONG WANG*, CHI TANG, ZHISHENG LIN, RAYMOND SACHS, YAFIS BARLAS, and JING SHI (Department of Physics and Astronomy, University of California, Riverside, 3401 Watkins Drive, Riverside, CA 92521; zwang009@ucr.edu, jing.shi@ucr.edu).

Conducting ferromagnets exhibit the well-known anomalous Hall effect (AHE) due the spin-orbit coupling (SOC). In the absence of both ferromagnetism and SOC, neither AHE nor spin Hall effect exists in pristine graphene. In this study, we introduce the exchange interaction via the proximity effect which is accomplished by transferring pre-fabricated graphene devices to atomically flat epitaxial magnetic insulator, yttrium iron garnet (YIG) films. Successful transfer is demonstrated by the unaffected carrier mobility and well-preserved graphene characteristic features in Raman spectra of transferred graphene devices. In addition to the ordinary Hall effect, there is a clear non-linear Hall component correlated with the magnetization of the underlying YIG, which is the signature of AHE. The magnitude of AHE in graphene/YIG devices decreases as temperature increases, and persists to room temperature in some devices, indicating a strong proximity-induced exchange interaction. By sweeping top gate voltages, graphene can be tuned between the electron- and hole-types. The ordinary Hall changes the sign as expected, but the sign of the AHE contribution remains the same. The clear manifestation of AHE in proximity coupled graphene does not only reveal the ferromagnetism but also a significantly enhanced SOC that is required by AHE.

247 Transport Properties and Devices of Molybdenum Disulfide, FENGLIN WANG*, PETR STEPANOV, MASON GRAY, and CHUN NING (JEANIE) LAU (Department of Physics, University of California, Riverside, 900 University Ave., Riverside, CA 92521; fwang005@ucr.edu).

Molybdenum Disulfide (MoS2) is a very promising material, especially the monolayer MoS2 with a direct bandgap; however, the low mobility is the major obstacle currently. We have combined multiple methods to improve the mobility, also investigate into the possible mechanism of the mobility bottleneck. With the help of additional gates, we are able to achieve ambipolar transport in MoS2 devices. We will present the latest experimental results.

248 2D Materials beyond 2D: Growth of MoS2, and Related Materials on Patterned Substrates, EDWIN PRECIADO*, DAVID BARROSO, ARIANA NGUYEN, SAHAR NAGHIBI, KELLY BROWN, VELVETH KLEE, SARAH BOBEK, JOHN MANN, and LUDWIG BARTELS (Department of Chemistry, University of California, Riverside, 900 University Ave., Riverside, CA 92521; bartels@ucr.edu).

Transition metal dichalcogenides (TMDs) present an exciting material system that provides tunable and direct-bandgap semiconducting properties at the single-layer limit. Single-layer films of MoS2, MoSe2, WS2, etc. can be grown in CVD-like processes on SiO2 and similar materials at process temperatures of ≤650°C. In this poster we explore how patterned substrates effect the growth of TMD films. For instance, we find that the presence of a regular array of micron-scale holes in an SiO2 layer on an Si substrate permits the localization of single-layer film growth. In contrast, lithographic patterning of structures on-top of the SiO2/Si surface affects the growth only minutely. This permits continuous and homogeneous covering of test structures paving the way towards the integration of 2D materials into photonics devices.

249 Effect of Misorientation on the Electronic Properties of van-der-Waals (vdW) Materials, MAHESH R. NEUPANE1*, DARSHANA WICKRAMARATNE1, SUPENG GE2, SHANSAN SU3, GEN YIN1, and ROGER K. LAKE4 (1 Department of Electrical Engineering, 2 Department of Physics and Astronomy, University of California, Riverside, 900 University Ave., Riverside, CA 92521; mneup001@ucr.edu).

Heterostructures of van-der-Waals (vdW) materials, such as graphene and graphene-like two-dimensional (2D) materials are formed either by mechanically stacking individual monolayers, or vdW epitaxy. Mechanical stacking of individual monolayers of vdW materials on to a substrate is known to lead to misorientation and structural imperfections. Prior experimental and theoretical studies on misoriented bilayer graphene revealed that a few degrees of misorientation was sufficient to decouple the individual layers leading to a linear dispersion around the Dirac point with a renormalized Fermi velocity with respect to a single layer graphene. Motivated by this a growing interest in vertically stacked vdW heterostructures, we explore the effect of misorientation on the electronic properties of graphene/hexagonal boron nitride (h-BN) and bilayer semiconducting transition metal dichalcogenides (TMDC).

We use ab-initio density functional theory to determine the electronic properties of G/h-BN and TMDC bilayers for a misorientation angles between 5 and 30°. In order to verify our supercell generation model, we also present our results on misoriented bilayer graphene and validate against other published data. The impact of misorientation angle on the interlayer coupling, bandgaps, effective masses and velocities (only on G/h-BN) in these vdW heterostructures will be discussed with respect to perfectly registered bilayers.

This work is supported by FAME, one of six centers of STARnet, a SRC program sponsored by MARCO and DARPA, and a U.S. Dept. of Education GAANN Fellowship. This work used the resources at XSEDE (NSF Grant no: OCI-1053575) and Purdue University.

250 In Situ Observation of Electrostatic and Thermal Manipulation of Suspended Graphene Membranes, WENZHONG BAO1, KEVIN MYHR0*, ZENG ZHAO1, ZHEN CHEN2, WANYOUNG JANG2, LEI JING1,
FENG MIAO, HANG ZHANG, CHRIS DAMES, and CHUN NING LAU (1Department of Physics and Astronomy and 2Department of Mechanical Engineering, University of California, Riverside, 900 University Ave., Riverside, CA 92521; kmyhr001@ucr.edu).

Graphene is nature’s thinnest elastic membrane, and its morphology has important impacts on its electrical, mechanical and electromechanical properties. Here we report manipulation of the morphology of suspended graphene via electrostatic and thermal control. By measuring the out-of-plane deflection as a function of applied gate voltage and number of layers, we show that graphene adopts a parabolic profile at large gate voltages with inhomogeneous distribution of charge density and strain. Unclamped graphene sheets slide into the trench under tension; for doubly clamped devices, the results are well-accounted for by membrane deflection with effective Young’s modulus $E = 1.1$ TPa. Upon cooling to $100$ K, we observe buckling-induced ripples in the central portion and large upward buckling of the free edges, which arises from graphene’s large negative thermal expansion coefficient.

251 Computational Exploration of Aspects of Contact Formation and Bending in 2D Layers of Transition Metal Dichalcogenides, MARK MICKLICH*, JESSICA MCKINLEY, VELVETH KLEE, CHEN WANG, and LUDWIG BARTELS (Department of Chemistry and Materials Science, and Engineering Program, University of California, Riverside, 900 University Ave., Riverside, CA 92521; bartels@ucr.edu).

2D transition metal dichalcogenides (TMDs) offer exciting opportunities due to their semiconducting properties at the single layer limit, direct bandgap and high stability in air. A multitude of devices and structures have been made and characterized both with regards to their electronic and to their mechanical properties. In this poster, we will present first steps towards exploring these properties from an atomistic, theory-based vantage point, using density functional theory (DFT) to simulate model structures. Because of the thickness of the materials involved, modeling of fairly large lateral systems and structures is possible. In my poster, I apply this modeling to the formation of metal-TMD contacts and explore from first principles the formation (or absence of) Schottky barriers. I will also present results on the bending of TMD films caused by inhomogeneous incorporation of chalcogens of different size in top and bottom layers.

252 Post-Growth Tuning of the Bandgap of Single-Layer Molybdenum Disulfide Films by Sulfur/Selenium Exchange, QUAN MA*, MIGUEL ISARRARAZ, CHEN WANG, EDWIN PRECIADO, VELVETH KLEE, SARAH BOBEK, KOICHI YAMAGUCHI, EMILY LI, PATRICK ODENTHAL, ARIANA NGUYEN, DAVID BARROSO, DEZHENG SUN, GRETEL VON SON PALACIO, MICHAEL GOMEZ, ANDREW NGUYEN, DUY LE, GREG PAWIN, JOHN MANN, and LUDWIG BARTELS (Department of Chemistry, University of California, Riverside, CA 92521; bartels@ucr.edu).

We demonstrate bandgap tuning of a single-layer MoS$_2$ film on SiO$_2$/Si via substitution of its sulfur atoms by selenium through a process of gentle sputtering, exposure to a selenium precursor, and annealing. We characterize the substitution process both for S/S and S/Se replacement. Photoluminescence and, in the latter case, x-ray photoelectron spectroscopy provide direct evidence. We discuss our experimental observations, including the limit of the achievable bandgap shift, in terms of the role of stress in the film as elucidated by computational studies, based on density functional theory. The resultant films are stable in vacuum, but deteriorate under optical excitation in air.

253 Spin Hall Effect in Graphene with Enhanced Spin-Orbit Coupling, Z. S. LIN*, Z. Y. WANG, B. W. YANG and J. SHI (Department of Physics and Astronomy, University of California, Riverside, CA 92521; zlin002@ucr.edu).

Graphene is the first theoretically predicted two-dimensional quantum spin Hall insulator or topological insulator. Owing to the extremely weak intrinsic spin-orbit coupling (SOC), such an exotic state can only be realized at ultra-low temperatures. Different approaches have been proposed to enhance the SOC strength in graphene. Recently, very large Rashba SOC strength ($\sim 2.5$ meV) manifested by the spin Hall effect (SHE) has been reported in hydrogenated graphene which introduces covalently bonded hydrogen atoms to the graphene lattice. In this work, we successfully demonstrate a much greatly enhanced SHE in hydrogenated graphene devices at room temperature. The enhancement of the non-local SHE signal can be tuned from a factor of three to three orders of magnitude by controlling the dose of the electron beam exposure of the silsesquioxane resist spin-coated on graphene. The magnitude of the SHE enhancement has been correlated with the defect density associated with the hydrogen-carbon bonds which is characterized by the height of the D-peak in the Raman spectra. We will discuss possible effects of the large Rashba SOC on spin transport in graphene devices.

254 Enhanced Photoluminescence and Photocurrent Spectra in MoS$_2$ under Ionic Liquid Gating, ZHEN LI*, SHUN-WEN CHANG, and STEPHEN B. CRONIN (1Department of Electrical Engineering, 2Department of Physics, University of Southern California, Los Angeles, CA 90089, USA; scronin@usc.edu).

We report substantial improvements and modulation in the photocurrent (PC) and photoluminescence (PL) spectra of monolayer MoS$_2$ taken under electrostatic and ionic liquid gating conditions. The photocurrent and photoluminescence spectra show good agreement with a dominant peak
at 1.85eV. The magnitude of the photoluminescence can be increased 300% by ionic liquid gating while the linewidth decreases by 37%, due to the passivation of surface states and trapped charges that act as recombination centers. The photocurrent also doubles when passivated by the ionic liquid. Interestingly, a significant shift of the PL peak position are observed under electrostatic (14meV) and ionic liquid (30meV) gating, as a result of passivation.

The ionic liquid provides significant screening without any externally applied voltage, indicating that these surface recombination centers have net charge. The acute sensitivity of monolayer MoS2 to ionic liquid gating and passivation arises because of its high surface-to-volume ratio, which makes it especially sensitive to trapped charge and surface states. These results reveal that, in order for efficient optoelectronic devices to be made from monolayer MoS2, some passivation strategy must be employed to mitigate the issues associated with surface recombination.

255 Giant Interaction-induced Gap and Electronic Phases in Rhombohedral Trilayer Graphene, YONGJIN LEE*, DAVID TRAN, KEVIN MYHRO, JAIRO VELASCO, JR., NATHANIEL GILLGREN, YAFIS BARLAS, and CHUN NING (JEANIE) LAU (Department of Physics, University of California, Riverside, 900 University Ave., Riverside, CA 92521; yle093@ucr.edu).

In rhombohedral-stacked trilayer graphene (r-TLG), the cubic dispersion and large density of states near the charge neutrality point give rise to large electronic interactions and a variety of possible symmetry-broken phases. Here, using transport measurements, we show that, contrary to predictions by tight-binding calculations, r-TLG is an intrinsic insulator, with a giant interaction-induced gap \( \Delta \sim 42\text{meV} \). This insulating state is a spontaneous layer antiferromagnetic with broken time reversalsymmetry, and can be suppressed by increasing charge density \( n \), an interlayer potential \( U \), a parallel magnetic field, or a critical temperature \( T_c \sim 38\text{K} \).

256 Magnetic Proximity Effect Induced Effects in Topological Insulator/YIG Heterostructures, ZILONG JIANG*, CHI TANG1, FERHAT KATMIS1, PENG WEF, JAGADEESH S. MOODERA2 and JING SHI2 (1Department of Physics and Astronomy, University of California, Riverside, 900 University Ave., Riverside, CA 92521; 2Francis bitter laboratory, Massachusetts Institute of Technology, 77 Massachusetts Ave., Cambridge, Massachusetts 02139; zjian001@ucr.edu).

The broken time-reversal symmetry in topological insulator (TI) can lead to a lot of interesting phenomena, such as crossover between weak antilocalization (WAL) and weak localization (WL) and quantized anomalous Hall effect (QAHE). Here we carry out an experimental study on induced ferromagnetism in heterostructures of a thin TI film (Bi2Se3) and an insulating magnetic film (YIG). The YIG film is grown by pulsed laser deposition with an atomically flat surface and in-plane magnetic anisotropy, and 20QL Bi2Se3 films are grown on YIG in a molecular beam epitaxy system. Excellent crystallinity of TI films is confirmed by RHEED and XRD analysis. The positive magnetoresistance is affected by the induced magnetic layer and the weak anti-localization effect is clearly weakened. We find a suppression of alpha value and reduced phase coherence length from HLN fitting plot in Bi2Se3/YIG devices. These distinct behaviors indicate a proximity effect between TI and YIG. This research was supported by UC Lab Fees Program.

257 Electronic Properties of Misoriented Bilayer Transition Metal Dichalcogenides, SUPENG GE1*, DARSHA WICKRAMARATNE1, MAHESH NEUPANE2, SHAN-SHAN SU2, and ROGER LAKE2 (1Department of Physics and 2Department of Electrical Engineering, University of California, Riverside, 900 University Ave., Riverside, CA 92521; sge002@ucr.edu).

Motivated by a growing interest in vertically stacked van-der-Waal heterostructures, we explore the effect of misorientation in bilayers of MoS2, MoSe2, WS2 and WSe2 on their electronic properties. Mechanical stacking of individual monolayers or chemical and epitaxial growth of this family of layered materials often leads to misoriented interfaces between individual monolayers. Isolated monolayers of MoS2, MoSe2, WS2 and WSe2 exhibit a direct band gap between 1 - 2 eV. The band gap transitions from direct to indirect when the film thickness increases from a monolayer to a bilayer. The question we address is “Does misorientation between semiconducting TMD bilayers electronically decouple them, as is observed in misoriented bilayers of graphene?” Using density-functional-theory we investigate the effect of different commensurate rotation angles, stacking order and displacements on the electronic structure of these materials. The effect of these atomic structural variations on the inter-layer coupling, band gaps and effective masses is presented and compared to the equivalent monolayer and bilayer properties for each material.

EDUCATION
Wednesday, 9:00 a.m. – 11:45 a.m. in HUB 302

258 It’s Critical: Student Attitudes Toward Critical Thinking and an Assessment of a Lecture to an Introductory Engineering Class, ESTHER K. CHO*, KARLY V. JERMAN, KAMERON J. LACALLI, SABRINA E. LUCERO, VICTORIA S. MARAGA*, DAVID P. PENNINGTON, AIMEE E. SLAVENSKY, RACHEL E. STEIN*, NEIL C. VRANICAR, and FRANK G. JACOBITZ (Shiley-Marcos School of Engineering, University of San Diego, 5998 Alcala Park, San Diego, CA 92110, esthercho@sandiego.edu).
Critical thinking is an essential skill for achievement as an engineering student, as well as a tool for success in the engineering profession. Although engineering students are taught the engineering design process early on, they must learn to make tough decisions that cannot be solved by the process in their work without the use of critical thinking. Critical thinking can be defined as a mental process to responsibly form an unbiased conclusion that includes skillful analysis, identification, and evaluation of evidence to guide decision-making. In our research we analyzed the definitions of critical thinking and bias, what tools could be used to help in the critical thinking process, and how concepts such as bias and critical thinking affect us in the real world. We then presented this information to several introductory engineering classes in the form of a lecture regarding critical thinking definitions, examples, and applications. The students were asked to assess their knowledge and understanding of critical thinking concepts before and after our presentation. The surveys asked the students to give their own definitions of critical thinking and bias, asked them how well they understood the topics, and then asked them questions regarding subjects presented in the lecture. It was observed that on average the students’ understanding of critical thinking along with their understanding of bias increased. Compared to the initial survey, the students’ definitions in the post survey had many of the key words used in the lecture.

259 Staying on Track: Revisiting the DNA Subway as a Tool to Engage Life Sciences Community College Students in Basic Research, ALEJANDRO CORTEZ1*, NH TRAN2, JAMES BURNETTE III1, and RICHARD A. CAR-DULLO2 (1Dynamic Genome Program, 2College of Natural and Agricultural Sciences, University of California, Riverside, Riverside, CA 92521; alejandro.cortez@ucr.edu).

In its second year of implementation, the Sequencing in situ DNA Barcoding College provides Community College students in the Life Sciences with an opportunity for hands on research laboratory training and exposure to a four-year institution. The project is funded by the US Department of Education and jointly coordinated by the CNAS HSI-STEM Pathways Program and the Dynamic Genome Program. Riverside City College students attended UC Riverside to barcode commercially available fish from local markets in order to molecularly validate the samples’ identities. Participants learned techniques common to a genomics research laboratory including DNA extraction, PCR amplification, gel electrophoresis at the Neil A. Campbell Science Learning Laboratory during a one-day workshop. Fish DNA from several species and bought at different locations in the Inland Empire was amplified by PCR using 16S primers and sequenced at UCR’s Genomic Core Facility. In the following weeks, participants working in small breakout groups used the DNA Subway to verify the identity of their fish samples with some guidance from faculty at UCR and at RCC. The exchange of data, analysis of results, and dissemination of information was facilitated in large part by using Google Docs and our Dynamic Genome WordPress site (dynamic-genome.org). The project culminated in poster presentations at a science symposium three weeks after the participants’ first visit.

MOLECULAR REPRODUCTION and DEVELOPMENT
Wednesday, 9:00 a.m. – 11:45 p.m. in HUB 302 N

260 Transcriptomics between Fertile and Infertile Colonies of the Urochordate B.schlosseri Reveal Key Genes Involved in Germline Formation and Maintenance, DELANY RODRIGUEZ*, KELSEA FARELL, ERIN SANDERS, ADAM LANGENBACHER, DARYL TAKETA, and ANTHONY W. DE TOMASO (Department of Molecular, Cellular, and Developmental Biology, University of California Santa Barbara, Santa Barbara, CA 93106, USA; drodriguez@lifesci.ucsb.edu).

Germline development is an essential function for all sexually reproducing species, and many aspects of these developmental processes are highly conserved among the metazoa. The colonial ascidian, Botryllus schlosseri is a chordate model organism which offers two unique life history traits that can be utilized to characterize the genes underlying germline development in a global manner: a colonial life history and variable fertility. These properties allow individual genotypes to be isolated at different stages of fertility and gene expression characterized in a global manner. Here we characterized the transcriptome of both fertile and infertile individuals throughout development using differential expression analysis. Spatial and temporal expression of differentially expressed genes was analyzed by in situ hybridization, confirming expressions in germline tissues and suggesting a high level of conservation between mechanisms regulating fertility between basal chordates and vertebrates. We identified a range of genes (from as low as 61, and as high as 716) differentially expressed and gene regulatory networks regulating fertility during each stage of blastogenesis in Botryllus. Several of these genes are expressed by follicle cells surrounding both testis and oocyte precursors that appear to drive gonad maturation.

261 The Role of Chromatin Modification in Germ Cell Specification and Development, JENESSA R. OLSON* and EKATERINA VORONINA (Division of Biological Sciences, University of Montana, 32 Campus Dr., Missoula, MT 59812; jenessaolson@umconnect.umt.edu).

Chromatin modifications are modifications of nuclear proteins called histones. Histones are important for the compaction of DNA. These chromatin modifications can result in activation or repression of transcription of the DNA, which
is essential for the cell to synthesize proteins and pass on genetic information. Some chromatin modifications have been linked to fertility and specification of reproductive cells called germ cells.

We are studying a chromatin modification that has not been previously identified in C. elegans germ cells. Our research has been focused on identifying the enzyme that regulates this modification. The hypothesis is that this modification will affect reproductive cells specification and fertility.

We use C. elegans, a eukaryotic nematode, as the model organism. We found a specific chromatin modification that is prominent in late embryo germ cells of C. elegans. We have been testing if worm strains mutant for specific histone methyltransferases, some with fertility defects, still present the chromatin modification in germ cells. Currently, we have found that six out of eight mutants have less enrichment of this modification in their germ cells and there has been a strong correlation with sterility.

Since C. elegans shares similar biological regulatory mechanisms with humans, results from this study can contribute to a better understanding of the mechanism in the development of germ cells in humans. The results can lead to new biomedical applications by being able to manipulate developmental regulatory mechanisms.

262 Using a Reactivated Sperm Model to Determine the Role of Calcium in the Regulation of Mosquito Sperm Motility, ELIZABETH S. KOO*, RICHARD A. CARDULLO, and CATHERINE D. THALER (Department of Biology, University of California, Riverside, Riverside, CA 92521; ekoo003@ucr.edu).

Sperm motility is essential for fertilization and, in most animal sperm, motility is generated by the 9+2 microtubule-based axoneme of the flagellum. In many insect sperm, including sperm from the mosquito Culex quinquefasciatus, there are additional microtubules surrounding the axoneme, resulting in a 9+9+2 structure, and the flagellum exhibits a superimposed waveform (a double wave). This current study examined the role of calcium and kinase activity in generating double vs. single waves in mosquito sperm using a detergent-treated, reactivated sperm model. Low concentrations of the non-ionic detergent, TX-100, were used to permeabilize the sperm plasma membrane and a reactivation buffer containing Ca²⁺, DTT, and Mg-ATP was used to activate motility. Under these conditions, flagellar motility was reactivated in approximately 40% of the sperm and these percentages were increased when the Mg-ATP concentration was increased from 3 mM to 6 mM. We are currently investigating the dependence of forward progression (velocity) in the presence of varying concentrations of Ca²⁺. We have previously showed that live mosquito sperm swim backwards in low concentrations of Ca²⁺ and switch to forward motility when Ca²⁺ is raised above a particular threshold. Additional studies will examine the role that kinases play in motility regulation in Culex quinquefasciatus sperm.

263 Prospective Isolation and Molecular Characterization of Germ Line Stem Cells from Botryllus schlosseri, SUSANNAH H. KASSMERS¹, DELANY RODRIGUEZ², ADAM LANGENBACHER², and ANTHONY DE TOMASO (¹Neuroscience Research Institute and ²Molecular, Cellular and Developmental Biology, University of California, Santa Barbara, CA USA; Susannah.kassmer@lifesci.ucsb.edu, Delany.Rodriguez@lifesci.ucsb.edu, Adam.Langenbacher@lifesci.ucsb.edu).

The colonial ascidian Botryllus schlosseri provides a unique model to study germ line stem cell biology, as it continuously regenerates entire bodies, including all somatic tissues and the germ line, during repetitive cycles of asexual reproduction. Germ line stem cells (GSC) can mobilize and transplant between individuals during naturally occurring parabiosis, giving rise to a competitive phenotype in which germ line stem cells from one genotype can out-compete those of another genotype. Isolation of GSC from winner animals and microinjection into looser animals provides a quantitative assay for competitive reconstitution of the germ line. In order to functionally characterize GSC and the processes involved in maintenance, differentiation and seeding of the niche, GSC from Botryllus were prospectively enriched by flow cytometry based on expression of aldehyde dehydrogenase (ALDH). Transcriptome analysis revealed expression of highly conserved genes involved in germ cell specification, such as vasa, piwi, pumilio nanos and tudor in Botryllus-GSC, as well as high levels of genes associated with stem cell self renewal and pluripotency, such as Bmi1, EZH2, myc and DNA-methyltransferase-1. Signaling pathways potentially involved in germ cell self-renewal and differentiation, such as Notch1/Delta, retinoic acid receptor, BMP and IGF-receptor were expressed in GSC and/or the niche, as confirmed by qPCR and in situ hybridization. Sphingosine-1-phosphate receptor and somatostatin receptor expressed on Botryllus GSC regulate chemotactic migration. In vivo, treatment with inhibitors of the retinoic acid, insulin-like-growth factor, sphingosine-phosphate and somatostatin pathways provides insight into the role of these pathways in GSC homing, self renewal and gonad formation in Botryllus.

264 Detection of a Trypsin-like Protease in the Accessory Glands of Culex quinquefasciatus and the Reproductive Tract of Aquarius remigis, ERANTHI U. JAYAWARDENA*, CATHERINE D. THALER, and RICHARD A. CARDULLO (Department of Biology, University of California, Riverside, Riverside, CA 92521; ejaya001@ucr.edu).

Sperm in the male reproductive tracts of many insect species (including water strider A. remigis and mosquito C. quinquefasciatus) are quiescent. Prior to fertilization, sperm require a transition from an immotile to a motile state. One proposed mechanism of insect sperm motility activation is via proteases such as trypsin. We have previously found that A. remigis and C. quinquefasciatus sperm motility can be fully
activated in vitro by trypsin. Therefore, we hypothesized that there might be endogenous trypsin-like compounds produced by the reproductive system that activate sperm motility in both of these animal models. In order to test this hypothesis, we used the trypsin substrate Nα-Benzoyl-L-arginine ethyl ester hydrochloride (BAEE) to determine whether any trypsin-like endogenous protease activity was in the ejaculatory ducts of *A. remigis*. Control assays using bovine pancreas trypsin demonstrated that we could detect trypsin activity at concentrations as low as 10 ng/mL. In subsequent assays using isolated, sonicated accessory glands from male *C. quinquefasciatus*, trypsin-like activity was detected in samples containing as few as eight accessory glands with a signal intensity equivalent to control assays containing approximately 2 μg/mL trypsin. Trypsin activity was weakly and variably detected in the ejaculatory ducts of the male reproductive tract of *A. remigis*. Further assays will be needed to discern whether the variability in detection reflects differences in the age or condition of the *A. remigis* males, or other factors.

**265 Localization and Trafficking of ATP-Binding Cassette Transporters in the Sea Urchin, *Strongylocentrotus purpuratus*.** Embryo, ROSE Z. HILL*, LAUREN E. SHIPP, and AMRO HAMDOUN (Marine Biology Research Division, Scripps Institution of Oceanography, 8750 Biological Grade Rd., La Jolla, CA 92097; rzhill@ucsd.edu).

ATP-binding cassette (ABC) transporters are conserved membrane-spanning proteins that efflux structurally diverse compounds, and thus their cellular functions are varied and incompletely known. Differences in primary structure account for some variability, but it is not fully understood how localization and trafficking, which dictate subcellular distribution, affect transporter function. The goals of this project were 1) to characterize the differences in ABC transporter localization within sea urchin embryos as relates to predicted function and 2) to assess the mechanisms governing trafficking of ubiquitous ABC transporters. Urchin embryos express at least twenty ABC transporters, including those with presumed developmental (ABCC5a) or protective (ABCB1a) functions. I first determined the tissue-specific localization of ABCC5a by immunohistochemical analysis, and found that it is expressed in aboral non-skeletogenic mesenchyme cells, supporting a developmental function. To address the second goal, I co-expressed fluorescently tagged ABC transporters and Rab11-GTPase, a marker of apical recycling endosomes, via microinjection of embryos with synthetic mRNAs. Using confocal microscopy, I visualized the trafficking of newly synthesized transporters to the plasma membrane after inhibiting anterograde ER-Golgi membrane traffic with brefeldin-A. Previous reports indicate Rab11 is required for localization of ABCB1a to apical membranes in fertilized embryos, but my preliminary results demonstrated that in blastulae, Rab11-positive vesicles do not co-localize with ABCB1a or related ABCB4. Continued testing will identify vesicle populations responsible for the transport of these proteins to the plasma membrane, and elucidate how localization and traffic patterns influence protein function on embryonic and cellular scales.

**266 Membrane Proteins Regulate Viral Immunity by Controlling Viral siRNA Production in Arabidopsis.** ZHONGXIN GUO*, BINHUI ZHAN, JINFENG LU, STEPHANIE COFFMAN, and SHOUWEI DING (Department of Plant Pathology and Microbiology, University of California, Riverside, CA 92521; zhongxin@ucr.edu).

siRNA-mediated antiviral immunity plays vital roles to protect plant from viral infection. To further elucidate the siRNA-mediated pathway, a sensitized genetic screening was used to identify novel components in the pathway. Some interesting mutants were identified. Several novel genes were found to limit the viral infection and viral RNA (vsiRNA) accumulation of *Cucumber Mosaic Virus* (*CMV*) by regulating viral siRNA production in *Arabidopsis*.

One is an ATPase. It was cloned from mutant #337 through whole genome sequencing. There is 11bp deletion to produce a stop codon in the gene. Two *Salk* lines were obtained for the gene. They showed the same disease symptom and significantly reduced vsiRNA as 337 mutant compared to Wild-type plant after *CMV-2a2b* virus infection. Transient expression of GFP-tagged proteins under 35S promoter in Tobacco indicated that the ATPase is membrane-bounded as predicted. A lipid Transfer protein was cloned from mutant #230. A T-DNA insertion disrupted the gene and eliminated its transcription. The mutant also showed disease symptom after *CMV-2a2b* virus infection and vsiRNAs were drastically reduced. The genomic gene with native promoter can rescue both disease symptom and vsiRNA phenotype of the mutant. Transient expression of GFP-tagged proteins under 35S promoter in Tobacco indicated that it is a membrane-bound protein too. The third one, an Acyltransferase, was identified from the mutant #107644 by whole genome sequencing. There is 11bp deletion in the intron of the Acyltransferase. Genotyping the backcrossed F2 population plants indicated that the T-DNA was linked to the disease symptom phenotype of the mutant. A second allelic mutant was obtained and it showed the same phenotype as 107644. The Acyltransferase was localized in membrane too. During the invasion of *CMV* virus, these membrane proteins may restrict viral infection through modulating the small RNA-mediated antiviral immunity in plants.

**267 ATP-binding Cassette Transporters Mediate Small Micromere Migration and Left/Right Coelomic Pouch Segregation in the Purple Sea Urchin, *Strongylocentrotus purpuratus*.** JOSEPH P. CAMPANALE*, JOSÉ A. ESPINOZA, TUFAN GÜKIRMAK, and AMRO HAMDOUN (Marine Biology Research Division, Scripps Institution of Oceanography, University of California San Diego, 9500 Gilman Drive, La Jolla, CA 92093-0208; jpcampan@ucsd.edu).
with structural edges or grain boundaries is unexplored in large-area two-dimensional materials such as functionalized graphene, which is a single-atomic-thick patchwork consisting of randomly oriented crystallites separated by line defects and edges. Here, we use a combination of micro-Raman spectroscopy and scanning tunneling microscopy to map the dopant concentration from the atomic to the micron scale in polycrystalline N-doped graphene. We experimentally demonstrate that, the substitutional N dopants in N-doped graphene polycrystals avoid grain boundaries and edges over micron length scales while distributing uniformly in the interior of each grain.

269 Studying the Microstructure Changes of CVD-Synthesized Graphene with Growth Pressure using Fluorescence Quenching Microscopy (FQM), PAIGE ROMERO*, HAMDEN HOSSEINI BAY, WEI WANG, CENGIZ S. OZKAN and MIHRIMAH OZKAN (Departments of Materials Science and Engineering, Mechanical Engineering and Electrical Engineering, University of California, Riverside, 900 University Ave., Riverside, CA 92521; promote001@ucr.edu).

Graphene has been elected as a new candidate for various applications in energy storage, electronic devices, and solar cells. This is due to the unique superior mechanical, electrical, and thermal properties graphene has. Chemical Vapor deposition (CVD) is the favored process in industry where large-scale production of graphene is required. While moving forward to industrial scale synthesis is the ultimate goal, developing a large scale, high output and high resolution characterization method is still challenging. In the past few years, a method based on fluorescence quenching of fluorescent dyes by graphene has been developed as a high-throughput non-invasive quality control method for metrology of CVD-graphene sheets. On the other hand, there are several parameters in a CVD system, which define the microstructure of graphene, chief among which is the growth pressure. Herein, we investigate the changes of graphene microstructure in different pressures implementing this method. The results indicate that growth domains of graphene are larger at lower pressures. However, more defects such as cracks, discontinuity and multi-layer regions can be observed as well. Furthermore, we compared results of fluorescence quenching microscopy with scanning electron microscopy and Raman spectroscopy to evaluate the efficiency and resolution of this novel characterization method as well as its pros and cons.

270 Internal Polarization of Bromine Adatoms on Si(111) Measured by Low Energy Alkali Ion Scattering, J. KEAGY*, S. TEMIZ, and J. A. YARMOFF (Department of Physics and Astronomy, University of California, Riverside, CA 92521, yarmoff@ucri.edu).

Previous work has shown that low energy alkali ion scattering can measure the internal polarization of halogen...
adatoms on solid surfaces by monitoring the neutralization of scattered ions as a function of emission angle. Such measurements are extended here for bromine adsorbed onto Si(111)-7x7. The surfaces were cleaned by standard methods, and Br was adsorbed from a solid-state electrochemical cell. X-ray photoelectron spectroscopy (XPS) was used to measure the surface purity and Br coverage. Time-of-flight spectra of scattered ions and neutrals were collected for incident 1.5 keV Li+ ions as a function of emission angle. The change of neutralization with angle is used to determine how the polarization of the Br adatoms changes with coverage.

271 Demonstrating Entanglement by Testing Bell’s Theorem in Majorana Wires, DAVID E. DRUMMOND1, KIRILL SHTENGEL1, ALEXEY A. KOVALEV2, CHAND-YU HOU1,3, and LEONID P. PRYADKO1 (1Department of Physics and Astronomy, University of California, Riverside, CA 92521; 2Department of Physics and Astronomy, and Nebraska Center for Materials and Nanoscience, University of Nebraska-Lincoln, Lincoln, NE 68588; 3Department of Physics, California Institute of Technology, Pasadena, CA 91125; ddrum001@ucr.edu).

We propose an experiment that would establish the entanglement of Majorana zero modes in semiconductor nanowires by testing the Bell and Clauser-Horne-Shimony-Holt inequalities. Our proposal is viable with realistic system parameters, simple “keyboard” gating, and projective measurement. Theoretical models and simulation results indicate entanglement can be demonstrated with moderately accurate gate operations. In addition to providing further evidence for the existence of the Majorana bound states, our proposal could be used as an experimental stepping stone to more complicated braiding experiments.

272 Fluctuation-Induced Forces between Inclusions Embedded in Membrane, TYLER CARO*, JEFFREY WAGNER, UMAR MOHIDEEN, and ROYA ZANDI (Department of Physics and Astronomy, University of California, Riverside, 900 University Ave., Riverside, CA 92521; tyler.car0@email.ucr.edu).

Several experimental evidences suggest that membrane-mediated interactions exist in a number of soft matter systems including the forces between lipid domains in vesicles. However, no experimental data yet has proved the presence of membrane fluctuation-induced forces acting on membrane inclusions. The primary goal of the research performed is to show experimentally the existence of such forces by using silica beads embedded in a lipid bilayer, an analog for a cell membrane and its protein inclusions. We have implemented a Brownian based algorithm to investigate the interaction between the embedded particles and compared the relevant results with the experimental data. Through understanding the forces involved in membrane inclusion aggregation, we would gain a better working image into how proteins self-organize.

273 Magnet and Accumulator for Making a Two-dimensional Positronium BEC, ALINA M. ESCALERA*, PARTH B. PATEL, and ALLEN P. MILLS, JR. (Department of Physics and Astronomy, University of California, Riverside, 900 University Ave., Riverside, CA 92521; aescal002@ucr.edu).

Positronium is a pseudo-atom comprised of a bound positron-electron pair. The study of the positronium Bose-Einstein condensate (BEC) in a two-dimensional geometry will enable the performance of high precision experiments to search for new fundamental interactions. This report describes the design and construction of a high homogeneity 0.1 T solenoid magnet that will make possible the accumulation of large numbers of positrons for the production of dense clouds of positronium. The magnetic field has been measured with a novel oscillating magnetometer capable of accuracies of a few parts per million. The high uniformity of the magnetic field will maximize both the lifetime of trapped positrons within the accumulator and the compression of the trapped charge cloud, allowing larger positron densities to be achieved than was heretofore possible. The assembly will be integrated into the existing UCR positron beamline and used to produce and study the first 2-dimensional positronium Bose-Einstein condensates.

274 Mechanical Characterization of an Adhesive Tape, RUKMINI A. RAVI (Claremont High School, 1601 N. Indian Hill Blvd., Claremont, CA 91711; garuda01@att.net).

A commercial adhesive tape was mechanically characterized. Tensile tests were conducted on dog-bone shaped samples with a test area 10 mm wide and 50 mm long. The crosshead speed was 0.2 mm/s corresponding to an engineering strain rate of 0.4%/s. The Young’s modulus of the tape was 0.39 GPa and the ultimate tensile strength was 9.27 MPa. Digital image correlation (DIC), which is a method of 2D and 3D optical analysis, was used in order to analyze the displacement and contour of the tape during the tensile test. Each sample of tape was coated with a grey, speckled pattern using industrial paint to facilitate the analysis of any test is based on grey-scaled images. A charge coupled device (CCD) camera was used to record a video of the tensile test. The images were analyzed frame by frame using an image analysis software, was placed in front of the apparatus for the tensile test. In addition to the tensile tests, peel tests were conducted to determine the adhesive force relative to a glass surface. Tapes with widths of 5, 7.5 and 10 mm were attached to a glass slide held in a stand and pulled off at a 90° angle at a cross-head speed of 0.2 mm/s. The peel force was averaged to be 118, 140, and 261 mN respectively. Therefore, as the width increases, the peel force increases.

275 Corrosion of Nickel Chromium Alloys in Molten Sodium Sulfate Salt at 900°C, ZACK GENTRY, ANDREW SAKAMOTO, MATTHEW COREY, NORTON THONGCHUA*, and KISHAN PATEL (Chemical and Materials
Engineering Department, California State Polytechnic University, Pomona; 3801 W Temple Ave., Pomona, CA 91768; nthongchua@gmail.com).

The role of chromium in the corrosion resistance of binary nickel-chromium alloys was studied by varying the chromium content in the alloys and exposing the specimens to molten sodium sulfate (Type I hot corrosion). This will be used to characterize the corrosion reaction front and phase identification for each composition. Chromium is an excellent choice as an alloying element for combating corrosion because it enables the formation of a protective and adherent oxide on the surface of the alloy.

Nickel-chromium samples were studied via two methods: immersion and salt drip testing. In these experiments, nickel-chromium alloys containing 2.5, 5, 7.5 and 10 wt% chromium were isothermally tested at 900°C for 25, 36, 49, 100, and 500 hours. For salt drip testing, an aqueous salt solution was used to coat the sample with approximately 3-8 mg/cm², while immersion tests consisted of submerging samples in a pool of sodium sulfate. Corroded samples were subjected to X-ray diffraction and subsequently cross-sectioned. The sectioned samples were metallographically prepared and then characterized using scanning electron microscopy (SEM) coupled with energy dispersive spectroscopy (EDS). Optical microscopy was used to evaluate the extent of the attack by measuring the deepest penetrating corrosion front.

The salt drip tests more closely simulated the Type I hot corrosion phenomenon depicted in literature possibly by the higher oxygen partial pressure in the melt as compared to immersion tests. This resulted in an identifiable corrosion front depicted as a hot corrosion attack.

EARTH SCIENCES
Wednesday, from 9:00 a.m. – 11:45 a.m. in HUB 302 N

276 Imaging Tiny Earthquakes in the San Andreas Fault with a Mini Seismic Array, MANUEL MENDOZA* and ABHIJIT GHOSH (Earth Science Department, University of California, Riverside, 900 University Ave., Riverside, CA 92521; mmend028@ucr.edu).

Effective use of a small-aperture seismic array requires imaging of tiny earthquakes with the array and comparing the results with their catalog locations. This is useful to understand the effect of local signal-to-noise ratio, topography and the seismic velocity heterogeneity along the San Andreas fault near Parkfield. In order to produce high-quality and homogenous datasets, we must first measure the apparent velocity of an incident wave front (slowness) and back azimuth in great detail. The method used will distinguish between different seismic waves arriving at the array, separate them in distinct seismic events, and improve the signal-to-noise ratio by stacking ten to eighteen recordings of data with respect to their varying slowness of different seismic waves. In order to fully complete this project of calibrating the array, the first step is to perform a method that forms the basis of stacking techniques and analysis, beam-forming. This method of separating coherent signals and noise uses the differential travel times of the wave front due to a specific slowness and back azimuth to each station in the array. If a single stations recordings are appropriately shifted in time for the azimuth and slowness, then all other appropriately time-shifted signals that match that data will sum constructively. To do this I have located ~100 events that are shared between the array and an earthquake catalog. By comparing the slowness data with the earthquake catalog I will analyze any systematics bias present in the array and perform the proper calibration methods.

Atmospheric and Hydroospheric Sciences
Wednesday from 9:00 a.m. – 11:45 a.m. in HUB 302 N

277 From Passive Samplers to Estimates of Dry Nitrogen Deposition in the Western United States, ANDRZEJ BYTNEROWICZ*, WITOLD FRACZEK, ROBERT JOHNSON, MARK FENN, LEIMING ZHANG, and DARREL JENENERETTE (1USDA, Forest Service, Pacific Southwest Research Station, 4955 Canyon Crest Drive, Riverside, CA 92507; 2Environmental Systems Research Institute, 380 New York Street, Redlands, CA 92373; 3Center for Conservation Biology, University of California, Riverside, CA 92521; 4Air Quality Research Division, Environment Canada, 4904 Dufferin Street, Toronto, Ontario, M3H 5T4, Canada; 5Department of Botany and Plant Sciences, University of California, Riverside, CA 92521; abytnerowicz@fs.fed.us).

Passive samplers have been used for determinations of concentrations of nitorgenous (N) air pollutants such as nitrogen oxides (NOx), nitrogen dioxide (NO2), ammonia (NH3), and nitric acid vapor (HNO3). Their increasing use has led to greater understanding of the distribution of air pollutants in topographically complex landscapes, such as mountain ranges. Pollution distribution in the Sierra Nevada Mountains (including Sequoia & Kings Canyon National Parks and the Lake Tahoe Basin), the San Bernardino Mountains, Joshua Tree National Park, and the wildland-urban areas of southern California has been illustrated by maps developed with ArcGIS Geostatistical Analyst (ESRI, USA). A GIS-based empirical inferential method (GIS-EIM) has been developed specifically for estimation of dry and total N deposition in arid and semi-arid areas. Our methodology is based on concentrations of gaseous N air pollutants determined with passive samplers, empirical values of surface deposition velocity for NH3 and HNO3; empirically and literature-based values of stomatal conductance for NH3, NO2 and HNO3; satellite information on leaf area index (LAI); and detailed...
ABSTRACTS – Posters

landscape cover data. Comparison of summer-time measurements with those from the Community Multi-scale Air Quality (CMAQ) model allowed for extrapolation to annual N deposition values. Information on N deposition distribution helps to estimate exceedances of N deposition critical loads needed for better understanding of potential threats of N air pollution to ecosystem health and services. This new modeling approach will be illustrated by an example from the San Bernardino Mountains of southern California.

CHEMISTRY and BIOCHEMISTRY
Wednesday from 9:00 a.m. – 11:45 a.m. in HUB 302 N

278 Characterization of Glycosidases in the Aquarius remigis Sperm Plasma Membrane, KIMBERLY STEPHENSI*, CATHERINE D. THALER2, and RICHARD A. CAR-DULLO12 (1Department of Entomology and 2Department of Biology, University of California, Riverside, Riverside, CA 92521; kstep002@ucr.edu).

For successful fertilization to occur, gametes must recognize each other in a species-specific manner. In some organisms, sperm possess a glycosidase on the plasma membrane overlying the head while eggs have complementary glycoproteins on their surface that are hypothesized to be involved in sperm-egg recognition. Our central hypothesis is that glycosidases present on the sperm surface and complementary carbohydrates on the surface of the chorion are necessary for the primary sperm-egg recognition event in the water strider Aquarius remigis. In this study, two glycosidases, mannosidase and β-N-acetylglucosaminidase, have been characterized. Characterization included solubility, kinetic properties, pH and the effect of inhibitors on activity.

Aquarius remigis sperm mannosidase had a K_m of 2617 ± 3750 µM, a V_max of 29.6 ± 9.99 picomoles/minute and a Hill coefficient of 0.94 ± 0.18 at its optimal pH of 7.0. The mannosi-dase was extracted most efficiently with CHAPSO but was not by Kifunesine, suggesting it is a type II mannosidase. Aquarius remigis sperm N-acetylglucosaminidase had a K_m of 90 ± 25 µM, a V_max of 156 ± 7.2 picomoles/minute and a Hill coefficient of 0.96 ± 0.63 at its optimal pH of 7.0. N-acetylglucosaminidase was extracted most efficiently with potassium iodide but was also efficiently extracted with Triton X-100. The detection of these enzymes on the surface of Aquarius remigis sperm is consistent with their role as putative receptors that recognize complementary glycoconjugates on the chorion.

279 Investigating the Folding Dynamics of the RNA Pseudoknot Structural Motif via Massively Parallel Molecular Dynamics, KHAI NGUYENI*, AMETHYST RAD-CLIFFI, SAMANTHA CAOI, PHUC LAI, MONA BACKHOMI, RICHARD WANGI, and ERIC SORINII (Departments of 1Chemistry and Biochemistry, 2Physics and Astronomy, and 3Computer Engineering and Computer Science, California State University, Long Beach, 1250 Bellflower Blvd., Long Beach, CA 90840; Eric.Sorin@csulb.edu).

RNA pseudoknots compose a three-dimensional structural motif capable of stimulating ribosomal frameshifts, which are also present in the catalytic cores of some ribozymes. Their complex topology and non-canonical hairpin-loop composition make pseudoknots an ideal structural motif with which to study the RNA folding process. Here we report our analysis of over 8,000 independent all-atom molecular dynamics simulations of the ribosomal frame-shifting pseudoknot of Luteovirus. Using the Folding@Home distributed computing network and a novel Pathway Enumeration sampling method, a cumulative sampling time of over 115 ms was achieved. K-means clustering identified 27 conformational microstates, which reached equilibrium after ~6 ns of ensemble sampling. The kinetics between these microstates was observed to span four orders of magnitude, with fast motions on the nanosecond timescale and slower motions on the tens-of-microseconds timescale. Multiple folding metrics were used to identify 9 macrostates participating in the folding process, including previously undescribed misfolded and intermediate states.

280 The Study of Diffusion of Volatile Organic Compounds Through a Synthetic Membrane Using a Low Cost Apparatus in an Undergraduate Laboratory Setting, JULIAN LEEI*, RICHARD RAKIJIAN, and MARCO M. ALLARD (Department of Chemistry and Biochemistry, La Sierra University, 4500 Riverwalk Parkway, Riverside, CA; mallard@lasier.edu).

A methodology was prepared to determine the diffusion rate of environmentally unsafe gases through a synthetic vapor barrier. The overall goal of this study is to insure that the permeability of these barriers to these potentially unsafe vapors is within acceptable environmental levels. The diffusion of the volatile organic compounds (VOCs) was tested from a known high concentration on one side of the membrane to the opposite side. The analysis and quantification of the diffused gas samples was done using a GC-MS with samples collected over a wide range of time. The pressure on both side of the membrane was carefully monitored to ensure no over-pressure bias was present. A working low-cost prototype to hold and test the permeability was constructed and tested under different conditions to ensure chemical compatibility with the VOCs. The results and methodologies will be used towards the design of an undergraduate Physical Chemistry laboratory experiment in order to show case a real-world application of Fick’s law of diffusion.

281 Single-stranded DNA-Protein Binding and Collections through Asymmetrical Flow Field-Flow Fractionation,
A fluorescamine-based assay was applied to interactions of model proteins with various nanomaterials (silica, latex, polystyrene). What was found was that the proteins capable of binding exhibited increased fluorescence compared to non-binding examples. In addition, different proteins were found to have different interactions with specific particles, demonstrating how this assay could be used to analyze both batch-to-batch variability as well as attempt to predict how certain NMs may behave within the body.

283 Flow Field-flow Fractionation-based Localization and Quantitation of MicroRNA Biomarkers, KENNETH FLACK*, JONATHAN ASHBY, and WENWAN ZHONG (Department of Chemistry, University of California, Riverside, 501 Big Springs Rd., Riverside, CA 92521; kf1ac001@ucr.edu).

MicroRNA (miRNA) are short, non-coding RNA strands that are involved in a wide variety of processes, such as cell-to-cell communication, gene expression and gene silencing. The under- or over-expression of various miRNA could result in a variety of abnormal states, such as cancer. As a result, being able to quantitate miRNA levels is essential to early-stage disease detection. However, a single miRNA strand could be involved in several gene expression pathways. Probing multiple strands simultaneously is needed to properly diagnose abnormalities. In addition, the perceived ranges of healthy miRNA levels can span several orders of magnitude, making early stage detection difficult. If the levels of miRNA bound to a particular carrier could be quantified, it could be possible to narrow the healthy range for a particular strand, and allow for earlier and more accurate diagnostics.

Asymmetrical flow field-flow fractionation, being a purely size based separation technique, is well suited to localizing miRNA to particular carriers (protein, lipoprotein complexes, vesicular) without disturbing the miRNA-macromolecular complex. A method was devised to fractionate pure serum into several fractions for miRNA localization. After extraction and quantitation, the profile of four miRNAs (associated with breast cancer) across the fractions made it possible to determine which fractions may be most important for a particular miRNA strand.
glycoproteins function in growth and development, although exact functions remain unknown. Hypothesized functions of AGPs include action as a marker of cell identity and involvement in cell signaling. AGPs from the moss Physcomitrella patens contain an unusual sugar, 3-O-methyl-L-rhamnose (3-O-Me-Rha), not found in angiosperm AGPs or polysaccharides. The present goal is to identify the gene encoding the methyltransferase that synthesizes 3-O-Me-Rha in the moss. Identification of this gene could lead to characterization of other methyltransferase genes and use of these genes to improve biofuel production. Three promising moss genes (KO1, KO9, KO11) have been expressed in Nicotiana tabacum. Gas chromatography-mass spectrometry showed increased abundance of m/z = 146 ion, which is characteristic of methylated sugars, in trimethylsilyl (TMS) methylglycosides from AGPs of some KO9 plants. To check this preliminary finding, AGP sugars from KO9 and wild-type plants were converted to alditol acetates. Analysis of the alditol acetates revealed the unanticipated presence of another methylated sugar, 3-O-methyl-pentitol, that was the principal source of m/z = 146 ion in the TMS methylglycosides. It seems now that none of KO1, KO9, or KO11 causes synthesis of 3-O-Me-Rha in tobacco. This result might indicate that none of KO1, KO9, or KO11 encodes the desired methyltransferase. Alternatively, lack of 3-O-Me-Rha might indicate a problem in subcellular targeting of the KO1, KO9, or KO11 gene products in the transgenic tobacco. Supported by National Research Initiative grant 2008-35318-04599 from USDA NIFA.

285 Microsecond Monomer-Oligomer Exchange in the Intrinsically Disordered Protein Stathmin as Revealed by Saturation Recovery EPR, JESUS M. MEJIA* and MICHAEL D. BRIDGES (Department of Chemistry and Biochemistry, California State University Fullerton, 800 North State College Blvd., Fullerton, CA 92831; jm_mejia@csu.fullerton.edu).

Intrinsically disordered proteins (IDPs) are an interesting class of biomolecules that lack a stable tertiary structure, but which can fold upon association with their binding partner. Stathmin is an IDP that plays a vital regulatory role in cell division and growth via its interaction with microtubules. As has been reported with other regulatory or pathogenic IDPs, we have identified that soluble stathmin exists in a monomer-oligomer equilibrium, although the exchange timescale of this process is unknown. The coupled techniques of site directed spin labeling (SDSL) and continuous wave electron paramagnetic resonance (CW-EPR) spectroscopy are important tools for identifying the structural states and conformational equilibria of proteins, but they are unable to directly measure the dynamical timescales of equilibrium motion. However, the recently popularized, cutting-edge magnetic resonance technique of pulsed saturation recovery (SR) EPR, in which relaxation rates of spin labels are measured, has a proven utility in the direct measurement of conformational exchange lifetimes in proteins when studied in the presence of a “relaxation agent” (such as Oxygen or Nickel (II) EDDA). We used this SR-EPR technique to study six spin labeled stathmin mutants in various common biochemical environments, and fit the resulting data to a complex mathematical model to estimate a monomer-oligomer exchange lifetime on the order of 1 to 70 microseconds. This finding is significant as it helps define a timescale of IDP oligomerization kinetics, which could aid in the development of treatments for various neurodegenerative diseases caused by the oligomerization or aggregation of unfolded proteins.

286 The Effect of Morphology of ZnO Support on Activity of Gold Catalyst in Low Temperatures Oxidation of Benzyl Alcohol, REZA SHIDPOUR*, HADI SALARI, ABDOL-REZA SIMCHI, and MANOUCHEHR VOSSOUGHI (Department of Chemistry, University of California, Riverside, CA 92521; reza.shidpour@ucr.edu).

Gold nanoparticles supported on ZnO nanostructures were prepared through a simple chemical-thermal method and characterized by SEM, TEM, XRD, BET and photo luminescence (PL) spectroscopy. Effect of annealing temperature on catalytic activity of these Au/ZnO nanocatalysts were investigated by aerobic oxidation of benzyl alcohol. The results indicated that the catalyst with ZnO nanowire support annealed at 300 °C exhibited more activity than Au/ZnO catalyst supported on ZnO nanoparticles annealed at 600 °C. The Au/ZnO-nanowire achieved to increase the benzaldehyde selectivity and yield to 93.7 % and 85.6 %, respectively, at 60 °C whereas in Au/ZnO-nanoparticle the benzaldehyde selectivity and yield to 85.1 % and 69.9 %, respectively at 80 °C. The XRD and PL spectroscopy revealed that the supports have interstitial zinc (Zni), oxygen vacancy (VO) defects definitely but there is no evidence for interstitial oxygen (Oi) and zinc vacancy (VZn) defects and single ionized charged oxygen vacancy (VO)
The ability of science to produce experimental data has outpaced the ability to effectively visualize and integrate the data into a conceptual framework that can further higher order understanding. Large amounts of experimental data are available in regenerative biology, but there has been little progress made in understanding how organisms such as planaria are able to robustly achieve and maintain body form. We are developing a model discovery framework that uses a cell-based modeling platform combined with evolutionary search to automatically search for and identify plausible mechanisms underlying the regenerative capabilities of this organism. We will present a number of cell-based models of planaria that can regenerate anatomical regions following bisection of the organism. The multicellular models incorporate basic biological properties such as cell polarity and long-range morphogen gradients dependent upon gap junction and cell-cell signaling pathways. We will describe the strengths and limitations of these models and illustrate how they will be used to automate the search process for novel biological mechanisms in future work.


Multiple, independent evolutionary origins of biological traits are often associated with a putative adaptive value. The convergent evolution of mimicry, for example, is a well-known case of the power of natural selection. Therefore, the observation of a complex trait that has evolved independently in multiple lineages but shows no clear adaptive value is intriguing. Such is the case of the evolution of extensive placentotrophy, an evolutionary event that has occurred in many animal species, but for which no clear or comprehensive adaptive explanation is available. The study of the ecological and evolutionary forces that have favored the origin of placenta requires a group of closely related species that vary in their degree of placentotrophy and exhibit convergent evolution of extensive placentotrophy. We hypothesize that the skink genus Trachylepis may serve as a useful model system for such studies. This group of approximately 80 species of old-world skinks contains a species (T. ivensii) that has an invasive placenta similar to that of eutherian mammals; other species, however, are oviparous and the vast majority of species in this genus have unknown reproductive mode. Recent studies have revealed the phylogenetic relationships within most of the genus and confirmed the genera Eutr opis and Mabuya as sister groups of Trachylepis. We propose to describe and quantify the variation in reproductive mode of Trachylepis species through dissections of museum specimens. We can then map this variation onto the phylogeny of the genus and test whether it represents an example of convergent evolution of extensive placentotrophy.

289 Red Water of Mesodinium Blooms in the Columbia River Estuary Contain Elevated Levels of Euduboscquella, a Parasitic Dinoflagellate that Infects Tintinnid Ciliates, DEIRDRÉ MCA TEER*, PETER KAHN, and PETER ZÜBER (Center for Coastal Margin Observation and Prediction, Oregon Health Sciences University, 3181 SW Sam Jackson Park Rd., Portland, OR 97239; mcateerdk@gmail.com).

Mesodinium rubrum, a mixotrophic ciliate, is known to form non-toxic red tides (red water) around the world in estuaries, fjords, and major upwelling areas along the coast. The exact triggering mechanism that initiates the formation of the red water blooms is unknown and in the Columbia River estuary; these blooms have been used as an indicator of environmental health and play a major role in cycling nutrients throughout the lower trophic levels of the estuary. The blooms also encourage the rapid growth of bacterial populations and could potentially promote propagation of species that prey upon M. rubrum, such as the toxic dinoflagellate Dinophysis.

Initial screening of M. rubrum samples for dinoflagellate species did not detect the presence of Dinophysis, but instead uncovered an abundance of Euduboscquella, a parasitic dinoflagellate known to infect tintinnid ciliates. Certain species of Euduboscquella possess in their genome a unique area of sequence polymorphism (henceforth referred to as the Unique Sequence Element, or USE) in the 28S rRNA gene. Analysis of this USE region in water samples from the Columbia River Estuary showed that large populations of Euduboscquella occurred during bloom periods, however FISH and DAPI staining microscopy did not show any infected M. rubrum cells. While further evidence is needed, it is possible that Euduboscquella populations are found in conjunction with bloom periods due to an increase in tintinnid populations.

AGRICULTURE, FOOD, and RENEWABLE RESOURCES
Thursday from 9:00 a.m. – 11:45 a.m. in HUB 302 N

290 The Effect of Biochar Soil Amendments on Wheat Biomass, CLAUDIA C. MARIN*, ELIZABETH CRUTCHFIELD, J. GILES WAINES and MILTON E. MCGIFFEN, Jr. (Department of Botany and Plant Sciences, University of California, Riverside, 900 University Ave., Riverside, CA 92521-0124; cmari009@ucr.edu).

Soil quality is a determining factor in crop productivity that affects water budgets, fertilizer efficiency, and overall
yield. Biochar is a specialized type of charcoal that may improve the soil’s ability to hold and release plant nutrients, increase the growth of beneficial microbes, and decrease the amount of water needed to grow a crop. We incorporated biochar into two different soils, a sandy loam soil and a 50:50 mixture of sandy loam soil and sand. Biochar was added at three rates: no biochar (untreated control), biochar incorporated throughout the soil profile, or biochar added only to the top 15 cm of the soil. Two near isogenic wheat varieties, Pavon 76 (root mass typical of modern varieties) and Pavon 1RS-1AL (30% greater root mass), were then grown under stressed conditions in a randomized complete block greenhouse experiment. After harvest, the root, shoot, seed number and biomass were measured for each wheat plant. Preliminary analysis of the data suggests biochar mixed throughout a soil increased wheat biomass.

ANTHROPOLOGY and ARCHAEOLOGY
Thursday from 9:00 a.m. – 11:45 a.m. in HUB 302 N

291 Archaeological Feature Extraction from Aerial Imagery: Ahupua’a o Kāloa, Kaua‘i, JOHN T. O’CONNOR (Department of Anthropology, University of Oregon, 308 Condon Hall, 1218 University of Oregon, Eugene, OR 97403; joconnor@uoregon.edu).

Twentieth century economic development has adversely affected the integrity of archaeological features on the islands of the Hawaiian archipelago. Commercial, industrial, residential, and tourist projects continue to alter island topography with a disproportionately negative impact on archaeological resource preservation. Efforts to mitigate the destruction of archaeological landscapes rely on the ability of advocacy groups to identify and classify ancient Hawaiian features. Here I compare pixel-based and object-oriented approaches for the extraction and classification of aggregate basalt archaeological features at Kāloa, Kaua‘i. Unsupervised and supervised classifications were performed using ERDAS IMAGINE software on 2m-resolution WorldView-2 multispectral imagery. Object-oriented segmentation and classification procedures were performed using eCognition software. eCognition object-based multi-resolution segmentation tool was also used on 0.5m pan-sharpened/merged Worldview-2 imagery and 8cm-resolution mosaic imagery acquired from kite-mounted sensors. Supervised raster classification and object-oriented segmentation were successful in the identification of coherent features at the landscape scale. Object-based classification with sub-meter resolution holds potential for analysis at the scale of the aggregate feature. Remote sensing data acquisition and image analysis are beneficial for monitoring spatiotemporal variation in ancient landscapes. Spatial, spectral, and radiometric classification of aggregate basalt archaeological features is advantageous for the preservation of Hawaiian cultural resources and holds promise for addressing archaeological research questions throughout the Pacific.

PSYCHOLOGY
Thursday from 9:00 a.m. – 11:45 a.m. in HUB 302 N

292 Relationship of Physician-Patient Communication to Patient Satisfaction, Health, and Psychological Outcomes: A Meta-Analysis, TRICIA A. MILLER*, JULIET BENI EDGCOMB, and M. ROBIN DIMATTEO (Department of Psychology, University of California, Riverside, 900 University Ave., Riverside, CA 92521; trishmiller122@gmail.com).

Effective physician-patient communication is critical for improving health care quality. Numerous correlates of this communication have been identified. The purpose of this quantitative meta-analysis is to assess the magnitude and direction of the average “r” effect size of these correlates of physician-patient communication: patients’ satisfaction with care, health, and psychological outcomes. An extensive literature search using PubMed and PsycINFO (1949-2012) found 153 published empirical journal articles; effect sizes were extracted and articles coded for moderator analyses. Random effects analyses (allowing broad generalization) indicate a significant positive correlation of effective physician-patient communication with patient satisfaction with medical care ($r$=0.35, $p<.001$). Effective communication was positively correlated, at the fixed effects level allowing more limited generalization, with both patients’ health ($r=0.10$, $p < .001$) and psychological outcomes ($r=0.13$, $p < .001$). Random effects moderator analyses indicate a stronger relationship with patient satisfaction of communication involving shared decision making compared with other forms of communication. Thus, patient choice and partnership appear to be crucial in predicting patient satisfaction with medical care. Additionally, the relationship between effective communication and patient health outcomes is higher when nonverbal communication is considered compared with verbal communication alone. Future research is focused on building effective strategies to train physicians toward the goal of more effective communication with their patients.

293 Aversions to Water Consumption Increase with Proximity of Use, MARY GAUVAIN and DANIEL HARMON* (Department of Psychology, University of California, Riverside, 900 University Ave., Riverside, CA 92521; dharm001@ucr.edu).

The current study examines the motivations behind people’s aversions to innovative water technologies. The study included two questionnaires to which participants ($N=144$) responded. The first is a likert-scale questionnaire assessing people’s motivations in accepting or avoiding various water uses, such as drinking recycled wastewater or using
wastewater in washing. The second is a questionnaire of twelve scenarios detailing various uses of water, from drinking recycled wastewater to using water for hydroelectric power production. In each scenario participants were asked to detail how they would react to the situation and the reasons for their reaction.

Results showed that participants were increasingly more averse to innovative water technologies, especially those involving treated waste water, as the proximity of the use became more personally focused, as shown by 33% of participants refusing recycled water when the scenario was personally framed but accepting the same scenario when it was more distally framed. These aversions were explained by a fear of pathogens or unconscious views of dirtiness. These findings suggest that fear of illness and cleanliness motivations become more salient as water use becomes more direct and personal for the user.

Participants additionally exhibited a low amount of awareness concerning peripheral water uses. Participants more often made decisions based on incorrect scientific information in scenarios involving secondary and tertiary uses of water. These findings suggest that in addition to health and cultural aversions, people may often waste water in their own behaviors based on beliefs founded on incorrect scientific information.

294 The Effect of Differing Conversation Types on Bystanders, CHRISTINA CARNER*, CHRISTOPHER DISHOP*, and VERONICA V. GALVÁN (Department of Psychological Sciences, University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; vgalvan@sandiego.edu).

Cell phones are a common means of communication in public settings. Two studies conducted by Galván et al. examined the effect of overheard conversations on the attention and memory of bystanders in a naturalistic design. In study 1, published March 13, 2013 in PLoS ONE, participants were more attentive to cell phone conversations than two-sided conversations. In study 2, researchers examined the differences between overhearing different types of conversations (one-sided cellphone vs. typical two-sided) with different stimulation (boring vs. interesting). The studies suggest that cell phone conversations are more intrusive than typical conversations, which has implications for workplace and public environments.

295 Stress and Coping in College Students, SARAH JENSEN*, CORI TERGESEN*, and VERONICA V. GALVÁN (Department of Psychological Sciences, University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; vgalvan@sandiego.edu).

College students report the highest levels of stress to other age groups. Of the factors related to college-age stress, locus of control may be the greatest influence. External locus of control, the perception that one has no control over his or her life has been correlated with higher levels of the stress hormone cortisol. These stress hormone levels can be measured using biological markers in saliva. One hundred and sixty college students completed surveys about their college experience, including the Perceived Stress Scale, Almost Perfect Scale, Social Provisions Scale, Rotter Locus of Control, as well as surveys on nutrition, sleep, and work habits. In addition, salivary samples of cortisol were analyzed. Results indicate that most participants have an external locus of control. Results also suggest that a greater disparity between expectations for college and college experience was associated with higher levels of self-reported stress. In addition, perfectionists who are not meeting their high expectations also report higher stress levels. We also expect that an internal locus of control will be associated with low levels of cortisol.

ENGINEERING, TECHNOLOGY, and APPLIED SCIENCE

296 Effect of ICG Concentration on the Fluorescence Emission Characteristics of Erythrocyte-Mimicking Optical Nanoprobes, JACK TANG*, WANGCUN JIA2, VICTOR SUN2, J. STUART NELSON2, and BAHMAN ANVARI1 (1Department of Bioengineering, University of California, Riverside, 900 University Ave., Riverside, CA 92521; 2Beckman Laser Institute and Medical Clinic, University of California, Irvine, 1002 Health Sciences Road, Irvine, CA 92617).

Molecular dyes convert light into other forms of energy, such as heat, photochemistry, and acoustic waves. This provides the basis for optical-based procedures such as fluorescence imaging, and photothermal destruction of tissue malformations.

Indocyanine green (ICG) is an FDA approved near-infrared (NIR) dye used for choroidal angiography, measurement of cardiac output, and assessment of hepatic function. Rapid clearance of ICG from the vasculature (half-life ≈ 3-5 min) limits the dye’s usefulness to short times following administration. We aim to deliver ICG in an appropriate formulation that can be utilized for optical imaging and phototherapeutic applications over long periods of time.

We engineered optical nanoconstructs derived from hemoglobin-depleted erythrocytes doped with ICG. We refer to them as NIR erythrocyte-mimicking transducers (NETs). To utilize NETs as effective nanoprobes for fluorescence imaging, we must ensure that they provide maximal emission. Here, we maximize the fluorescence quantum yield of NETs by changing the ICG concentration over a broad range (5 - 500 μM). NETs are fabricated by hypotonic treatment of erythrocytes (140 mOsm, pH = 8, 5 min, 4° C), followed by ICG incubation. We varied the ICG concentration introduced in
the buffer over a range of 5 - 500 µM. Absorption and emission spectra of the constructs were acquired, and the relative fluorescence quantum yield was determined for each ICG concentration.

Low concentrations of ICG resulted in weak fluorescence emissions, while higher concentrations quenched the fluorescence signal.

NETs can provide maximal fluorescence when containing an optimum concentration of ICG.

297 Increasing Power Output by Reducing the Windmill Blade Tip Vortex, ELEANOR FROST (Chaminade College Preparatory School, Los Angeles, CA; mailing address: 18034 Ventura Blvd., #182, Encino, CA 91316; Eleanorfrost1@gmail.com).

As the blade of a horizontal axis windmill passes through the air, air pressure creates lift which improves blade performance. However, air pressure forms a vortex at the tip, reducing power output. A blade tip winglet can reduce the size of the vortex. (Xia 2013) My hypothesis is that the airfoils with the winglet will produce greater electrical output than the airfoils without winglets. To test my hypothesis, I used a windmill and wind tunnel design inspired by a 2009 US Department of Energy Report. The set up was similar to that used by Birch and Wilson in their 2013 study of the vortex. I tested 2 inch and 5 inch, Flat Bottomed and Symmetric blades with and without the winglet, at static angles from 5 to 15 degrees. The blades tested had the same weight and rotational inertia. The blade was inspired by a 2010 Sandia Labs paper, published in conjunction with the USDOE Office of Renewable Energy. I recorded 20 observations for each test. I averaged the results and calculated the standard deviation for each test. I calculated a t test statistic to see if the results were statistically significant to a 95% confidence level. My analysis of the experimental data shows that my hypothesis could not be supported to a 95% level of confidence. For the 5 inch flat blades, set to a static angles of 5 and 10 degrees, the blades with the winglet produced more power; however these results are not statistically significant.

298 A Study of Sperm Motility of Culex quinquefasciatus Sperm, CARLA DE LOS SANTOS1*, MARCO GARCIA2, CATHERINE D. THALER2, and RICHARD A. CARDULLO1,2 (1Department of Bioengineering, 2Biomedical Sciences, 2Environmental Toxicology, and 3Chemistry, University of California, Riverside, 900 University Ave., Riverside, CA 92521; cdelol002@ucr.edu).

Sperm motility is essential for successful fertilization in various organisms. Studies on insect sperm motility are limited despite the fact that many insects are vectors for serious diseases, including our organism of study, the mosquito Culex quinquefasciatus. We recently showed that motile C. quinquefasciatus sperm undergo a transition between three distinct waveforms in vitro: a low amplitude and high frequency waveform (A), a waveform containing a low amplitude and high frequency waveform superimposed with a high frequency and low amplitude waveform (B), and a high amplitude and low frequency waveform (C). These waveform transitions have not yet been identified in other species and may play an important role in successful fertilization in C. quinquefasciatus. Waveform parameters were estimated by measuring sperm on multiple frames from digital recordings of motility. In Wave A motility, the average amplitude and wavelength were 4.0 µm and 85.0 µm, respectively. In Wave C motility, by contrast, the average amplitude and wavelength were 10.0 µm and 91.0 µm, respectively. Consistent with the wave parameters, the velocity averaged 8.8 µm/s for wave A sperm and increased to 120 µm/s, in Wave C sperm. Applying a mathematical model for flagellar motility, and using the measured amplitude and wavelength for each motility pattern, values of 4.1 µm/s and 17.3 µm/s were calculated for the velocity of Wave A and Wave C sperm, respectively. This mathematical model will be adjusted for the particular hydrodynamic properties that are unique to C. quinquefasciatus sperm to obtain more accurate velocity measurements.

299 Fabrication of Silica Nanofibers for DNA Extraction, MARISSA GIONET-GONZALES1*, YANG LIU1, and WENWAN ZHONG4 (Departments of 1Bioengineering, 2Biomedical Sciences, 3Environmental Toxicology, and 4Chemistry, University of California, Riverside, 900 University Ave., Riverside, CA 92521; mgion001@ucr.edu).

DNA extraction is a vital technique in biology often used in the diagnosis of diseases, and DNA and RNA research. Commercially available silica coated iron oxide beads (1um in diameter) are able to extract as low as 10 picomolar of DNA. However silica nanofibers should better extract DNA because of their larger surface area. Silica fibers are also much cheaper to produce than the silica beads, making them more economical as well as extraction efficient. In this research, silica nanofibers were produced via the sol-gel electrospinning method. Tetraethyl orthosilicate (TEOS), a precursor of silica, was first treated with acid to produce silica, and then polyvinyl alcohol (PVA), an easily electrospun polymer, was added before electrospinning to increase the entanglements. After electrospinning, the fibers were calcinated at 600ºC to remove solvents and PVA. These fibers were then used in DNA extraction from 1 mL of solution. After eluting the extracted DNA from the fibers and amplification by polymerase chain reaction (PCR), gel electrophoresis showed that the DNA from the silica fibers demonstrated a more distinctive band in the gel than the silica beads at 2 pM (3.3 fmol). This indicates that the fibers recovered a higher concentration of DNA and proves that silica nanofibers are more efficient both extraction and cost wise. The use of silica fibers in DNA extraction can potentially increase detection of disease and lower the cost of biological and medical research that rely on extraction.

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**ABSTRACTS – Posters**

300 *Visualization of Direct Numerical Simulation Results of an Advection-Diffusion Equation for Magneto-Geostrophic Turbulence*, KRISTIAN WITTMAN*1, FRANK JACOB-ITZ2, and SUSAN FRIEDLANDER2 (1Mechanical Engineering Department, Shiley-Marcos School of Engineering, University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; 2Center for Applied Mathematic Sciences, Mathematics Department, University of Southern California, 3620 South Vermont Ave., Los Angeles, CA 90089-2532; kwittman@sandiego.edu).

Magneto-geostrophic turbulence is studied using a direct numerical simulation approach for an advection-diffusion equation for the density $\rho$. Both the velocity vector $\mathbf{u}$ and the magnetic field $\mathbf{b}$ are directly computed from the scalar $\rho$ through multipliers in Fourier space (H.K. Moffatt, Magnetostratigraphic Turbulence and the Geodynamo, IUTAM Symposium on Computational Physics and New Perspectives in Turbulence, IUTAM Bookseries Volume 4, 2008, pp 339-346). The direct numerical approach uses a Fourier-spectral method for the spatial discretization and a fourth-order Runge-Kutta method for time advancement. The advection term is evaluated in physical space and a variety of initial conditions are used. The iso-value surfaces of density, velocity, and magnetic field are visualized using the Vapor software package and the time evolution is studied by combining fixed-time images into movies. Instabilities are observed, which result in an increase in the kinetic energy of the flow. An increase of the Reynolds number decreases the time for the instabilities to occur. Movies of the evolution of the power spectrum show that the instabilities occur at the highest wave numbers, even for the cases with the lowest Reynolds number. The visualization method employed to create the movies of iso-values and power spectra will be discussed in detail.

**ECOLOGY, ENVIRONMENTAL SCIENCES, and SUSTAINABILITY**

Thursday from 9:00 a.m. – 11:45 a.m. in HUB 302 N

301 *Epiphytic Moss as a Biomonitor of Nitrogen Deposition in the Pacific Northwest*, TIMEA DEAKOVA*1, TERRY ROLFE3, ERIN SHORTLIDGE1, MEENAKSHI RAO3, TODD ROSENSTIEL1, and ANDREW RICE2 (1Department of Biology, 2Department of Physics, 3Department of Environmental Science and Management, Portland State University, 1825 SW Broadway, Portland, OR 97201; deakova@pdx.edu).

Tracking nitrogen deposition patterns in and around urban centers is important for understanding how anthropogenic sources of nitrogen affect natural habitats, human health, and for evaluating computer models of future nitrogen deposition. This pilot study investigated *Orthotrichum lyellii*, a common urban epiphytic moss, as a natural bioindicator for nitrogen deposition through the analysis of total moss nitrogen content. We collected 168 *O. lyellii* samples from the trunks of deciduous trees in 53 geographical locations in the Portland metropolitan area. Intact moss shoots were cleaned of debris, oven dried, and ground by mortar and pestle. The samples were then analyzed for nitrogen and carbon content using an elemental analyzer (Thermo Flash EA 1112). Nitrogen content was found to range between 0.71% and 3.36% (mean 1.82%). Carbon content was found to range between 19.2% and 45.6% (mean 41.9%) and C/N was found to range 11.5 to 63. The N content was then plotted spatially and compared against a land-use regression model developed from high-resolution spatial NO$_2$ measurements made during summer 2013. The correlation between the moss N and modeled NO$_2$ was found to be highly significant ($p < 0.001$, $r = 0.625$). These results demonstrate the potential utility of *O. lyellii* as a low-cost and readily available bioindicator of anthropogenic nitrogen deposition within urban environments.

302 *Quantification of in situ Root Herbivory Using Remote Sensing Technology*, SAMANTHA A. ESTANISLAO*, MICHAEL F. ALLEN, and MATTHEW R. O’NEILL (UCR Center for Conservation Biology, University of California, Riverside, 900 University Ave., Riverside, CA 92521; sesta001@ucr.edu).

Symphylans are soil dwelling arthropods from the subphylum Myriapoda. Investigations into the natural history of this group often use destructive methods to quantify population dynamics, and primarily focus on the negative impacts these organisms have on agricultural systems. However, little data exist documenting symphylan behavior in natural systems. Therefore, the objective of this study was to gather data on the natural history of this group via nondestructive in situ observation. To accomplish this an Automated Mini-Rhizotron was installed in typical Riversidean Coastal Sage Scrub habitat. This technology allowed for fine scale observation of distribution within the soil profile, age, morphology and feeding behavior of symphylans in a natural system. Observed individuals were similar in age and primarily clustered 8-10cm below the soil surface. We found a strong positive relationship between symphylan length ($\rho = 0.60$), number of segments ($\rho = 0.66$) and root length. Perhaps this trend indicates a coupled ontogeny of consumer and resource as greater size and segment numbers indicate greater age in this group. While we were unable to make quantitative conclusions about herbivory patterns observed, our observations provide strong qualitative evidence that forb roots are preferred relative to grass roots. This pattern may be important for plant community composition, as it may decrease the relative abundance of forbs relative to grasses.

303 *Evaluation of the Design, Performance, and Metal Emissions of Electronic Cigarettes*, MONIQUE WILLIAMS1*, AMANDA VILLARREAL1, KRASSIMIR BOZHILOV2, and PRUE TALBOT3 (1Department of Cell Biology and
Neuroscience, University of California, Riverside, 900 University Ave., Riverside, CA 92521; ‘Central Facility for Advanced Microscopy, University of California, Riverside, 900 University Ave., Riverside, CA 92521; mwillo08@ucr.edu).

Electronic cigarettes (EC) are novel nicotine delivery devices. Based on our earlier data, we hypothesized that new models of EC will vary in their performance characteristics and have heavy metals in their aerosol. We investigated this hypothesis using 10 brands of cartomizer EC and three approaches that included dissections, performance, and elemental analysis of EC aerosols. All 10 brands had the same basic design components, which consisted of wires, solder joints, air-tubes, a mouthpiece, fluid, and fibers. Four brands had been used prior to packaging, while six were in pristine condition. The flow rate required for aerosol production ranged from 4–21 mL/s. During “smoke out”, flow rate was constant for 5 brands, but had to be increased periodically in 5 brands. Within brands, pressure drop was relatively stable, but varied between brands (12–330 mm H₂O). Aerosol density oscillated during “smoke out” for all brands. The elemental composition of EC aerosol and conventional cigarettes smoke was compared using inductively coupled plasma optical emission spectroscopy. Of 62 elements screened, 21 were present in EC aerosols. Four (Al, Na, Se, Zr) were less abundant in EC aerosol than in cigarette smoke. In contrast fourteen (Ag, Ba, Ca, Cr, Cu, Fe, Mg, Mn, Ni, Pb, Sn, Sr, Ti, Zn) were more abundant in EC aerosol than in smoke. In summary, the cartomizers, while similar in design, varied in performance. All 10 cartomizers had metals in their aerosol. The health effects of metal exposure from EC are not yet known.

304 Isolation and Characterization of a Crude Oil-Tolerant Bacterium from the Great Salt Lake, RUHUL KUDDUS, JONATHAN OAKES, JOHURIMAM NOAH KUDDUS, and EASTON DOWNS* (Department of Biology, Utah Valley University, 800 West University Parkway, Orem, UT 84058 USA; ruhul.kuddus@uvu.edu).

Background: The Great Salt Lake of Utah is a highly polluted natural hypersaline lake. Bacteria thriving in the lake can be useful in bioremediation of crude oil given that crude oil spills mostly occur in the marine environments.

Methods: Samples from the water column and the bottom mud of the highly saline southeastern tip of the lake were placed in a salt agar growth medium. The pure culture of a rapidly growing isolate was biochemically and molecularly characterized. Results: About a dozen potentially different species grew in the medium but only one grew vigorously to be considered for bioremediation. The isolate was molecularly identified as *Salinivibrio* sp. The bacterium is a Gram-negative pleomorphic helical flagellated rod and an obligate aerobic halophile. The isolate is oxidase, catalase, amylase, lipase and Voges-Proskauer positive but a mannnitol non-fermenter. The bacterium is resistant to penicillin, amikacin, bacitracin, streptomycin, tetracycline and vancomycin but sensitive to chloramphenicol. The bacterium grew in 1-20% salt but optimally at 10% salt and at room temperature. The bacterium is not a spore-former but can be stored at room temperature for a year without loss in cell viability. The bacterium can survive in a medium containing crude oil as the sole carbon source but requires some organic carbon for efficient growth in media containing crude oil. The rate of breakdown of crude oil by the bacterium is currently being investigated. Conclusions: The isolate is a hardy and fast-growing halophile that can be manipulated to develop an agent of marine bioremediation.

305 Gradient Analysis of Terrestrial Arthropod Community Composition in a California Desert Habitat, SARAH L. O’NEILL*, RICHARD REDAK, and MATT DAUGHERTY (Department of Entomology, University of California, Riverside, 3401 Watkins Drive, Riverside, CA 92521; sdave001@ucr.edu).

Ecotones host increased levels of biodiversity, and are thus critical targets for conservation. The Coachella Valley within southern California’s Colorado Desert is a high-biodiversity wilderness area home to many endemic species of plants and animals, including some currently under threat of extinction. The Oasis de Los Osos UC Natural Reserve in the western Coachella Valley encompasses a plant community ecotone, as well as a riparian area adjacent to arid creosote bush scrub-land. This unique combination of landscape features is presently threatened by encroachment of an invasive weed, *Brassica tournefortii*. An observational study was initiated to explore arthropod diversity in relation to plant community composition and position along a perennial stream. Twelve transects were established perpendicular to the stream. Transects are ~100 m apart with collection plots at 0, 4, 8, 16 and 32 m from the stream channel bank. Pitfall and pan traps were deployed for 24 hour periods four times over one month and arthropod samples identified to morpho-species. Plant species identity and percent cover were recorded. Sampling recovered 4381 specimens in 425 distinct morpho-species from 18 orders. While only separated by ~1 km in space, transects at perennally flowing stream reaches collected greater abundances and distinct arthropod assemblages from transects at dry (ephemeral flowing) reaches. While changes in the arthropod community co-vary with changes in the plant community, the presence of this desert stream appears to enhance the richness and complexity of the terrestrial arthropod community.

CELL and MOLECULAR BIOLOGY
Thursday from 9:00 a.m. – 11:45 a.m. in HUB 302 N

306 PG0686 May Function in Oxidative Stress Resistance as a Redox Sensor in *Porphyromonas gingivalis* W83, ALEXIA D. XIMINIES*, YUETAN DOU†, WILSON
Survival of Porphyromonas gingivalis in the inflammatory environment of the periodontal pocket requires an ability to overcome oxidative stress caused by reactive oxygen species. Transcriptome analysis in P. gingivalis demonstrated that oxidative stress can modulate several functional classes of genes depending on the severity and duration of the exposure. There was a 4.0 up-regulation of the hypothetical protein, PG0686, in P. gingivalis in the presence of 0.25 mM hydrogen peroxide for 15 minutes. Other studies have also indicated an up-regulation of PG0686 in the presence of 6% O2 and NO.

In silico analysis of PG0686 protein identified 6 domains; including hemerythrin, DUF-1835, and a possible sensory box domain. The purpose of this investigation is to study the relative significance of PG0686 in oxidative stress resistance and its possible role as a redox sensor in P. gingivalis. DNA microarray analysis and Real-time RT-PCR were used to determine gene induction under oxidative stress. Upstream and downstream flanking regions of the 1.5 kb gene were fused with the ermF antibiotic resistance cassette, and used to create a PG0686 deletion mutant, designated FLL361, by allelic exchange mutagenesis. The FLL361 mutant was more sensitive to hydrogen peroxide than W83. The PG0686 open reading frame was cloned into the pEXP5-NT vector, and the corresponding 60 kDa histidine-tagged recombinant PG0686 protein was overexpressed and purified from E. coli.

Our data indicate that PG0686 gene encodes a 60 kDa protein that appears to be multimeric under native conditions, and functions in oxidative stress resistance in P. gingivalis W83.

308 Prediction of Cardiac and Skeletogenic Teratogens Using Human Induced Pluripotent Stem Cell-Based in vitro Models of Differentiation, LAUREN WALKER1*, NICOLE SPARKS1, VERONICA PUIG-SANVICENS2, and NICOLE ZUR NIENEN1 (1Department of Environmental Toxicology, University of California, Riverside, 900 University Ave., Riverside, CA 92521, lauren.walker@email.ucr.edu; nicole.sparks@email.ucr.edu; 2Department of Cell Biology and Neuroscience, University of California, Riverside, 900 University Ave., Riverside, CA 92521, nicole.zurnieden@ucr.edu).

Within the past decade, human induced pluripotent stem cells (hiPSCs) have become the center of concentrated research efforts in pharmaceutical and toxicological assessments. hiPSCs are highly similar to human embryonic stem cells (hESCs) in genetic and epigenetic regulation of gene expression, proliferation ability, and differentiation capacity. hiPSCs have been identified as a promising alternative to hESCs in in vitro toxicity evaluations such as the embryonic stem cell test (EST). Originally murine-based, the EST is a well-established assay that evaluates embryotoxicity of compounds by measuring cell viability and capacity of ESCs to differentiate into functional (i.e., beating) cardiomyocytes following treatment. At present, EST teratogenicity screens featuring hiPSC-derived cardiac and non-cardiac tissue endpoints have not yet been reported though numerous screens with hESCs have been successfully carried out. This study investigated the robustness and predictive capacity of the hiPSC-based EST featuring cardiac and bone tissue endpoints. Cells were treated with compounds possessing...
established toxicity assessments: 5-fluorouracil (5FU), retinonic acid (RA), and penicillin G (non-teratogenic; negative control). Differentiation inhibition was measured via beating and calcium assays for cardiac and bone endpoints, respectively. Cell viability was measured by MTT assays for both tissue endpoints. Day 10 changes in cardiac and osteogenic gene expression were assessed by qPCR analysis. Dose-dependent cell death, differentiation inhibition, and down-regulation of gene expression were observed in 5FU and RA in both tissue endpoints. Results demonstrate that cardiac and bone endpoints in the hESC-based EST are comparable to the hESC-based EST in their predictive activity for toxicological analysis.

309 Comparing Mandible Bone Marrow Derived Osteoblast Attachment to Titanium Scaffolds With or Without UV Treatment, MARIA SIERRA ASIAN B. BALATAN*1, NANCY SILVA*2, MANABU ISHIJIMA2, POOYA SOLTANZADEH2, CHIKA IWASAKI2, and TAKAHIRO OGAWA2

(Howard Hughes Medical Institute Pre-College Science Education Program, UCLA School of Dentistry, 10833 Le Conte Ave., B3-068 CHS, Los Angeles, CA 90095; 2UCLA School of Dentistry, 10833 Le Conte Ave., B3-068 CHS, Los Angeles, CA 90095; balatan.sierra@gmail.com, naancy.23@gmail.com).

About 6.8 million people fracture their bone annually costing the US alone $13.8 billion in healthcare expenditures. To regenerate a broken bone, titanium implants are essential. Unfortunately, bone-to-titanium integration (osseointegration) of titanium implants still needs improvement of long term stability and functionality. In particular, the capability of titanium to attract and nurture bone-making cells (osteoblasts) needs to be improved. Objective: Determine whether ultraviolet (UV) light pre-treatment of titanium scaffolds enhances the implants by exhibiting increased cell attachment, function and maturation. Methods: Titanium scaffolds were acid-etched and half were treated with UV-light for 15 minutes. UV-light treatment converted the titanium scaffolds from hydrophobic to superhydrophilic. Osteoblasts were collected from the mandibular bone marrow of 8-week-old male rats and pipetted into both the UV and non-UV treated titanium scaffolds for comparison. AWST-1 assay was used to quantify cell attachment. An ALP assay was done to measure cell function and maturation. Results: UV treatment significantly increased the number of osteoblasts attached at 24 hours and the function and maturation level of cells at day 8. Discussion: The data indicate that UV-light pretreatment of titanium enables stronger and more complete establishment of osseointegration. This suggests a wide range of usage for UV-light treatments in various orthopedic implant materials such as titanium scaffolds. Conclusion: Pretreatment of titanium with UV-light could mean higher long term success rates of titanium implants. This research puts us a step closer towards achieving the main goal of regenerative medicine and science.

310 Neurobehavioral Effects of In Utero Exposure to Polybrominated Diphenyl Ethers (PBDEs) on the F1 Progeny of C57Bl/6 Mice, M. VALDEZ*1, G. GONZALEZ2, R. GUTIERREZ3, H. CHENG2, T. KYAW2, J. VALDEZ3, M. BLAIBEL2, H. CHERUKURY3, and M. CURRAS-COLLAZO2

(‘Neuroscience Graduate Program, Department of Cell Biology and Neuroscience, University of California, Riverside, 900 University Ave., Riverside, CA 92521; 3Biological Science Department, California State University, Fullerton, 800 N. State College Blvd., Fullerton, CA 92831; valdez.matt@gmail.com).

Industrial organohalogen compounds have penetrated all aspects of our environment and biota. The susceptibility of children to toxicants during critical developmental periods has raised concerns of their lifelong adverse health effects. Polybrominated diphenyl ethers (PBDEs) are organohalogen compounds used as indoor flame-retardants globally. Therefore, these toxicants could impact human health for many decades to come due to their chemical stability and biological penetration.

In this study we assessed any possible transgenerational effects of PBDEs on neurological disorders in the F1 progeny of C57Bl/6 mouse mothers exposed to PBDEs. Epidemiological studies have implicated organohalogen compounds such as PBDEs in the etiology of autism spectrum disorder (ASD). We therefore focused on behaviors relevant to the three core symptom domains of ASD: deficits in communication, abnormal social interaction and restrictive/repetitive interests and behaviors. To model human exposure, mice were orally dosed with DE-71, an industrial mixture of PBDEs, for 10 weeks. This 10 week regime includes a 4 week pre-dose period, gestation (3 weeks), and up through weaning (3 weeks). Female mice were allocated to three groups: Corn oil control, DE-71 low dose (0.1 mg/Kg/day), and DE-71 high dose (0.4 mg/Kg/day). Animals were subjected to the following battery of behavioral tests: Juvenile Play (PND 20), Sociability (PND21), Open Field (PND 30-40), Marble Burying (PND 40-50), Olfactory Preference (PND 50-55), Social Recognition (PND 55-60), and Elevated Plus (PND 60-65). Here we show that PBDE treatment effects fertility, sensorimotor development and social interactions.

311 Cytotoxicity of Electronic Cigarette Refill Fluid Aerosols, RACHEL Z. BEHR* and PRUE TALBOT (Department of Cell Biology and Neuroscience, University of California, Riverside, 900 University Ave., Riverside, CA 92521; rbeha001@ucri.edu, talbot@ucr.edu).

Electronic cigarettes (EC) are nicotine delivery devices, often advertised for smoking cessation. The fluids used to refill these devices typically contain nicotine, a humectant (i.e. propylene glycol (PG) or glycerol/vegetable glycerin (VG)), and flavorings. Few studies have assessed the health effects of EC aerosols. Previously, 35 refill fluids (RF) were screened for cytotoxicity. In this extension of the prior study,
we produced aerosols from these fluids using the Vea EC from Johnson Creek and then tested them for cytotoxicity in the MTT assay using human pulmonary fibroblasts (hPF, adult lung model). A comparison was made between the RF applied to hPF and aerosols produced from the fluids which were then used to treat the cells. Aerosols ranged in IC₅₀ values from 0.018% to >3%. For 54.3% of the RF, the corresponding aerosols had similar cytotoxicity. 11.4% of the fluids were more cytotoxic than their aerosols. Finally, 34.3% of the products were more potent as aerosols than as fluids. This latter observation is important as it shows that heating a RF can increase its cytotoxicity. Moreover, when screening for cytotoxicity of EC products, testing RF on cells is not always representative of the effects of an aerosol on cell survival. Additionally, the humectants in these fluids correlate to the toxicity of the aerosolized products. 10-of-11 products containing only glycerol/VG were cytotoxic, whereas 3-of-12 products comprised mainly of PG were minimally cytotoxic. This study provides valuable insight into which of these EC refill products or additives may be potentially harmful to users.

312 The Effects of Astrocytic Swelling on Neuronal Excitability, KELLI LAUDERDALE, TODD A. FIACCO, and TINA TUNG* (Department of Cell Biology and Neuroscience, University of California, Riverside, 900 University Ave, Riverside, CA 92507).

Epilepsy affects approximately 50 million people worldwide and is the third most common neurological disorder in the United States (statistics from the http://www.epilepsyfoundation.org/aboutepilepsy/). Current antiepileptic drugs (AEDs) are often associated with cognitive depression, physical side effects, and limited in treating only two thirds of the population with epilepsy. Previous researchers have shown that cell swelling and a reduction of extracellular space (ECS) precede neuronal excitability and seizures. While the underlying mechanisms of seizure generation are still poorly understood, astrocytes may play crucial roles in seizure initiation and generation because of their abilities to regulate the extracellular environment in brain tissues. During the initiation of epileptiform activity in brain slices, astrocytes swell as they take on water alongside uptake of glutamate and potassium ions released by neurons. In this study, electrophysiology whole-cell patch-clamp techniques were used to record neuronal activity in the CA1 hippocampal region before and during astrocytic swelling. We hypothesize that astrocytic swelling and the release of glutamate through a volume regulated anion channel (VRACs) increase neuronal excitability in a dose-dependent manner with reductions in osmolarity by activating several different types of neuronal channels such as AMPA and NMDA (N-methyl-D-aspartate) receptors. Furthermore, astrocytic swelling is capable of inducing neuronal firing of action potentials. This hyper-excitability can cause excess neuronal firing which ultimately may lead to seizures and epilepsy. The findings in these experiments may contribute to a better understanding of cerebral edema and epilepsy as well as the development of better treatments and drugs focused on astrocytic targets.

313 Transcriptional Regulation of LPS-Induced Inflammatory Genes in Dental Pulp, ANIKA BENONS*, JONATHAN VERGARA-DIAZ#, SHERLI MEHRAZARIN2, MINSUNG HUH, and MO KANG# (Howard Hughes Medical Institute Pre-College Science Education Program, UCLA School of Dentistry, 10833 Le Conte Ave., 43-009 CHS, Los Angeles, CA 90095; #UCLA School of Dentistry, 10833 Le Conte Ave., 43-009 CHS, Los Angeles, CA 90095; anikabenons@gmail.com, vergara.jonathan88@gmail.com).

About 15.1 million root canals are performed annually in the United States due to pulpitis, or inflammation of the pulp, induced by different endodontic bacteria and the endotoxin lipopolysaccharide (LPS). Pulpal inflammation is mediated by pro- and anti-inflammatory cytokines, specifically interleukins (IL). Expression of IL-13 and IL-15, whose role in pulpal inflammation is not well understood, was examined in this study. Objective: We sought to investigate the effect of Porphyromonas gingivalis LPS treatment on inflammatory cytokine expression in dental pulp stem cells (DPSCs). Methods: DPSCs were treated with 1 ug/ul P. gingivalis LPS for 24 hours, and then cell morphology was examined. Reverse transcription-quantitative polymerase chain reaction (RT-qPCR) was performed to detect changes in gene expression of pro- and anti-inflammatory ILs after LPS treatment of DPSCs. Results: DPSCs treated with LPS showed no change in cell morphology. Expression of pro-inflammatory cytokines IL-4 and IL-8 increased significantly, and expression of anti-inflammatory cytokines IL-6 and IL-10 decreased in DPSCs treated with LPS. Expression of IL-13 and IL-15 was clearly enhanced after LPS treatment. Discussion: LPS-induced inflammatory response is associated with enhanced IL-13 and IL-15 expression in DPSCs. Conclusion: IL-13 and IL-15 may serve a unique function in regulating pulpal inflammation. Further research will examine the effects of knockdown or suppression of IL-13 and IL-15 gene expression on pulpal inflammation and determine if pulpal inflammation and expression of other pro- and anti-inflammatory cytokines are disrupted.

314 Characterizing Candidate Allorecognition Genes in Botryllus schlosseri, DARYL A. TAKETA*, ADAM D. LANGENBACHER, DELANY RODRIGUEZ, ALLISON B. ANDRASKI, KEVIN J. YOUNG, LIVIU CENGER, MICHAEL A. TRIBINO, KATHARINA R. CLORE-GRONENBORN, and ANTHONY W. DE TOMASO (Department of Molecular, Cellular and Developmental Biology, University of California Santa Barbara, Santa Barbara, CA 93106; daryl.taketa@lifesci.ucsb.edu).

Botryllus schlosseri is a colonial tunicate where allorecognition, the ability to distinguish self from non-self, is dependent upon a single highly polymorphic locus
called the fusion/histocompatibility (fuhc). Only individuals sharing at least one allele of fuhc are able to fuse with one another forming a vascular chimera. In the fuhc locus, two candidate genes, cfuhcα and cfuhcβ, have been identified as the putative ligands and interestingly is separated by only 227 base pairs. Two additional genes in allorrecognition, fester and uncle fester, have been identified in previous work as putative receptors based on knockdown and interfering monoclonal antibody experiments. These two genes have 50-60% homology with one another at the carboxyl-terminal and play a role in fusion and/or rejection. Our current working hypothesis is that one or both of the cfuhc acts as the ligand for the fester family receptors. This model is analogous to the missing-self recognition of vertebrate Natural Killer cells where recognition of self allows the target cell to live while cells missing the self-marker will result in death. Recently, two additional candidates in the fuhc locus have been reported, hsp40-l and bhf (Botryllus histocompatibility factor), but their roles in allorrecognition have also not been characterized well. We are currently assessing the molecular function(s) of each gene in allorrecognition using a variety of tools such as tissue culture based assays, recombinant proteins, and antibodies.

315 Changes in Glutamatergic and GABAergic Receptor Subunits in a Rodent Model of Post-Traumatic Stress Disorder. JOSE CATALAN*, EDWARD MEYER, and IGOR SPIGELMAN (1Howard Hughes Medical Institute Pre-College Science Education Program, UCLA School of Dentistry, 10833 Le Conte Ave., 63-078 CHS Los Angeles, CA 90095; 2UCLA School of Dentistry, 10822 Le Conte Ave., 63-078 CHS, Los Angeles, CA 90095; catalan_jose95@yahoo.com).

Each year about 7.7 million American adults are diagnosed with post-traumatic stress disorder (PTSD). This debilitating disorder causes patients to experience nightmares, trouble sleeping, and abuse with either alcohol or drugs. Understanding changes in the brain following a traumatic event will help lead to future treatments for PTSD. Through using the stress-enhanced fear learning (SEFL) rat model, which mimics many aspects of PTSD, we examined changes in neurotransmitter receptors. Our research focused on the basolateral amygdala (BLA) due to it being the fear center of the brain. Objective: Identify changes in Glutamatergic & GABAergic receptor subunits in the BLA and compare expression levels between SEFL and control rats. Methods: Western Blots were performed after the BLA tissue was removed from both SEFL and control animals in order to probe and compare GABAergic receptor subunits α2 and α3, as well as Glutamatergic receptor subunits GluA1 and GluA2. Proteins were separated by size through PAGE gel electrophoresis, and Western blots were made. Protein bands were digitally captured then analyzed for statistical significance between both specimens. Results: There was a significant change in GLuA2 expression in SEFL rats. There was no statistical change in GluA1, α2 or α3. Discussion: This shows that SEFL conditioning triggered the change in the expression of GluA2 in the BLA of SEFL rats. Conclusion: Overall there was an increase in excitatory proteins in the BLA, which coincides with the assumption that excitatory receptors are part enhanced fear learning in the SEFL model.

316 Cardiovascular Toxicity and Sympathetic Nervous System Disruption following Developmental Exposure to Organohalogen Pollutant. KURT SPURGIN*, ROBERTO GUTIERREZ, ALEXANDER PRIEN, and MARGARITA CURRAS-COLLAZO (Department of Cell Biology and Neuroscience, University of California, Riverside, 900 University Ave., Riverside, CA 92521, 760-578-5651; kurtspurginde@gmail.com).

We have shown that developmental exposure to polybrominated diphenyl ethers (PBDEs) exaggerate pressor responses to osmotic challenge. We hypothesized that this response could be due to dysregulation of the sympathetic nervous system (SNS). Dams were dosed with PBDE or oil vehicle. Adult offspring received hyperosmotic or normosmotic injection with or without ganglionic blockade (GB). Blood pressure was monitored 3 hours post-challenge. Hyperosmotic treatment increased systolic pressure in PBDE-dosed animals compared to hyperosmotic controls (22.59 ± 3.08 vs. 1.53 ± 2.25 % Δ baseline, n=10; p<0.001). GB partially but significantly reduced pressor responses in hyperosmotic PBDE-exposed rats (13.89 ± 1.54 vs. 22.59 ± 3.08 % Δ baseline n=10; p<.05). Markers of SNS activity in were evaluated via qPCR for catecholamine synthesizing enzymes, tyrosine hydroxylase (TH) and phenylethanolamine N-methyltransferase (PNMT) in the adrenal glands. Under hyperosmotic conditions, PBDE treatment significantly prevented the rise in TH mRNA levels as compared to hyperosmotic control animals (TH: 0.51 ± 0.17 vs. 2.35 ± 0.68, n=8; p<.05). PBDE under normosmotic conditions significantly decreased expression of TH and PNMT compared to oil-dosed controls, respectively (TH, 0.34 ± 0.05 vs. 1.09 ± 0.27, n=8; p<0.05; PNMT, 0.26 ± 0.04 vs. 1.01 ± 0.06, n=8; p<0.0001). Ganglionic blockade had no further effect on hyperosmotic TH mRNA levels in PBDE rats. In contrast, ganglionic blockade blunted PNMT mRNA levels PBDE rats vs. oil-dosed controls (0.62 ± 0.13 vs. 1.63 ± 0.51, n=10; p<0.05). Results suggest that developmental exposure to PBDEs elevates blood pressure, in part, by increased activation of SNS.

317 Collagen Related Proteins Can Modulate the Invasive Ability of Filifactor alocis. OZIOMA CHIOMA*, ARUNI WILSON, YUETAN DOU, and HANSEL M. FLETCHER (Division of Microbiology and Molecular Genetic School of Medicine, Alumni Hall Room 114, 24941
**ABSTRACTS – Posters**

**F. alocis** a Gram-positive, assacharolytic, obligate anaerobe is now reported to be associated with severe periodontitis. Our preliminary data using transcriptome and proteome approaches suggest that Microbial surface components recognizing adhesive matrix molecules (MSCRAMMs) such as collagen and fibronectin were in high abundance in *F. alocis* during co-infection of epithelial cells with *P. gingivalis*. We tested the hypothesis that these proteins; hypothetical protein (HMPREF0389_01750), collagen adhesin protein (HMPREF0389_01006) and Protease (HMPREF0389_00122) of *F. alocis* can play a role in colonization, adhesion and destruction of host tissue. Domain architecture and Protein modeling showed collagen binding domains, as well as characteristic interactive domains in all the three proteins. The isogenic defective mutants, generated using overlapping extension PCR technique showed white colonies in contrast to small translucent wild type colonies. In addition to reduced growth in the mutants under normal conditions, the collagen adhesin protein (HMPREF0389_01006) deficient mutant exhibited beta- hemolysis, compared to the wild-type *F. alocis* ATCC 35896 strain. There was no variation in growth of the mutants during oxidative stress compared to the wild type; however, co-culture of *F. alocis* strains enhances the growth of *P. gingivalis* under oxidative stress conditions. There was a decrease in the ability of collagen adhesin protein (HMPREF0389_01006) and Protease (HMPREF0389_00122) deficient mutants to invade epithelial cells. Biofilm formation was increased in Protease (HMPREF0389_00122) deficient mutant. Our observations, taken together, suggest that collagen related proteins of *F. alocis* can modulate its invasive ability of epithelial cells and may be important virulence factors.

318 **Low Level Laser Therapy and Malignant Cells: A Pilot Systematic Review**, MOOLDO MADRESHKEVARY1, SAJJAD ASHNAGAR2, ROMINA MADRESHKEVARY*, and POOYAN SADR-ESHKERI4 (1Queen Mary University; London, UK, m_sadr88@yahoo.co.uk; 2Students Scientific Research Center, School of Dentistry, Tehran University of Medical Sciences (TUMS), Tehran, Iran, Sajjadashma@yahoo.com; 3University of California, Los Angeles Extension, Los Angeles, CA USA, rominaa.sadr@gmail.com; 4School of Dentistry, University of California, Los Angeles, CA USA, psadr@ucla.edu).

**Background:** Premalignant lesions or undiagnosed lesions may be irradiated during the use of Low Level Laser Therapy (LLLT) in the treatment of a variety of diseases and disorders. Understanding of this effect will determine the safety of use of LLLT in patients with tumours or a history of malignancies. The objective of this report is to critically analyse the studies that are available on the effect of LLLT on malignant cells. **Materials and methods:** PubMed and Web of Knowledge were searched using the keywords lasers and malignancy. Excluded were reports on laser photodynamic therapy, laser chemotherapy, etc. **Results:** A total number of 8 publications, 8 in-vitro and one in-vivo, have been systematically retrieved and reviewed. Diode, Lambda, and GaAlA were among the mostly studied laser types. HEP2-HEPG2 and melanomas were among the mostly studied cell lines. Due to varying parameters of laser, wavelength/dose combinations, cell lines, experimental conditions and the lack of standardization of experiments and the lack of understanding regarding the subcellular effects of LLLT, making comparisons and conclusions have been made highly challenging. **Conclusion:** the effect of LLLT on malignant cells remains controversial. Further investigations should be made to achieve better understanding of the effect of LLLT on tissue and cellular levels.

319 **Astrocytic Localization of Supraoptic Serine Racemase and its Potential Participation in NMDA-stimulated Vasopressin Responses in Hypothalamo-Neurohypophysial Explants**, SIMON KIM1, MATTHEW VALDEZ2, JOE VALDEZ1, GWENDOLYN GONZALES1, ROBERT FERNANDEZ1, ROBERT GUITERREZ1, and MARGARITA C. CURRAS-COLLAZO1,2* (1Department of Cell Biology and Neuroscience, 2110 Biological Sciences Building, University of California, Riverside, Riverside, CA 92521; 2Neuroscience Graduate Program, University of California, Riverside, Riverside, CA 92521; mcur@ucr.edu, simonkim10@gmail.com).

We have shown that vasopressinergic magnocellular neuroendocrine cells (MNCs) express various NMDA receptor subunits including the obligatory NR1. NMDA receptors (NMDAr) mediate osmotically-induced vasopressin (VP) release from the hypothalamo-neurohypophysial system (HNS). Recently, Panatier et al 2006 revealed that D-serine is the endogenous coagonist for NMDAr in MNCs of the supraoptic nucleus (SON). Therefore, we investigated the role of D-serine in NMDAr-mediated vasopressin (VP) release from HNS explants taken from adult male C57BL/6 mice and incubated in a perfusion chamber (Gregg & Sladek 1984). After a 4 hr incubation, explants were treated with 5-100 uM NMDA for 1 hr with or without SR inhibitor, L-Aspartic acid β-hydroxamate (LA-βH; 3 mM). We found that NMDAr-mediated VP release was reduced by LA-βH, indicating a requirement for D-serine. Immunoblotting for SR immunoreactivity (ir) in green and glial fibrillary acidic protein (GFAP) or glial excitatory amino acid transporter GLT-1 labeled with red ir showed colocalization in rat SON (yellow). Other rats were injected with Evans Blue (EB), which retrogradely labels VP and oxytocin-producing MNCs projecting to the posterior pituitary with red fluorescence (excitation/emission maxima ~540/680 nm). SR ir was examined under hyperosmotic (3.5M NaCl) or normosmotic conditions (0.9% NaCl; 0.6cc/100g bw, i.p.). EB-positive
MNCs showed little or no SR ir, which was redistributed in hyperosmotic animals. We hypothesize that a significant proportion of SR is expressed in astrocytes and that D-serine gliotransmission contributes to VP responses in SON MNCs. Supported by APS fellowships (JV, MV), Sigma Xi and MARC U* STAR (GG, RF, RG).

320 Vitamin D and Resveratrol: A Fountain of Youth in Gene Regulation, MARFYA S. SABIR1*, ZAINAB KHAN1, MICHAEL A. GALLIGAN1, ANGELIKA DAMPF-STONE1, G. KERR WHITFIELD2, MARK R. HAUSSLER1, and PETER W. JURUTKA12 (1Mathematical and Natural Sciences, Arizona State University, 4701 W. Thunderbird Rd., Glendale, AZ 85306; 2Basic Medical Sciences, University of Arizona College of Medicine, 550 E. Van Buren St., Phoenix, AZ 85004; msabir@asu.edu).

The 1,25D-VDR-RXR heterocomplex modulates transcription in vitamin D target tissues and regulates epithelial cell proliferation/differentiation/chemoprevention. The significance of 1,25D in health stresses the importance of elucidating the molecular signaling network by which 1,25D and putative VDR modulators, such as resveratrol (Res), an antioxidant, regulate gene expression. Res functions as a potent activator of sirtuin-1 (SIRT-1), a deacetylase protein associated with longevity in animal models. This study employed mammalian-two-hybrid (M2H) and VDRE-based transcriptional assays to investigate the potential effects of Res/SIRT-1 on VDR signal transduction. Results from VDRE-based assays indicate that Res and SIRT-1 can potentiate 1,25D-VDR activity. Additionally, 1,25D displacement experiments reveal an increase in VDR-bound 1,25D only in the presence of Res, suggesting Res may increase VDR transactivation by stimulating 1,25D binding. M2H assays in HEK-293 cells were utilized to examine levels of physical interaction between VDR and VDR comodulators, including RXR, SRC-1, and DRIP-205. The results indicate Res and SIRT-1-mediated stimulation of VDR-RXR and VDR-SRC-1 association. The specificity of SIRT-1 action towards other nuclear receptors was probed, and only VDR and ER exhibited SIRT-1 stimulation. A specific SIRT-1 inhibitor, EX-527, was used to suppress endogenous SIRT-1 levels resulting in decreased VDR transactivation. To analyze the acetylation status of VDR, the activity of a non-acetylatable VDR mutant, K413R, was probed in VDRE assays. Significantly, K413R demonstrated amplified transactivation in contrast to wild-type VDR. In summary, this study illuminates the coordinated interaction between two nutritionally-derived lipids, vitamin D and resveratrol, thereby identifying a link between 1,25D-VDR signaling and SIRT-1 function.

321 Identification of Toxicants In Cinnamon-Flavored Electronic Cigarette Refill Fluids, RACHEL Z. BEHAR, BARBARA DAVIS*, YUHUAN WANG, VASUNDHRA BAHL, SABRINA C. LIN, and PRUE TALBOT (Department of Cell Biology and Neuroscience, University of California, Riverside, 900 University Ave., Riverside, CA 92521; rbha001@ucri.edu, bdavi014@ucr.edu, yuhuan_wang@yahoo.com, bahl.vasu@gmail.com, sabrina.c.lin@gmail.com, talbot@ucr.edu).

Electronic cigarettes (EC), which are gaining popularity worldwide, do not produce the numerous chemicals found in conventional cigarette smoke, suggesting that EC are safer than conventional cigarettes; however this has yet to be fully tested. Cinnamon Ceylon (CC), an EC refill fluid (RF), was previously found to be highly cytotoxic on in vitro models. The purpose of this study was to determine if high cytotoxicity is a general feature of cinnamon-flavored EC RFs and to identify the toxicant(s) in CC. Nine additional cinnamon flavored RFs were screened using the MTT assay to determine their cytotoxicity on human embryonic stem cells (hESC) and human pulmonary fibroblasts (hPF). The chemical composition of CC was determined using GS-MS, and authentic standards of the identified chemicals were then tested to establish the potency of each. HPLC was used to quantify the amount of each potent chemical in cinnamon-flavored refill products, and correlations were made between the concentrations of potent chemicals and the cytotoxicity of each product. Of the four chemicals identified, dipropylene glycol and vanillin were minimally cytotoxic, whereas cinnamaldehyde and 2-methoxycinnamaldehyde were cytotoxic. Moreover, the nine RFs screened were generally highly cytotoxic to hESC and hPF. These data indicate that cinnamon flavorings used by manufacturers of EC RFs pose possible health hazards for users and that studies involving cytotoxicity testing of EC products are crucial for global health and safety.

322 qPCR Analysis of Gene Expression in Salivary Glands of NOD Mice Treated by Bone Marrow Cells, BARAKA GATHER1*, JACQUELINE GARCIA1*, RAMIN RABII2, and SHEN HU2 (1Howard Hughes Medical Institute Pre-College Science Education Program, UCLA School of Dentistry, 10833 Le Conte Ave., 63-078 CHS Los Angeles, CA 90095; 2UCLA School of Dentistry, 10822 Le Conte Ave., 63-078 CHS, Los Angeles, CA 90095; kid12gathere@yahoo.com, jackie.k.garcia@gmail.com).

Introduction: Sjögren’s syndrome is an inflammatory autoimmune disease that causes the immune system to attack the exocrine glands that produce saliva and tears. Objective: Test the treatment of Sjögren’s syndrome to determine if the treatment results in coercing moisture-producing glands to produce more amylase and reduce the genetic expression of inflammatory genes. One of the more successful treatments for this syndrome is hematopoietic stem cell transplantation (HSCT). HSCT is the transplantation of multiple hematopoietic stem cells or blood. Methods: We transcribed 5 samples of mRNA from a NOD mouse into cDNA using a Thermal Cycler 480 machine. Three of the samples coded for primary Sjögren’s with the gene, Sjögren’s syndrome antigen B no
poly a. After that, we took the samples and placed the wells into a 750 fast real-time PCR system and ran a program that would track the changes of the cDNA. **Results:** Proteins like Parotid secretary protein (PSP) which help produce saliva were up regulated, while detrimental proteins like Sjögren syndrome antigen (SSA) were down regulated. **Conclusion:** We had a reference gene, which we labelled as Sample 2, and we compared and contrasted our other samples to attain our results. Two samples matched our hypothesis; but another sample showed a decrease in amylase and a different sample showed an increase in the sss antigen. **Discussion:** We found that the treatment is effective due to inhibiting inflammation while also improving the regeneration and differentiation of salivary gland cells.

**323 A Comprehensive Comparison Between RNA-Seq and Microarray for Transcriptomic Profiling.** CHARLES WANG, BINSHENG GONG, PIERRE R. BUSHEL, VICTOR RUAN, JEAN THIERRY-MIEG, DANIELLE THIERRY-MIEG, JOSHUA XU, HONG FANG, HUIXIAO HONG, LEMING SHI, SCOTT AUBERBACH, and WEIDA TONG (1 Center for Genomics, and Division of Microbiology and Molecular Genetics, School of Medicine, Loma Linda University, Loma Linda, CA 92350, chwang@llu.edu; 2 Division of Bioinformatics and Biostatistics, National Center for Toxicological Research, Jefferson, AR 72079; 3 Microarray and Genome Informatics Group, National Institute of Environmental Health Sciences, RTP, NC 27709; 4 National Center for Biotechnology Information, National Library of Medicine, National Institutes of Health, Bethesda, MD 20892; 5 Center for Pharmacogenomics, Schools of Life Sciences and Pharmacy, Fudan University, Shanghai, China, 200433; 6 National Toxicology Program, National Institute of Environmental Health Sciences, RTP, NC 27709; chwang@llu.edu).

Next-generation sequencing technologies have revolutionized the genomic research and allow the genome and transcriptome of any organism to be explored without a priori assumptions and with unprecedented throughput. Compared to microarrays, RNA-Seq is able to provide single-nucleotide resolution, strand specificity, and short-range connectivity through paired-end sequencing. However, emerging transcriptomics technologies should be evaluated by ways in which they create opportunities to advance the understanding of complex biological systems. An extensive and systemic investigation based on a comprehensive study design was performed to investigate the strengths/weaknesses and comparability of the two platforms in biologic elucidation. RNA extracted from livers of rats exposed to many agents eliciting a broad range of transcriptional response, comprised of seven modes of action (MOAs) with varying degree of biological complexity, was used to profile gene expression using Illumina RNA-Seq and Affymetrix microarrays and to assess concordance. We found that RNA-Seq detected more differentially expressed genes (DEGs) than microarray and hence enriched more biological pathways. The cross-platform concordance in terms of differentially expressed genes (DEGs), enriched pathways, or modes of action is highly correlated with treatment effect size, gene-expression abundance, and the biological complexity of the mode of action.

**324 Understanding Promiscuous Efflux Functions of MDR Transporters with Guidance from Evolution.** TUFAN GOKIRMAK, JOSEPH P. CAMPANALE, LAUREN E. SHIPP, GARY W. MOY, and AMRO HAMDOUN (Scripps Institution of Oceanography, University of California, San Diego, 8750 Biological Grade Rd., La Jolla, CA 92037; tgokirmak@uscd.edu).

Multidrug resistance (MDR) transporters are polyspecific ATP-binding cassette (ABC) plasma membrane proteins that efflux a wide variety of structurally diverse compounds. Active transport of drugs out of tumor cells by MDR efflux transporters ABCB1, ABCB1, ABCC2, and ABCG2, is the major mechanism of acquired drug resistance in tumors. In addition, MDR transporters are the first line of defense that limits the bioaccumulation of environmental toxins. A clear structural understanding of how MDR transporters interact with their substrates is essential for rational design of novel therapeutics and environmentally safe synthetic chemicals. We recently showed that promiscuous efflux functions of MDR-type ABC transporters are conserved from sea urchin to human (spanning ~540 million years). Because high-resolution crystal structures are not available for every clinically important MDR transporter, we adopted an evolution guided mutagenesis approach to understand substrate-transporter interactions. We discovered that as few as two residues in the drug-binding pocket can determine the stereo-selective binding of substrates to the transporters. Current efforts focus on determining the conserved residues in the MDR transporter drug-binding pocket across deuterostomes. Of special interest is identification of residues responsible for the promiscuous efflux function of transporters using site directed mutagenesis. This research will broaden our knowledge of the basis of substrate-transporter interaction and help in the design of better drugs that will not be effluxed from cancer cells and green chemicals that will not bioaccumulate.

**325 Metabolic Effects of Soybean Oil and Fructose in Female Mice.** ANTONIA RIZO, FRANCES SLADEK, POONAMJOT DEOL, and JANE EVANS (Department of Cell Biology and Neuroscience, University of California, Riverside, 900 University Ave., Riverside, CA 92521; arizo001@ucr.edu).

Consumption of soybean oil in the U.S. has increased, from 0.01 kg/capita/year in 1909 to 11.6 kg in 1999, a 1000-fold increase; soybean oil consists of 50-60% linoleic acid (LA), so the energy intake from LA has increased from 2%...
326 IFN-gamma and IL-10 Production by NK Cells Cultured with Probiotics, SCARLETT PLANTILLAS¹*, THAIS HOGARTH¹*, HELEN TSENG², and ANAHID JEWETT² (¹Howard Hughes Medical Institute Pre-College Science Program, UCLA School of Dentistry; ²Wientraub Center, UCLA School of Dentistry, Box 951668, Los Angeles, CA 90095; scarlettplantillas@gmail.com, thaishogarth@gmail.com).

Annually 12.7 million individuals are diagnosed with oral cancer in the United States. Natural Killer (NK) cells are cytotoxic lymphocyte white blood cells, which function in selection and differentiation of stem cells and play key roles in regulation of inflammation and regeneration. Objective: Investigate and compare how the addition of bacteria to NK cells will affect levels of differentiation and regeneration. Methods: ELISAs were performed to record and compare NK cell secretions of IL-10 and IFN-gamma after exposure to 6 different probiotic strains: AJ1, AJ2, short AJ2 (sAJ2), AJ3, and VSL3. Results: NK cells treated with the probiotic AJ2 resulted in the most secretion of IL-10. In bacteria-treated cells, IL-10 secretion rose, while IFN-gamma decreased. These results are contrary to the lab’s original results that show NK cell treatment with Bifidobacterium longum produced the highest level of IL-10 secretion. In untreated cells, IFN-gamma was higher and IL-10 was lower. Discussion: Bacteria-treated NK cells expressed higher levels of anti-inflammatory cytokines than untreated cells. Conclusion: Secretion of more IL-10 and less IFN-gamma may result in augmented induction of NK cell anergy or the change in phenotype of NK cells. This will potentially lead to differentiating more stem cells and increasing resistance against cancerous cells. Hypothetically, more resistance will result in higher cytotoxic levels in NK cells. If proven, future research will translate this hypothesis into in vivo mouse studies.

327 Adverse Metabolic Effects of a Soybean Oil Diet, CYNTTHIA PEREA*, JANE EVANS, POONAMJOT DEOL, and FRANCES SLADEK (Department of Cell Biology and Neuroscience, University of California, Riverside, 900 University Ave., Riverside, CA 92521; cpere027@ucr.edu).

Linoleic acid (LA) is an essential fatty acid and a precursor to arachidonic acid, which is a key player in obesity and diabetes, but the role of LA in the current obesity epidemic is not well understood. To investigate effects of LA on obesity, we designed a series of isocaloric diets that are moderately high in saturated fats (40% kcal total fat) with or without supplementation of soybean oil to achieve 2% kcal LA (HFD) or 10% kcal LA (LA-HFD). Previous preliminary studies showed that the first-generation C57/BL6 mice on LA-HFD had increased weight gain and insulin insensitivity as compared to the low-LA HFD. To determine if the obesogenic effects of LA are trans-generational, female mice on LA-HFD, HFD or vivarium chow (VC) were mated with VC males. Pups born from these dams were weaned on to LA-HFD, HFD, or VC. Pups born to LA-HFD moms had higher lean weights, than pups born to HFD or VC fed moms. However, as the pups matured, pups born to LA-HFD moms started gaining more weight relative to other two groups, with the difference reaching statistical significance at week 14. There was no difference in the mice food consumption. Results suggest that pre-natal exposure to a HFD may predispose mice to obesity, but putting these mice on the healthy VC can offset this effect in mice born to moms that consumed soybean oil HFD. Mice born to moms fed soybean oil enriched HFD may be at risk of developing obesity.

328 TRPV1 Channel Activity Triggered by Hypersmotic Stimulation Increases Phosphorylated NOS Activity in Rat Supraotic Slices, ANDRANIK KHACHATUROV*, SHAWNT TOSONIAN, CHRISTY BEITZEL, and MARGARITA CURRAS-COLLAZO (Department of Cell Biology and Neuroscience, University of California, Riverside, 900 University Ave., Riverside, CA 92521; Andranik. Khachaturov@ucr.edu).

Magnocellular neuroendocrine cells (MNCs) in the supraoptic (SON) and paraventricular nucleus (PVN) of the hypothalamus release vasopressin (VP) from axons and somata/dendrites in response to hypersmotic stimulation. Transient receptor potential vanilloid 1 (TRPV1) channels have mechanosensory properties that may participate in osmosensory transduction and/or axonal neurosecretion in SON MNCs. Our lab has shown that osmotic-stimulated somatodendritic VP responses occur in a TRPV1- and
NOS-dependent manner. Since TRPV1 activation may result in NO production, our current study examined the interaction between TRPV1 and NO synthase (NOS) under hyperosmotic conditions. Acutely dissected SON slices were prepared from adult male Holtzman rats and perfused with sucrose-enriched aCSF under deep anesthesia. Slices were treated with hyperosmotic stimulation in the presence and absence of TRPV1 antagonist SB366791 (1.5 μM) and later post-fixed. Slices were immunoprobed for phosphorylated stimulatory residue of neuronal NOS (p-nNOS ser1412) and combined VP-neurophysin (PS41) and oxytocin-neurophysin (PS38). We found elevated p-nNOS immunoreactivity in MNCs under hyperosmotic conditions but not always in the presence of SB366791, suggesting that TRPV1 activity may lead to NOS activation. By analogy to other neuroendocrine systems p-nNOS ser1412 may participate in neuropeptide secretion perhaps by coupling with NMDAr on MNCs.

329 Effect of Interleukin 4 on Oral Cancer Stem Cells, OLUFUNMILOLA ODUFALU*, OLUTOBI JEKA-INFIA*, NICOLE RIGAS2, and KI-HYUK SHIN2 (1Howard Hughes Medical Institute Pre-College Pipeline Program, UCLA School of Dentistry, 10833 Le Conte Ave., 43-009 CHS, Los Angeles, CA 90095; 2UCLA School of Dentistry, 10833 Le Conte Ave., 43-009 CHS, Los Angeles, CA 90095; lodufalu@sbcglobal.net, tobijek@gmail.com).

Oral cancer has been known to cause more than 7,000 deaths a year in the US alone. Cancer stem cells have the ability to proliferate and a high rate of tumorigenicity, making them a primary cause of malignant tumors and recurrences. “Cancer Stemness” refers to this ability. Interleukin 4 is a cytokine that induces differentiation and has been shown to have positive effects on the growth, migration, and differentiation of several cell types found in tumors, especially cancer stem cells. **Objective:** To investigate the effect of IL-4 on cancer stemness in oral cancer stem cells. **Methods:** Tumor sphere assay was performed to determine whether IL-4 had a significant impact on the cell lines SCC4, SCC9/TNFα, and BapT when compared to the control tumor spheres. The treated tumor spheres were compared to the control in size, number, and shape. Quantitative PCR was used to analyze the molecular effects of IL-4 on the cancer stem cells. **Results:** IL-4 has an effect on the cancer stem cell proliferation both physically and molecularly. IL-4 increased oral cancer stem cell survival through tumor growth, increased mRNA levels of cancer stem cell markers, and upregulated FGF4 expression in cancer stem cells. **Discussion:** IL-4 is allowing cancer stem cells to rapidly reproduce and create new tumors with the help of FGF4. **Conclusion:** These results show IL-4 is involved in keeping cancer stem cells alive post-chemotherapy. Future studies based on this understanding include observing how IL-4 upregulates FGF4 expression in oral cancer and discovering new ways to block IL-4.

330 Toxicology-in-a-Dish: Using In Vitro Stem Cell Models to Predict Health Defects Due to Cigarette Smoke Exposure, SABRINA C. LIN*, RATTAPOL PHANDTHONG, NIKKI WENG, BRENDA MONTES, and PRUE TALBOT (UCR Stem Cell Center and Department of Cell Biology and Neuroscience, University of California, Riverside, 400 University Ave., Spieht Hall 2313, Riverside, CA 92521; Sabrina.c.Lin@gmail.com, rphan005@ucr.edu, jweng002@ucr.edu, bmont005@ucr.edu, talbot@ucr.edu).

Human embryonic stem cells (hESC) are a valuable model for identifying environmental toxicants that harm prenatal development. This study uses a “toxicology-in-a-dish” approach to determine how sidestream (SS) smoke, which burns off cigarette tips, affects embryonic and adult cells. hESC, mouse neural stem cells (mnESC), and human pulmonary fibroblasts (hPF) were used because: (1) embryos are often sensitive to environmental toxicants, (2) brain development is susceptible to smoke exposure, and (3) the lung is a target of inhaled smoke. Dose response MTT attachment/proliferation assays determined that hPF were more sensitive than stem cells and that harm reduction and conventional products were equally potent. Oxyblot protein oxidation detection showed that hPF proteins were oxidized by 2 hours of exposure, while stem cell proteins were not affected until 24 hours, suggesting that stem cells regulate reactive oxygen species (ROS) more efficiently than fibroblasts. Endpoints examined using time-lapse imaging included: (1) morphology, (2) ROS production, and (3) motility. SS smoke caused sporadic hESC colony migration, inhibition of mnESC gap closure, and attenuation of attached hPF. All cell types exhibited contraction during treatment. These results suggested that smoke negatively affected the cytoskeleton, a known target of ROS. ROS production was elevated in hESC and hPF, and formation of vacuoles indicated elevated cellular stress. Immunohistochemistry and western blot experiments confirmed that SS smoke depolymerized and degraded actin and tubulin. Using a “toxicology–in-a-dish” approach, we demonstrated that SS smoke adversely affects cell morphology and behavior, and can interfere with dynamic processes important to development.

331 Lyve1 Distinguishes Yolk Sac Myelo-erythroid Progenitor Wave from Primitive Hematopoiesis, YEON JOO KIM*, LYDIA LEE, and HANNA MIKKOLA (615 Charles E. Young Drive South, Biomedical Science Research Building 457, Los Angeles, CA 90095; rladuswn7@yahoo.com).

Hematopoietic stem cells (HSCs) are self-renewing
multipotent cells are capable of differentiating into progenitors of all blood cell types. Embryonic hematopoiesis occurs in three waves that overlap spatially and temporally: Primitive (red blood cells and macrophages), transient-definitive (erythro-myeloid progenitors, EMPS), and definitive (multipotent, self-renewing HSCs). Understanding the divergence in regulation of these various hemogenic precursors is critical in developing in vitro transplantable HSCs for leukemic patients. However, current research is hindered by inability to purify the diverse precursor populations. Through conditional targeting strategies, we identified the lymphatic vascular endothelial receptor 1 (LYVE1) as a differential marker of the transient-definitive and definitive waves.

To characterize LYVE1 expression, we developed a lineage tracing model (Lyve1-eGFP-hCre; Rosa26-YFP), where the progeny of LYVE1-expressing cells are distinguishable by YFP. The cultured hemogenic organ explants in OP9 and OP9DL1 differentiated into lymphoids, erythroids, and myeloids; analyses by flow cytometry and colony forming assays demonstrated that EMPs and subset of HSCs express LYVE1. Yolk sac transient-definitive wave robustly expresses LYVE1, and the lineage-traced progenitors initiate fetal liver hematopoiesis. In contrast, LYVE1 lineage does not label primitive erythropoiesis, as confirmed by immunostaining and absence of primitive erythroid defect in Lyve1-eGFP-hCre; Sel-/- embryos. Our data indicate that the divergence of the two waves from mesoderm must occur prior to formation of LYVE1+ hemogenic endothelium. Currently, we are further investigating LYVE1 marking of transient-definitive versus definitive hematopoiesis. Our findings provide a new model to selectively study the EMPs that ultimately seed the fetal liver and give rise to self-renewing HSCs.
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