PROCEEDINGS of the
AMERICAN ASSOCIATION for the ADVANCEMENT of SCIENCE
PACIFIC DIVISION

Volume 31, Part I **24 June 2012**

93rd ANNUAL MEETING

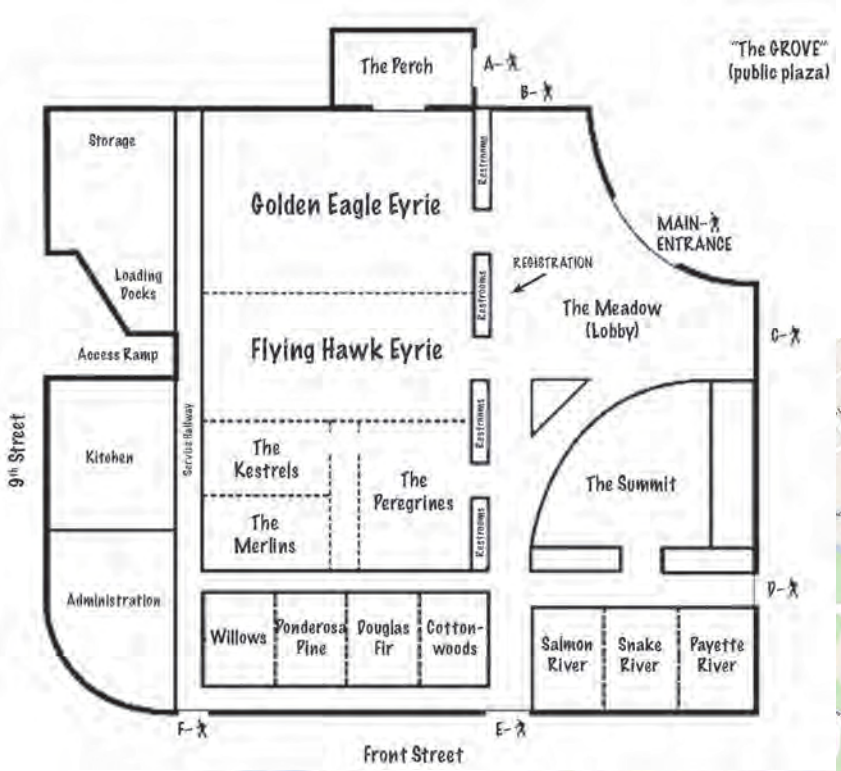
PROGRAM with ABSTRACTS

Boise Centre on the Grove
Boise State University
Boise, Idaho
24 – 27 June 2012

BOISE STATE UNIVERSITY

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

SIGMA XI
THE SCIENTIFIC RESEARCH SOCIETY

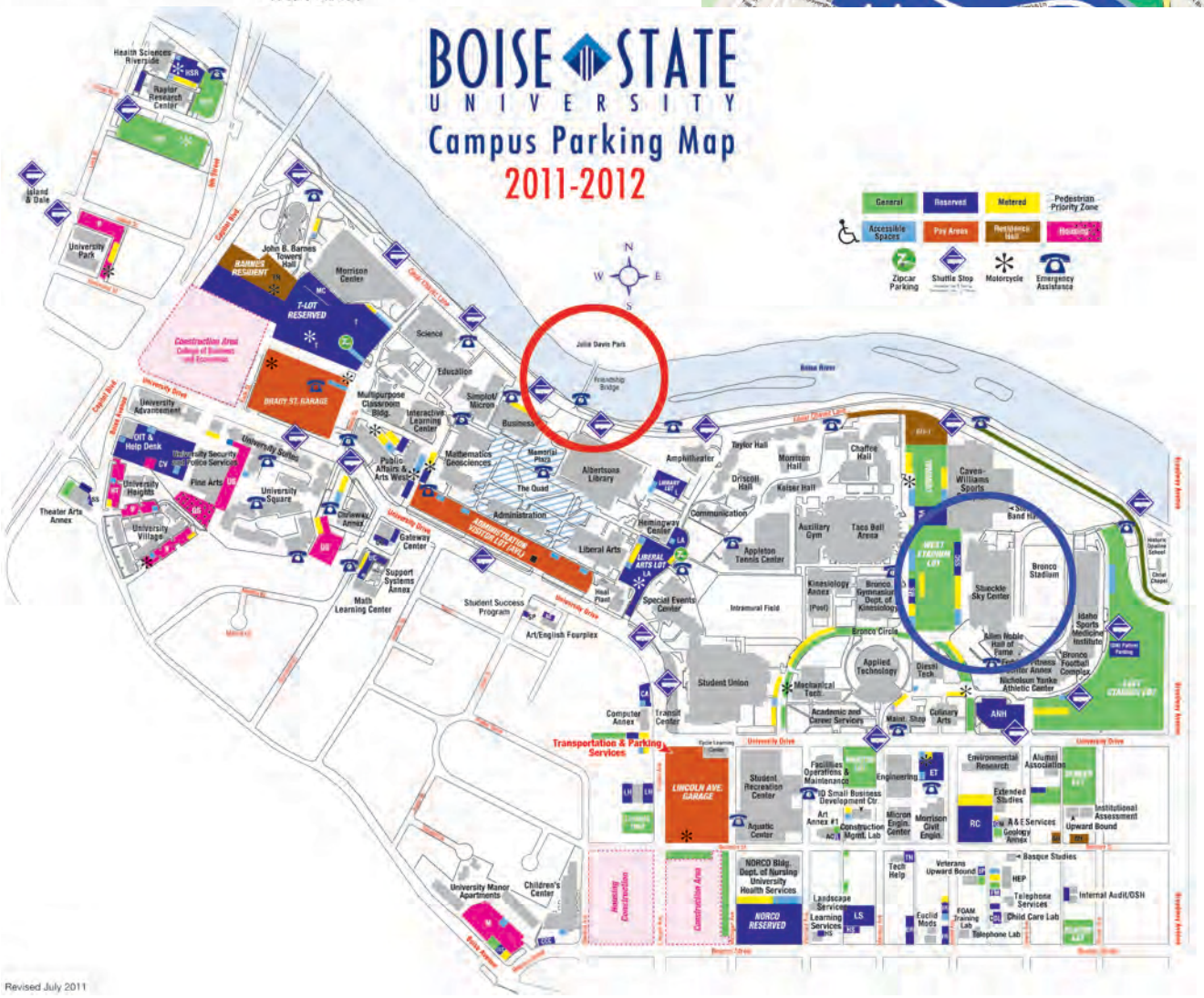


Maps

Upper Left: Boise Centre on the Grove room locations.

Upper right: Boise Centre (red square) in relation to Julia Davis Park (green) and Boise State University (blue).

Lower: Boise State University. Friendship Bridge is circled in red. Stueckle Sky Center is circled in blue.



PROCEEDINGS
of the
Annual Meeting
of the
AAAS, PACIFIC DIVISION

Volume 31, Part I ***24 June 2012***

PROGRAM with ABSTRACTS

93rd Annual Meeting of the Pacific Division of the American Association for the Advancement of Science

co-located with the

67th Annual Meeting of the Northwest Regional Meeting of the American Chemical Society (NORM 12)

Boise Centre on the Grove
Boise, Idaho
24 – 27 June 2012

Contents accurate as of 1 June 2012.
Times and/or locations of events may change.
Please refer to the "Changes" flyer for updated information.

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

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Publication
Publication of symposia or other technical sessions or talks that have been prepared under the auspices of the AAAS, Pacific Division requires written permission of the AAAS, Pacific Division as well as that of the individual organizers and speakers.

Video and/or audio taping of any session or parts thereof for commercial purposes is not permitted without prior approval from the speakers, organizers and AAAS, Pacific Division.

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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.

No Smoking Rule
On December 30, 1971, the AAAS Council approved a motion requesting that persons in attendance refrain from smoking at Council meetings and scientific and public sessions. The AAAS, Pacific Division ascribes to this policy and asks that all persons who attend the meeting comply with this ruling.

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 13 of these *Proceedings*.

Assembled and edited by Roger G. Christianson. Co-edited by Angela R. Christianson.
Front Cover: Bruneau Dunes. Photo by Jason Lugo – Courtesy SouthernIdahoLiving.com
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Web
www.cityofboise.org/mayor

June 24, 2012

Dear friends:

It gives me great pleasure to welcome back to Boise the American Association for the Advancement of Science Pacific Division (AAASPD) and the regional American Chemical Society (ACS-NORM) for your 2012 joint meeting. The capital city is pleased to again be the site for this important event. We look forward to being your host for this week as you discuss issues of such vital importance to our nation and our planet.

Boise lies at the heart of one of the fastest-growing metropolitan areas in the country, and for good reason. Natives and long-time residents know what makes our city unique: our picture-postcard-perfect foothills, with its miles of hiking and mountain-biking trails; the Boise River, one of the cleanest urban streams in the nation, and the 25-mile-long greenbelt that runs alongside; our diverse and attractive neighborhoods; a thriving arts and cultural community; and some of the most varied outdoor recreation opportunities in the nation right in our backyard.

Add a top-ranked public school system, the academic excellence of Boise State University, and a welcoming business climate, and it's no wonder Boise is making the headlines from coast to coast. We can also lay claim to the most important asset of all: creative, caring people working together to make sure Boise is the most livable city in the country.

I hope your conference is both enjoyable and a professional success. On behalf of the residents of the "City of Trees," we are happy to have you as our guests.

Sincerely,

David H. Bieter
Mayor

BOISE STATE UNIVERSITY
Office of the President
1910 University Drive Boise, Idaho 83725-1000
phone 208-426-1491
fax 208-426-3779
http://www.boisestate.edu

June 1, 2012

Dear Conference Attendees:

On behalf of Boise State University, welcome to the 93rd annual meeting of the American Association for the Advancement of Science, Pacific Division. We extend to you our warmest hospitality as you gather in Boise — one of the most vibrant cities in America and home to Boise State University.

As a metropolitan research university, Boise State is very pleased to again host the annual AAAS meeting. We also are happy to welcome the 67th Northwest region American Chemical Society (ACS NORM), whose meetings are being held in conjunction with AAAS 2012, and whose presence certainly adds a new dimension of excitement to this annual event.

With an enrollment of nearly 20,000 students, undergraduate and graduate programs in eight colleges, and growing interdisciplinary research programs in nanotechnology, biomedicine, geophysics and other fields, Boise State is a university on the rise. Beyond our signature blue football turf, you will discover that an innovative spirit exists in many fields of study and research.

During the next five days, you will have opportunities for intellectual stimulation, cultural explorations and outdoor expeditions. From the first field trips on June 24 to the Snake River Birds of Prey National Conservation Area and a Boise River walk, through the final symposia and workshops on June 27, there will be much to see and do. We hope you will take in as much as you can, and also find time to relax and enjoy this beautiful area.

Again, we are pleased to have you in Boise and at Boise State University. Enjoy all that our campus and community have to offer!

Sincerely,

Robert W. Kustra
President

Pacific Division

AAAS

24 June 2012

Dear Meeting Attendees,

Welcome to the 93rd annual meeting of the Pacific Division of the American Association for the Advancement of Science. Our four-day gathering in Boise, the City of Trees, promises to be academically valuable in bringing together hundreds of scientists, students, and guest participants, as well as many chemists as they hold the 67th Annual Northwest Regional Meeting of American Chemical Society in conjunction with our meeting. We are especially pleased to welcome members of the Northwest Region of Sigma Xi, The Scientific Research Society, who are joining us in this meeting.

The setting of this meeting in the downtown capital of Idaho, with the capital building in view against the background of nearby mountains, adds to its ambience as a place to come and talk and speculate about our relationship to the natural world, to this and any city, and our own communities back home. The river that runs through town reminds us of the interconnections between local environments and that life flows these days according to the vagaries of climate as well as the care and protection of human beings. The balmy evenings, which allow us to stroll around the plaza and take up conversations that have begun in the meetings, add to our sense of well being as scholars, students, and citizens engaging in a search for answers as to how we can keep places like Boise and others everywhere in healthy shape. Our theme this year, "Science Informing Outcomes," precisely states what we hope this conference and conferences in many other fields will strive to accomplish—conversations that produce valuable results.

To that end, we have assembled a program that includes sixteen half-day or full-day symposia with specialist and generalist topics, as well as numerous contributed oral and poster presentations and a series of public lectures. There will be discussions of spaceflight, science-themed fiction, and the "lone wolf" Norwegian terrorist. Additional offerings include workshops on various topics and field trips that include the Boise River, the Basque Museum, Bruneau Dunes, and the study of local birds of prey, as well as instruction in fly fishing, white-water rafting, and tours of Micron Technology.

As an English professor and current president of the Pacific Division of AAAS, I urge you to seek out each other no matter what field or discipline or degree you have and engage each other in conversation and debate about what outcomes we hope science will produce. Your experience in environmentally, culturally, and intellectually rich Boise will be richer for it.

Robert L. Chianese

Robert L. Chianese, Ph.D.
President, AAAS Pacific Division

Office of the Executive Director

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Courtesy Boise Convention and Visitors Bureau

Boise Centre on the Grove

93rd Annual Meeting
of the
Pacific Division of AAAS
co-located with the
67th Annual Meeting of the Northwest Region
of the American Chemical Society (NORM 12)
Boise Centre on the Grove
Boise, Idaho
24 – 27 June 2012

GENERAL INFORMATION

PACIFIC DIVISION SECTIONS AND AFFILIATED SOCIETIES SPONSORING SESSIONS AT THE BOISE MEETING

Sigma Xi, The Scientific Research Society
Agriculture and Horticultural Sciences
Anthropology and Archaeology
Cell and Molecular Biology
Chemistry and Biochemistry
Computer and Information Sciences
Earth Sciences
Ecology, Organismal Biology and Environmental Sciences
Education (Science and Technology)
Engineering, Technology and Applied Sciences
General and Interdisciplinary
Health Sciences
History and Philosophy of Science
Mathematics
Oral Biology and Dental Medicine
Physics and Materials Science
Psychology
Social, Economic and Political Sciences

BOISE AND BOISE STATE UNIVERSITY

History of Boise[1]

Nestled on a high desert plain in the shadow of the Rocky Mountains with a pristine river flowing through its center, Boise finds its roots from the gold rush days of the 1800s.

In 1834 Fort Boise, owned by the Hudson Bay Company, was established by British fur traders. The fort, now known as Old Fort Boise, was located at the mouth of the Boise River, 40 miles from present day Boise. In 1854, due to frequent Indian

[1]Courtesy Boise Convention and Visitors Bureau


Courtesy Boise State University

Rafting on the Boise River

raids, the fort was abandoned. Despite this, the military desired to build another fort in the area, but, before this plan could go into effect, gold was discovered in the Boise Basin in 1862. It was now necessary, more than ever, to protect the vast number of travelers coming to the area.

On July 4th, 1863, the military chose a location for the new Fort Boise and construction began soon afterward. A town site was located next to the fort, and with the protection of the military, the town grew quickly. A major reason for this growth, other than the gold rush, was its location along the Oregon Trail.

The Oregon Trail was a thoroughfare for thousands of travelers heading for the Oregon Territory. Of all the western roads, the Oregon Trail was the longest at 2,020 miles. It began in Independence, Missouri and ended at Oregon City, Oregon. Its route in Idaho began at the Idaho–Wyoming border, crossed through Bear Valley, turned north toward Fort Hall and then followed the Snake River until it reached the Boise River. It followed the south side of the river winding through what is now the southern part of Boise. To this day, wheel ruts can still be seen along some areas of its path.

Adding to this major thoroughfare were the routes to the Boise Basin and Owyhee mines. These routes crossed the Oregon Trail at the Fort Boise location. Because it was located at these major crossroads, Boise became a prosperous commercial center.

In 1864, when the territorial legislature held its second session in Lewiston, Boise was incorporated as a city and proclaimed the capital of the Idaho Territory. This same year, on July 26, the Idaho Statesman newspaper produced its first publication and became the second newspaper in Idaho. The first was the Idaho World in Idaho City.

After the gold rush, Boise's population declined from 1,658 citizens in 1864 to 995 in 1870. With new construction, including the territorial prison in 1869 and the U.S. Assay Office in 1872, Boise began to grow again. The capitol building was completed in 1886 and in 1887 Boise built a streetcar system. In 1890, Idaho became a state.

In the early 1900s Boise once again enjoyed rapid growth. This growth came with the expansion of irrigation in the valley in 1902. This led to the construction of Arrowrock Dam, the tallest in the world from 1915 to 1932.

In the late 1930s, Boise was graced with the massive migration of Basques from their native home in the Western Pyrenees Mountains. These proud people became sheepherders, a large industry at the time, and gradually moved into the mainstream of city life in Boise, bringing their colorful culture with them. Today Boise has the largest concentration of Basques per capita outside the Pyrenees Mountains.

As the Great Depression ravaged many cities in the nation, Boise enjoyed growth. And during World War II, multitudes of airmen trained at Gowen Field, Boise's air base.

Today Boise is still the largest metropolitan community in the state with over 600,000 residents in the metropolitan area, and the third largest city in the Northwest, behind only Seattle, Washington and Portland, Oregon. Numerous international, national, regional and state corporations have their headquarters or a large presence in Boise. Some of these include Boise (formerly Boise Cascade), J.R. Simplot Company, Albertsons/SuperValu, and Micron. Boise is the hub of commerce, banking and government for the state and is located midway between Salt Lake City, Utah and Portland, Oregon.

Boise Today[2]

Known as the City of Trees, Boise is located in a land of great variety. To the south are rich farmlands; a rugged, high-mountain desert; North America's tallest sand dunes; and the famous Birds of Prey Natural Conservation Area. To the north, forests, whitewater rivers, and mountain lakes provide opportunities for fishing, hiking, hunting, and kayaking. Bogus Basin ski resort is just 16 miles from the Boise State University campus, and world-famous Sun Valley is less than three hours away.

The Boise Greenbelt, a network of city parks and riverside paths, runs through the Boise State University (BSU) campus. Three city parks are within walking distance of BSU, and a footbridge spans the Boise River, linking the campus to Julia Davis Park, where the Boise Art Museum, Idaho State Historical Museum, and Zoo Boise are located. An array of outdoor activities—camping, fishing, golf, hiking, river rafting, skiing, and tennis—are available only a short distance from campus.

The city and campus offer many cultural opportunities, such as the American Festival Ballet, Boise Civic Opera, Boise Philharmonic, Gene Harris Jazz Festival, Idaho Shakespeare Festival, Trey McIntyre Project, and a variety of other musical and theatrical productions. Touring artists frequently perform in the Morrison Center and Taco Bell Arena, both located on the Boise State University campus. In addition, Taco Bell Arena hosts a variety of national sporting events.

Boise State University[3]

In 1932, the Episcopal Church founded Boise Junior College, the first post-secondary school in Idaho's capital. When the Episcopal Church discontinued its sponsorship in 1934, Boise Junior College became a nonprofit, private corporation, sponsored by the Boise Chamber of Commerce and by the

[2]Excerpted from "About Boise State University," http://registrar.boisestate.edu/catalogs/online/aboutboisestate.shtml.

[3]Excerpted from "About Boise State University," http://registrar.boisestate.edu/catalogs/online/aboutboisestate.shtml.

Courtesy Boise State University

community. In 1939, the State Legislature created a junior-college taxing district to fund the college through local property taxes.

By the end of the 1930s, Boise Junior College boasted an enrollment of 600 students. Originally located at St. Margaret's Hall, near the present site of St. Luke's Regional Medical Center, the school was moved in 1940 to its present location alongside the Boise River. In 1965, Boise Junior College became a 4-year institution and was renamed Boise College. In 1969, the college was brought into the state system of higher education as Boise State College. The Graduate College was established in 1971. The creation of the new graduate programs led to the designation, in 1974, of the institution as Boise State University.

Boise State University is the largest institution of higher learning in Idaho. It has long been heralded as an institution devoted to excellence in classroom teaching, but a new dimension to its mission emerging—that of a Metropolitan Research University of Distinction.

Each semester, Boise State University enrolls nearly 20,000 students in its academic programs. Students come to Boise State University from every county in Idaho, from nearly every state in the nation, and from numerous foreign countries. The university's urban setting both attracts and complements this diverse student body, which includes many nontraditional students as well as traditional students enrolling directly from high school. Last spring, 3,599 degrees and certificates were awarded[4], including 2,571 Bachelor's, 64 Master's and 11 Doctorates.

The university attracts faculty who are dedicated to excellence in teaching, creative in generating new knowledge, and generous in using their expertise to solve society's problems giving students the opportunity to work with some of the West's most respected scientists, artists, researchers, and educators.

In addition to helping students learn, Boise State University faculty assist business, industry, educational institutions, government agencies, and professional groups with educational programs and research-and-development efforts. The university also works with many organizations to upgrade the knowledge and skills of their employees.

[4]From "Facts & Figures 2011-2012," . http://news.boisestate.edu/wp-content/blogs.dir/1/files/2011/10/Facts_Figures_2011-12.pdf.

ANNUAL MEETING

REGISTRATION

The Registration Center is in the lobby of the Boise Centre on the Grove (see maps on the inside front cover of these *Proceedings*). Hours of operation are:
Sunday: 2:00 p.m. – 6:00 p.m.
Monday: 7:30 a.m. – 4:30 p.m.
Tuesday: 7:30 a.m. – 4:00 p.m.
Wednesday: 7:30 a.m. – 2:30 p.m.

All persons attending the meeting, except for public sessions, must be registered for the meeting and must wear their name badges at all times while participating in meeting events. Those not displaying a meeting name badge may not make scheduled presentations and may be asked to leave the meeting site.

On-site registration fees are as follows: full meeting professional, $125; program planners, program presenters, and field trip leaders full meeting, $85; one-day of meeting professional, $85 [note that individuals planning to attend more than one day of the meeting must pay the full meeting fee]; K-12 teachers, community college instructors, post-docs, and emeritus/retired individuals, $62.50; students, unemployed, and spouses/family members of registrants, $50.

Special stipends of $75 were given to the first twenty K–12 and community college instructors that registered in advance for the meeting and requested the stipend on their registration forms. The stipend is not available to teachers who register on-site.

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

About field trips: Due to limited seating in vehicles and the need to inform some destinations of the number of people arriving, pre-registration for all field trips was required. If you didn't register for a particular field trip in which you are interested in participating, please inquire at the AAAS, Pacific Division Registration Center to see if space is still available. At least one member of a family group requesting field trip reservations 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: Most workshops, are available at no additional charge to meeting registrants. Some workshops have limited space and persons indicating their participation on the Advance Registration Form will have priority in attending should a workshop fill.

About refunds: Requests for refunds must have been in writing and received in the Pacific Division office no later than 6 June 2012. 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. An additional 3.5% deduction is applied to the total amount for credit card refunds.

HOUSING FOR MEETING REGISTRANTS

Boise boasts many fine hotels of all qualities, many of which can be accessed for reservations through web sites such as expedia.com or hotels.com.

The three hotels listed below entered into agreements with the Pacific Division and/or NORM 12 to provide meeting attendees special rates and benefits. Attendees were asked to make their reservations directly with the hotel of their choice. The hotels are listed in no particular order, and certainly not in order of any preference on the part of the Pacific Division. Note that taxes (currently 13%) will be added to the listed room rates.

Hampton Inn & Suites – Downtown Boise
495 S. Capitol Boulevard, Boise, Idaho 83702
208-331-1900
$104 (1 to 4 persons)
Proximity to meeting: 2 blocks

Safari Inn Downtown
1070 W. Grove Street, Boise, Idaho 83702
208-344-6556
$69 (1 or 2 persons in single queen room)
$79 (1 to 4 persons in double queen room)
Proximity to meeting: 2 blocks

The Grove
245 S. Capitol Boulevard, Boise, Idaho 83702
208-333-8000
Rate: $119 (1 – 4 persons)
Proximity to meeting: 0.5 blocks

TRAVEL TO THE BOISE CENTRE ON THE GROVE

From the Airport:
- Go northeast on W Airport Way toward S Vista Ave.
- Stay straight to go onto S Vista Ave.
- In about 2.3 miles turn slight left onto S Capitol Blvd.
- In about 1 mile turn left onto W Front St/US-20 W/US-26 W.
- The Boise Centre is at 850 W Front Street, on the right just past the walkway into the Grove Plaza. The City Center Parking Garage is on the left, across the street from the Boise Centre and accessed from 9th St.

From the west on I-84 E:
- Keep left to take I-184 E toward I-184/City Center. In about 4.7 miles I-184 E becomes W Myrtle St/US-20 E/US-26 E.
- In about 0.4 miles turn left onto S Capitol Blvd.
- Take the second left onto W Front St/US-20 W/US-26 W.
- The Boise Centre is at 850 Front St, which will come up on the right in about a block, just past the walkway into the Grove Plaza. The City Center Parking Garage is on the left, across the street from the Boise Centre and accessed from 9th St.

From the east on I-84 W:
- From I-84 W take Exit 54 (US-20/US-26/Broadway Ave exit, toward City Center).
- In about 0.2 miles turn right onto S Broadway Ave/US-20/US-26.
- In about 2.8 miles turn left onto E Front St/US-20 W/US-26 W.
- In about 0.8 miles you will find the Boise Centre on the right at 850 W Front Street, just past the walkway into the Grove Plaza. The City Center Parking Garage is on the left, across the street from the Boise Centre and accessed from 9th St.

PARKING

Nearby parking is available in four parking garages: City Center Garage (312 9th St., directly across the street from the Boise Centre and accessed from 9th St.), Boulevard Garage (245 S Capitol Blvd., next to the Grove Hotel and accessed from Capitol Blvd.), Eastman Garage (866 W Main St., about a block to the northeast of the Boise Centre and accessed from either Main St. or Idaho St.), and Capitol Terrace Garage (770 W Main St., about 2 blocks northeast of the Boise Centre and accessed from either Main St. or Idaho St.). All garages are attended and accept Visa and MasterCard. The first hour of parking is free. Subsequent hours are $2.50, with a maximum of $12.00 per day. Less expensive parking lots may be found nearby to the Boise Centre, but they are unattended.

REGISTRATION CENTER

The Registration Center will be set up in the lobby of the Boise Centre. Hours of operation are as follows:
Sunday: 2:00 p.m. – 6:00 p.m.
Monday: 7:30 a.m. – 4:30 p.m.
Tuesday: 7:30 a.m. – 4:00 p.m.
Wednesday: 7:30 a.m. – 2:30 p.m.

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 21 and 27 June. After these dates, 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 for each session as appropriate. Refreshments will be served in the lobby of the Boise Centre, near the Registration Center.

FOOD SERVICES

Many good restaurants are within a short walking distance of the Boise Centre. In addition, limited food services for items such as coffee, soft drinks, sandwiches and salads will be available in the lobby of the Boise Center.

MEETING ROOMS, COMPUTERS, AND POWERPOINT PRESENTATIONS

This year's technical sessions will all meet in the Boise Center on the Grove. All meeting rooms are equipped with LCD projectors and computers running later versions of Windows and Microsoft Office. Only CD-ROMs and thumb/USB/flash drives may be used to load presentations onto the computers. Speakers requiring other specialized equipment such as slide or overhead projectors must have made their requests known when submitting their abstracts. If available, specialized equipment is provided. Any rental costs incurred are the responsibility of the requestor.

Should a presenter wish to use their own laptop computer for their presentation, it will be possible to connect the laptop directly to the LCD projector via a VGA port. It is the responsibility of the presenter doing this to make sure that they bring 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. Additionally, each winner receives a one-year student membership in AAAS, which includes weekly issues of Science magazine. Societies sometimes supplement these awards with their own cash prizes.

For this meeting, six Division-wide awards may be given: 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; Rita W. Peterson Award for Excellence in Science Education; Best Poster Award (for posters only but otherwise unrestricted); and the AAAS Robert I. Larus Travel Award, which will provide a reimbursement for travel and other meeting related expenses up to $900 for the awardee to attend the national meeting of AAAS in Boston, Massachusetts 14 – 18 February 2013 for the purpose of presenting their winning presentation as a poster. The Klauber, Lindsay, Dutro, Presidents, 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 Division-wide awards, a student must be registered for the meeting *prior to judging*, present the paper or poster, and 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). Sample evaluation forms for both oral and poster presentations are posted on the Division's meeting web page.

Students who are eligible for Awards of Excellence are invited to be the Division's guests at the annual Banquet Tuesday evening, 26 June. Festivities that evening include the presentation of student awards. Students were asked to indicate on the Advance Registration Form if they were planning to attend the banquet. Those who responded positively were provided a ticket along with their other 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 presentation also as a poster in order to be judged and in the pool of potential prize winners.

SPECIAL EVENTS

Sunday Evening Panel Discussion. 6:30 p.m. in the Summit, Boise Centre. *When Science and Policy Meet: Marriage or Divorce?*

Diminishing research dollars, increasing expectations, and demands for Science, Technology, Engineering, Arts, and Mathematics (STEAM) to provide answers; where are AAAS and ACS members to go for funding or do for research where they are competitive for scarce resources? The cry that has been going out around department meeting rooms across the country is a quote from Chicken Little, "The sky is falling, the sky is falling."

The AAAS and ACS regional co-located meeting inaugural panel, *When Science and Policy Meet: Marriage or Divorce?* will exam both successful and failed efforts at this important contemporary interface. The panel, composed of Dr. Cynthia Burrows (Distinguished Professor of Chemistry, University of Utah and Board Member of Utah Science Technology And Research (USTAR) initiative, state supported research economic development entity), Dr. John Freemuth (Professor of Political Science, Senior Fellow,

Courtesy University of Utah

Cynthia Burrows

Courtesy himself

John Freemuth

Courtesy himself

Patrick Shea

Andrus Center for Public Policy, and former Chair of the national Bureau of Land Management Science Advisory Board), and Patrick Shea (Associate Research Professor of Biology, University of Utah and Former Director of the Bureau of Land Management), will focus on successes and failures of the interaction between scientific research on public policy and suggest ways public support for basic research can be enhanced through appropriate and necessary outreach efforts by the scientific community.

Sunday Evening Boise State University President's Reception. Approximately 7:30 p.m. at the Boise Centre.

Immediately following the evening panel discussion, Dr.Robert Kustra, President of Boise State University, will host all registrants and their families to a dessert reception, which will be held in conjunction with the opening ACS poster session. Please wear your registration badge.

Monday Evening Basque Cultural Dinner and Entertainment. 6:00 – 9:30 p.m. at the Boise Centre on the Grove.

Immerse yourself in an evening of Basque culture at the ACS/AAAS Basque Cultural Dinner Reception. Boise is home to the largest concentration of Basques per capita outside the Pyrenees Mountains. The evening includes a family style Basque dinner, Basque-related entertainment (a performance by the Oinkari Basque Dancers) and a presentation on *Aukera: A History of the Basques in Idaho* by Dr. John Bieter (Department of History, Boise State University).

Before the festivities begin, you can take a tour of the only Basque Museum in the United States. The Basque Museum provides a look into the Basque heritage through exhibits, collections, oral history archives, and photographs. Free guided tours of the Basque Museum/Boarding House will be available from 4:30 – 6:00 p.m. The museum is located at 611 Grove Street, a short walk (1 block) from the Boise Centre on the Grove. More information about the museum is available at http://www.basquemuseum.com/. Cost for the dinner and dancing is $45.00. Cost for the museum tour is free.

Tuesday Evening Reception and Student Awards Banquet. 6:00 – 9:30 p.m. in the Double R Ranch Room in the Stueckle Sky Center on the Boise State University campus.

Tuesday 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, Rita W. Peterson Award for Excellence in Science Education, the Presidents' Award for Excellence (unrestricted), the Best Poster Award (for poster presentations only but otherwise unrestricted), and the AAAS Robert I. Larus Travel Award.

The evening is planned to begin at 6:00 p.m. with a reception sponsored by Sigma Xi, the Scientific Research Society. Dinner service will begin about 6:45 p.m. After dinner, the evening will include the presentation of the 2012 Sigma Xi Young Investigator Award to Sivaguru Jayaraman (North Dakota State University) by Kelly O. Sullivan (Pacific Northwest National Laboratory), the presentation of awards for superior student presentations at the meeting, and the Presidential Address, given by Dr. Robert L. Chianese (President of the Pacific Division and Professor of English (emeritus), California State University Northridge, Northridge, California). The evening should end by about 9:30 p.m.

Banquet attendees had the choice of three entrées: Fresh Idaho Trout, Grilled Teriyaki Flank Steak, or Stuffed Portabello Mushroom. All entrées come with a classic caesar salad, wild rice with pine nuts, grilled seasonal vegetables, rolls with butter, coffee, iced tea and water. Dessert is lemon pudding cake with citrus anglais. Due to State of Idaho restrictions on the presence of alcohol at an event that includes BSU students, the bar that was originally announced will not be available. However, with Sigma Xi's sponsorship, a very nice reception will precede the dinner. Banquet tickets were $35 each and needed to be purchased in advance. If you failed to purchase a ticket in advance and would like to attend this event, please check at the Registration Center to see if any tickets may be available.

Students in competition for Awards of Excellence were invited to be guests of the Division for this event. *Note that If you are such a student and requested a complimentary ticket, we expect you to attend the banquet. Please don't dishonor the Division's generosity in offering you this opportunity to fully participate in the meeting with minimal out-of-pocket expenses by asking for a ticket and then not showing up!*

Wednesday Morning Business Meeting of the Council of the Pacific Division. 7:00 a.m. at the Hampton Inn and Suites – Downtown.

The Council of the AAAS, Pacific Division will hold its annual breakfast and business meeting at 7:00 a.m. on Wednesday, 27 June at the Hampton Inn and Suites Downtown, 495 S Capitol Boulevard. The Council will elect officers, Executive Committee and Council members, discuss programs for the 2013 and 2014 annual meetings, and transact 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.

PUBLIC LECTURES

The following public lectures are planned. All members of the public are invited to attend these lectures at no charge (except for the Presidential Address, for which there is a charge to attend the banquet–see "Tuesday Evening Reception and Student Awards Banquet" in the preceding section of these *Proceedings*).

Sunday Evening Panel Discussion. 6:30 p.m. – 7:30 p.m. in the Summit Room, Boise Centre on the Grove. *When Science and Policy Meet: Marriage or Divorce?*

Please refer to page 13, "Special Events," of these *Proceedings* for details about this program.

Monday Noon Public Lecture. 12:15 p.m. in the Summit Room, Boise Centre on the Grove. *Reckoning with Redox in the RNA World*, presented by Dr. Cynthia Burrows, Distinguished Professor of Chemistry, University of Utah, and board member of Utah Science Technology and Research (USTAR), this noon lecture is available to all meeting attendees and the general public.


Courtesy University of Utah

Cynthia Burrows


Courtesy himself

John Bieter

Monday Evening Plenary Lecture. 8:00 p.m. in the Summit Room, Boise Centre on the Grove. *Aukera: A History of the Basques in Idaho.*

This lecture, presented by Dr. John Bieter, Department of History, Boise State University, will follow the Basque dinner program (see page 13, "Special Events," of these *Proceedings*). All meeting attendees and the general public are invited to attend this lecture.

Tuesday Noon Public Lecture. 12:15 p.m. in the Summit Room, Boise Centre on the Grove. *Correcting DNA Errors: From Amanda Knox's Wrongful Conviction, to Sexual Assaults in Georgia***,** presented by Greg Hampikian, Professor of Biological Sciences and Criminal Justice at Boise State University. Dr. Hampikian has held research and teaching positions at the Yale University Medical School, Emory University, La Trobe University in Australia, Clayton State University and the Centers for Disease Control. His laboratory at Boise State is involved in a wide array of DNA projects in the areas of forensic biotechnology, mitochondrial population studies, drug development, magnetic shape memory, the discovery of new Idaho species, and bioinformatics. He has also pioneered the study of the shortest DNA sequences not found in nature, which he has named "nullomers." His work has been published in leading scientific journals such as Nature, the Proceedings of the National Academy of Sciences, Science and Justice, and the American Journal of Physical Anthropology. He has offered DNA workshops and seminars at the American Academy of Forensic Sciences, Harvard University, and the Pasteur Institute.


Courtesy Boise State University

Greg Hampikian

Dr. Hampikian is the founder and Director of the Idaho Innocence Project at BSU. He works with police agencies and defense lawyers on DNA cases throughout the US, Ireland, the UK, Italy and France. His work has helped in 10 exonerations (including Amanda Knox). In four of those exonerations, new DNA testing led to criminal database matches. He is also the co-author of Exit to Freedom with Calvin Johnson. The book tells how Mr. Johnson was freed from prison by DNA evidence after 17 years behind bars.

Dr.Hampikian's research and outreach activities have been covered by CNN, the Wall Street Journal, Time Magazine, Fox News, 20/20, Nightline, Good Morning America, Science, and New Scientist among others. His laboratory and legal research has been supported by the National Institute of Justice, the Department of Defense, the Environmental Protection Agency, the National Science Foundation, and private donations.

Tuesday Evening AAAS, Pacific Division Presidential Address. Approximately 8:30 p.m. in the Double R Ranch Room in the Stueckle Sky Center on the Boise State University campus.


Courtesy himself

Robert L. Chianese

Following the presentation of the 2012 Sigma Xi Young Investigator Award and the student awards at the Student Awards Banquet, Dr. Robert L. Chianese (Professor of English (emeritus), California State University Northridge, and President of the Pacific Division) will present the Presidential Address.

Wednesday Noon Public Lecture. 12:15 p.m. in the Summit Room, Boise Centre on the Grove. *Learning from Nature: Bio-mimetic Supramolecular Photocatalysis,* presented by Dr. Sivaguru Jayaraman, Department of Chemistry and Biochemistry at North Dakota State University and winner of the 2012 Sigma Xi Young Investigator Award. Dr. Jayaraman's research involves the use of light to initiate chemical reactions and control photoreactivity in the excited state using molecular design and nano-confinement. The cornerstone of his program involves synthetic effort that allows a freedom of design to produce new structural motifs not only for studying stereoselective reactions, but also for chemical and bio-molecular recognition of encapsulated guests within water soluble nano-reaction vessels. Dr. Jayaraman's research investigates the molecular and supramolecular assembly characteristics of systems to gain a deeper understanding of the interplay between molecular structure, assembly, dynamics and the role of external interactions critical for molecular recognition events in light-initiated reactions.


Courtesy North Dakota State University

Sivaguru (Siva) Jayaraman

PACIFIC DIVISION SPONSORED 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-registrant participates in.

Due to limited space, advance registration was required for all field trips. Reservation and payment of field trip fee(s) was included on the Advance Registration Form. If you didn't pre-register for a field trip in which you would like to participate, inquire at the Registration Center to see whether any space remains.

A full refund will be granted if a trip is cancelled by the Division. If a registrant cancels via e-mail or written notification received in the Pacific Division office no later than 6 June 2011, the registrant will receive a refund of the fee(s) paid less a $15 processing fee. If paid by credit card, an additional 3.5% of the original charge will be deducted from the amount being refunded to help pay for fees charged to the Division by credit card companies. With the exception of the Division cancelling a field trip, no refunds will be granted after 6 June.

Sunday, 24 June

Field Trip #1: *Remaking the Boise River on the Eve of the Millennial Flood.* Sunday, 24 June: 1:30 p.m. – 3:00 p.m. Organized by Todd Shallat (Center for Idaho History and Politics, Boise State University, Boise, Idaho).

It is a geological certainty that the Boise River will flood. In an easy stroll along the river, Professor Shallat will trace the design of the floodway to the hopes and fears and scientific conjecture that shaped engineering design.

There is free parking in Julia Davis Park (700 S Capitol Blvd.), across the river from Boise State University. To get to Julia Davis Park by automobile from the vicinity of the Boise Centre (see map on page 31 of this *Newsletter*), drive south on 9th Street until it merges with Capitol Blvd. (about 0.6 miles from The Grove). In about 0.1 mile turn left onto W University Drive. Take the first right onto W Boise Ave., then the first right to stay on W Boise Ave. Then take a slight right onto S Capitol Blvd. Julia Davis Park is on the right about 0.5 miles up S Capitol Blvd.

To get to Julia Davis Park by walking, head south on S Capitol Blvd about four large city blocks. The park will be on the left just before crossing the Boise River.

Meet at the Friendship Bridge, which spans the Boise River and connects the park to the university (for location, see Boise State University map on inside front cover of these *Proceedings*). The bridge on the park side is just south of the Boise Zoo.

There is no cost for this field trip. However, space is very limited so participants were asked to sign up in advance. Cost: no charge.

Field Trip #2: *Birds of Prey.* Sunday, 24 June: 9:00 a.m. – 4:00 p.m.

This field trip will depart the Boise Centre at 9:00 a.m. to travel to the Snake River Birds of Prey National Conservation Area. Anticipated stops are at Initial Point (Idaho's geographic survey reference point), Dedication Point (an impressive view of the Snake River Canyon), Swan Falls Dam and Historical Exhibit (history of the dam and Snake River), and Celebration Park (archaeological and cultural history). Before returning to the Boise Centre, we will stop at the World Center for Birds of Prey, the premier captive breeding facility in the world for birds of prey.

Be sure to wear shoes that are comfortable for hiking – NO SANDALS, sun shade hats, light weight shirts, and sunscreen. A lightweight coat and day pack is recommended, as canyon temperatures may vary. Bring along your binoculars, sunglasses and camera!

Includes transportation, box lunch, snacks, and admissions. Cost: $50.00 per person.

Wednesday, 27 June

Field Trip #3: *Bruneau Dunes and Observatory.* Wednesday, 27 June: 2:45 p.m. – midnight.

Out on the expansive Snake River Plain are countless insights and windows into the past. From the hotspot volcanism of the last 16 million years, through the giant ice-age floods that profoundly sculpted these lands, Bruneau Dunes stands 470 feet above the desert floor as a geologic testament of the power of water and as a rich desert oasis for a diversity of life. Join us as we depart the Boise Centre at 2:45 p.m. for the approximately hour and fifteen minute ride to the Bruneau Dunes. Planned activities include touring the visitor center and bookstore, learning about the various plants and animals that inhabit the area, and exploring the dunes and small lakes. Bruneau Dunes is also home to Idaho's largest public observatory. As the sun starts to set we will gather for a short program introducing the observatory and then spend time looking at various celestial objects through the main telescope as well as some smaller, portable telescopes. We plan to return to Boise about midnight.

Be sure to bring sturdy hiking shoes for the dunes, insect repellent, sunscreen, sunglasses, and light jackets as the evening could cool off considerably. You might also want to include binoculars and your camera.

Trip includes transportation, box lunch, snacks and admissions. Cost: $50.00 per person.

WORKSHOPS

Workshops are available to all meeting registrants without additional fees with the exception of the POGIL Workshop offered by NORM 12 on Monday afternoon, for which there is a $15 fee. In order to help workshop developers in their planning, pre-registrants were asked to indicate their interest in attending each workshop. Some workshops have limited room. In case a workshop fills, those who pre-registered for the workshop will be given preference in attendance.

Descriptions of workshops may be found starting on page 35 of these *Proceedings.*

Future Meetings

Pacific Division Annual Meetings

2013.....16 – 19 June in Las Vegas, Nevada
sponsored by the University of Nevada, Las Vegas

2014.....17 – 20 June in Riverside, California
sponsored by the University of California, Riverside

AAAS National Meetings

2013.....14 – 18 Feb. in Boston, Massachusetts

2014.....13 – 17 Feb. in Chicago, Illinois

2015.....12 – 16 Feb. in San Jose, California

SUNDAY – 24 JUNE	MONDAY – 25 JUNE	TUESDAY – 26 JUNE	WEDNESDAY – 27 JUNE
	REGISTRATION CENTER OPEN *Boise Centre Lobby* 7:30 AM – 4:30 PM	***REGISTRATION CENTER OPEN*** *Boise Centre Lobby* 7:30 AM – 4:00 PM	*BUSINESS MEETING* **Business Meeting of the Council the Pacific Division** *Hampton Inn & Suites, 495 S. Capitol Boulevard* 7:00 AM - 10:00 AM
FIELD TRIP **Birds of Prey** *Bus departs from Front St. entrance to Boise Centre* 9:00 AM – 4:30 PM	*CONTRIBUTED PAPERS* **Chemistry and Biochemistry** **Health Sciences** **Oral Biology and Dental Medicine** **Physics and Materials Science** *Willows 1* 8:20 AM – Noon	*CONTRIBUTED PAPERS* **Cell and Molecular Biology** *Willows 2* 8:40 AM – Noon	***REGISTRATION CENTER OPEN*** *Boise Centre Lobby* 7:30 AM – 2:30 PM
	SYMPOSIUM **Library Science and Archives** *Snake River* 8:25 AM – 3:00 PM	*CONTRIBUTED PAPERS* **Anthropology and Archaeology** **Social, Economic, and Political Sciences** *Willows 1* 9:00 AM – Noon	*SYMPOSIUM* **Emerging and Re-Emerging Infectious Diseases** *Douglas Firs 1 & 2* 8:00 AM – NOON
	SYMPOSIUM **Long Term Space Flight and Health** *Salmon River* 8:30 AM – 11:35 AM	*SYMPOSIUM* **Computability and Complexity in Mathematics Session II** *Ponderosa Pines 1 & 2* 9:00 AM – 11:25 AM	*SYMPOSIUM* **Recent Advances in Pharmacology and Toxicology** *Payette River* 8:30 AM – 11:45 AM
	SYMPOSIUM **Forensic Psychology in Evaluating a Lone Wolf Terrorist: An Analysis of the Norway Killer** *Payette River* 8:40 AM – Noon	*SYMPOSIUM* **Biofuel: Computational Modeling of Cellulose and Cellulase** *Douglas Fir 1 & 2* 9:00 AM – 11:50 AM	*SYMPOSIUM* **Biophysical Insights from Experimental Approaches to Computational Simulations** *Willows 1 & 2* 8:30 AM – 4:30 PM
	CONTRIBUTED PAPERS **Agriculture and Horticultural Sciences** **Earth Sciences** **Ecology, Organismal Biology, and Environmental Sciences** *Willows 2* 9:00 AM – Noon	*SYMPOSIUM* **Water Resource Management in the Arid West: Historical Perspectives and Emerging Issues** *Payette River* 9:00 AM – Noon	*CONTRIBUTED PAPERS* **Education (Science and Technology)** **History and Philosophy of Science** *Merlins* 10:00 AM – Noon
	CONTRIBUTED PAPERS **Mathematics** *Ponderosa Pines 1 & 2* 10:30 AM – 11:25 AM		*CONTRIBUTED PAPERS* **Mathematics** *Ponderosa Pines 1 & 2* 10:00 AM – 12:30 PM
	NOON PUBLIC LECTURE **"Reckoning with Redox in the RNA World"** *Summit* 12:15 PM	*NOON PUBLIC LECTURE* **"Correcting DNA Errors: From Amanda Knox's Wrongful Conviction to Sexual Assaults in Georgia"** *Summit* 12:15 PM	*NOON PUBLIC LECTURE* **"Learning from Nature: Bio-mimetic Supramolecular Photocatalysis"** *Summit* 12:15 PM
FIELD TRIP **Remaking the Boise River on the Eve of the Millenial Flood** *Meets at the Friendship Bridge, spanning the Boise River between Julia Davis Park and Boise State University* 1:30 PM – 3:00 PM	*PROGRAM CONTINUING from MORNING* **Library Science and Archives** *Snake River* 1:30 PM – 3:00 PM	*SYMPOSIUM* **Modeling, Simulation, and Data Visualization** *Douglas Firs 1 & 2* 1:00 PM – 5:20 PM	*PROGRAM CONTINUING FROM MORNING* **Biophysical Insights from Experimental Approaches to Computational Simulations** *Willows 1 & 2* 1:30 PM – 4:30 PM
REGISTRATION CENTER OPEN *Boise Centre Lobby* 2:00 PM – 6:00 pm	*SYMPOSIUM* **The Forensic Psychology of Women Death Penalty Cases** *Payette River* 1:30 PM – 4:50 PM	*SYMPOSIUM* **Transport Across Membranes** *Payette River* 1:30 PM – 3:30 PM	*WORKSHOP* **DockoMatic: Calculations and Homology Modeling** *Douglas Fir 1 & 2* 1:30 PM
	SYMPOSIUM **Computability and Complexity in Mathematics Session I** *Ponderosa Pines 1 & 2* 1:30 PM – 5:15 PM	*SYMPOSIUM* **Science Themed Fiction** *Salmon River* 1:30 PM – 4:20 PM	*FIELD TRIP* **Bruneau Sand Dunes and Observatory** *Bus departs from Front St. entrance to Boise Centre* 2:45 PM – approx. Midnight
	SYMPOSIUM **Responses of Sagebrush-Steppe Ecosystems to a Changing Climate** *Salmon River* 1:30 PM – 4:50 PM	*SYMPOSIUM* **Mechanisms of Tumor Progression and Cancer Therapeutics** *Snake River* 1:30 PM – 4:50 PM	
	SYMPOSIUM **Expert and Novice Learning in STEM: Exploring Assumptions and Indicators of Success** *Willows 1* 1:30 PM – 3:30 PM	*WORKSHOP* **Programmed Genome Remodelng in Ciliates and Computing** *Ponderosa Pines 1 & 2* 1:30 PM – 4:20 PM	
	POSTER SESSION **AAAS, Pacific Division** *Golden Eagle* 3:00 PM – 5:00 PM	*CONTRIBUTED PAPERS* **Mathematics** *Ponderosa Pines 1 & 2* 2:30 PM – 3:00 PM	
		STUDENT AWARD JUDGES MEETING *to decide on Division-wide awards* *Willows 1* 3:00 PM	
	BASQUE CULTURAL DINNER and ENTERTAINMENT *Flying Hawk* 6:00 PM – approx. 8:00 PM	*RECEPTION and STUDENT AWARDS BANQUET* *Double R Ranch Room* *Stueckle Sky Center* *Boise State University* 6:00 PM	
EVENING PLENARY PANEL DISCUSSION **"When Science and Policy Meet: Marriage or Divorce?"** *SUMMIT* 6:30 PM	*EVENING PLENARY LECTURE* **"Aukera: A History of the Basques in Idaho"** *Summit* approx. 8:00 PM	*PACIFIC DIVISION PRESIDENT'S ADDRESS* *Double R Ranch Room* *Stueckle Sky Center* *Boise State Unniversity* APPROX 8:30 PM	
BSU PRESIDENT'S RECEPTION *Golden Eagle* 7:30 PM			
STUDENT AWARDS JUDGES ORGANIZATIONAL MEETING *WILLOWS 1* 8:30 PM			

GENERAL SESSIONS

Sunday, 24 June 2012

EVENING PUBLIC PANEL DISCUSSION*
SUMMIT
Sunday
6:30 p.m.

When Science and Policy Meet: Marriage or Divorce? Panelists include **CYNTHIA BURROWS** (Distinguished Professor of Chemistry, University of Utah and Board Member of Utah Science Technology And Research (USTAR) initiative, state supported research economic development entity), **JOHN FREEMUTH** (Professor of Political Science, Senior Fellow, Andrus Center for Public Policy, and former Chair of the national Bureau of Land Management Science Advisory Board), and **PATRICK SHEA** (Associate Research Professor of Biology, University of Utah and Former Director of the Bureau of Land Management). Please see page 13, "Special Events," in these *Proceedings* for additional information.

WELCOME RECEPTION
GOLDEN EAGLE
Sunday
7:30 p.m.

Sponsored by Boise State University President Robert Kustra, this informal reception features a variety desserts. It begins immediately following the conclusion of the evening public plenary panel and continues until about 9:15 p.m. All registrants and their families are invited to enjoy the conviviality of this event. Please wear your registration badge.

STUDENT AWARDS JUDGES ORGANIZATIONALMEETING
WILLOWS 1
Sunday
8:30 p.m.

Monday, 25 June 2012

NOON PUBLIC LECTURE*
SUMMIT
Monday
12:15 p.m. - 1:00 p.m.

1 *Reckoning with Redox in the RNA World*, presented by **CYNTHIA BURROWS**, Distinguished Professor of Chemistry, University of Utah, and board member of Utah Science Technology and Research (USTAR).

EVENING PUBLIC PLENARY LECTURE*
SUMMIT
Monday
8:00 p.m.

2 *Aukera: A History of the Basques in Idaho*, **JOHN BIETER** (Department of History, Boise State University).

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

Tuesday, 26 June 2012

NOON PUBLIC LECTURE*
SUMMIT
Tuesday
12:15 p.m.

3 *Correcting DNA Errors: From Amanda Knox's Wrongful Conviction, to Sexual Assaults in Georgia***,** presented by **GREG HAMPIKIAN** (Professor of Biological Sciences and Criminal Justice, Boise State University).

STUDENT AWARDS JUDGES MEETING
WILLOWS 1
Tuesday
3:00 p.m.

RECEPTION AND STUDENT AWARDS BANQUET
DOUBLE R RANCH ROOM
STUECKLE SKY CENTER
on the Boise State University campus
Tuesday
6:00 p.m.

Beginning at 6:00 p.m., a reception hosted by Sigma Xi will feature soft drinks and juices. Dinner service will begin about 6:45 p.m. Be sure to bring your dinner ticket with you, as it is needed to not only verify that you are on our dinner list but also to let the servers know your choice of entrée. Tickets to the banquet cost $35 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). If you do not have a ticket but would like to attend the banquet, please check at the Registration Center to see if any tickets remain. Following dinner will be the presentation by Dr. Kelly O. Sullivan (Pacific Northwest National Laboratory) of the Sigma Xi Young Investigator Award to Dr. Sivaguru Jayaraman (North Dakota State University). Announcement of the winners of the student Awards of Excellence will follow this presentation. *Student award winners are asked to stay until the end of the program so that photographs may be taken of the group.* After announcement of the award winners, Dr. Robert L. Chianese (Department of English (Emeritus), California State University Northridge, Northridge, California) will give the Presidential Address. The evening is expected to end by about 9:30 p.m.

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

Wednesday, 27 June 2012

MEETING OF THE COUNCIL OF THE PACIFIC DIVISION
HAMPTON INN & SUITES
495 S CAPITOL BOULEVARD
Wednesday
7:00 a.m. - 10:00 a.m.

The Council of the AAAS, Pacific Division will hold its annual breakfast business meeting starting at 7:00 a.m. at the Hampton Inn & Suites – Downtown, 495 S. Capitol Boulevard. The Council will elect officers, discuss programs for the 2013 and 2014 annual meetings, and transact such other business as is required by the Division's By-laws.

NOON PUBLIC LECTURE*
SUMMIT
Wednesday
12:15 p.m.

4 *Learning from Nature: Bio-mimetic Supramolecular Photocatalysis,* presented by Dr. Sivaguru Jayaraman, Department of Chemistry and Biochemistry at North Dakota State University and winner of the 2012 Sigma Xi Young Investigator Award.

TECHNICAL SESSIONS

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

I. SYMPOSIA

Monday, 25 June 2012

Library Science and Archives

SNAKE RIVER ROOM
Monday
8:25 a.m. – 3:00 p.m.

Organizers: *Crystal Goldman* (Scholarly Communications Librarian, Dr. Martin Luther King, Jr. Library, San Jose State University) and *Michal Walden* (Archivist, Idaho State Archives, Division of the Idaho State Historical Society).

Program sponsored by the Pacific Division section on General and Interdisciplinary Studies.

The last decade has seen numerous advances in the fields of Library Science and Archival Science, while at the same time existing services needed to be maintained, improved, and streamlined. Difficult budget times that have affected not only operational resources but also grant opportunities, have advanced the need for innovation and the adoption of new techniques and technologies.

This symposium will focus on numerous subjects of import to libraries and archives. Not only will it allow a forum for showcasing new approaches to standard services such as instruction and reference, but it will also spotlight emerging issues with digitization projects, electronic records programs, and institutional repositories. Open access publishing in the sciences, social sciences, arts and humanities will be discussed as a way to alleviate costs and increase dissemination of intellectual property. Institutional repositories, open access publishing, and scholarly communications bring to light the vital need for education about author's rights and copyright. Both theoretical and practical approaches to these topics will be presented.

Session Co-Chairs: *Crystal Goldman* and *Michal Walden*

8:25 *Introductory Remarks*

8:30 **5** *A Course in Scholarly Publishing for Undergraduates at the University of Utah*, **PETER L KRAUS** (University of Utah, J. Willard Marriott Library).

9:00 **6** *Using the Institutional Repository as an Affordable Learning Solution*, **CRYSTAL GOLDMAN* and SILKE HIGGINS** (King Library, San Jose State University).

9:30 **7** *Identifying University Publishing Trends Through Institutional Repository Data*, **MICHELLE ARMSTRONG** (Albertsons Library, Boise State University).

10:00 BREAK

10:20 **8** *An Overview of Special Collections and Archives Content in the Institutional Repository at Boise State University*, **JULIA STRINGFELLOW** (Special Collections and Archives, Albertsons Library, Boise State University).

10:50 **9** *Assessing the Strategic Credibility of Special Collections*, **ERIN PASSEHL[1]* and RICK STODDART[2]*** ([1]Western Oregon University, Hamersly Library; [2]Oregon State University, The Valley Library).

11:20 LUNCH

1:30 **10** *More Than Asphalt and Snowplows: Preserving Idaho's Transportation Past*, **MICHAL WALDEN** (Idaho State Archives, Idaho State Historical Society).

2:00 **11** *Assessing Value from the Digital Collection End-User: The Western Writers Series Digital Editions Experience*, **RICK STODDART[1]* and THOMAS HILLARD[2]*** ([1]Oregon State University, The Valley Library ; [2]Boise State University).

2:30 **12** *Case Study: Design, Workflows, and Final Results of a Large-scale and In-house Oral History Digitization Project At a Small Institution*, **KENT RANDELL** (Albertsons Library, Special Collections and Archives, Boise State University).

Long Term Space Flight and Health

SALMON RIVER
Monday
8:30 a.m. – 11:35 a.m.

Organizer: *Julia Oxford* (Department of Biological Sciences, Boise State University) and *Barbara Morgan* (Distinguished Educator in Residence, Boise State University).

Program sponsored by the Pacific Division sections on Ecology, Organismal Biology and Environmental Sciences, and Health Sciences.

Like every other living creature we know of, humans evolved at the bottom of a gravity well. We take the Earth's tug for granted, and so do our bodies. So it's not surprising that our bodies behave oddly in orbit. What is surprising is that humans turn out to adapt remarkably well to zero-g (more precisely, microgravity). Weightlessness itself is the most important and the most obvious influence on life in space. Weightlessness complicates the business of daily life, from eating to sleeping. And space adaptation involves some very complex changes in the human body, both short-term and long-term. These changes can cause health problems both in space and on return to Earth. There are other factors, too. Outside the protective shield of the Earth's atmosphere, astronauts have to contend with high radiation levels. These have long-term effects: an increase in the risk of cancer in later life, for example. This symposium is designed for anyone interested in the effects of microgravity on physiological systems including cardiovascular, balance, musculoskeletal, and vision. Research opportunities for undergraduate and graduate students, postdoctoral fellows, and faculty will also be discussed.

Session Chair: *Julia Oxford*

8:30 **13** *Long term Space Flight and Health*, **JULIA THOM OXFORD** (Department of Biological Sciences, Biomolecular Research Center, Musculoskeletal Research, Boise State University).

8:50 **14** *Changes in Solvent Accessibility of Wild-type and Deamidated bB2-crystallin Following Complex Formation with aA-crystallin Chaperone*, **KIRSTEN J LAMPI[1]*, CADE B FOX[1], and LARRY L DAVID[2]** ([1]Oregon Health and Science University, Integrative Biosciences; [2] Oregon Health and Science University, Biochemistry and Molecular Biology).

9:10 **15** *Effects of Simulated Microgravity on Articular Chondrocytes*, **LILIANA MELLOR[1]*, LINDSEY CATLIN[1], RAQUEL BROWN[1], WARREN KNUDSON[2], and JULIA THOM OXFORD[1]** ([1]Boise State University, Biomolecular Research Center; [2]East Carolina University, Brody School of Medicine).

9:30 **16** *A Role for PTHrP in Expression of Minor Fibrillar Collagens*, **NEDA SHEFA*, MINOTI HIREMATH, and JULIA THOM OXFORD** (Biological Sciences Department, Boise State University).

9:50 **BREAK**

10:10 **17** *Interactions of Osteoblasts, Inflammation, and the Extracellular Matrix in Simulated Free Fall*, **JAKE GOYDEN*, BENJAMIN DAVIS, JULIA THOM OXFORD, and CHERYL JORCYK** (Department of Biological Sciences, Biomolecular Research Center, Musculoskeletal Research, Boise State University).

10:30 **18** *Going Green in Space?* **KEITH LAMPI** (Hydration Technology Innovations, LLC, Albany, OR).

10:50 **19** *Calcium Flux During Cell-Cell Communication – BSU Microgravity University 2012*, **REILLY CLARK, LINDSEY CATLIN*, LANDON NYE, KELLEN MATHER, TRAVIS BAKER, DAVID CONNOLLY, MATTHEW DOLAN, JASON ARCHER, EUGENE CASTRO, AUDRA PHELPS, NIC BAUGHMAN, DANIEL LAMBERT, MARIE THARP, JOSHUA ANGHEL, BENJAMIN DAVIS, ROBERT HAY, ALARK JOSHI, SARAH HAIGHT, ELISA BARNEY SMITH, JULIA OXFORD, and BARBARA MORGAN** (Department of Biological Sciences, Department of Electrical and Computer Engineering, Department of Mathematics, Department of Mechanical and Biomedical Engineering, Department of Business Management, Department of Computer Science, Division of Research, Boise State University).

11:10 **20** *Device Design and Development for Imaging Cellular Behavior – BSU Microgravity University 2012*, **DAVID CONNOLLY, MATTHEW DOLAN*, JASON ARCHER, EUGENE CASTRO, REILLY CLARK, KELLEN MATHER, LINDSEY CATLIN, LANDON NYE, TRAVIS BAKER, AUDRA PHELPS, NIC BAUGHMAN, DANIEL LAMBERT, MARIE THARP, JOSHUA ANGHEL, BENJAMIN DAVIS, ALARK JOSHI, ROBERT HAY, SARAH HAIGHT, ELISA BARNEY SMITH, BARBARA MORGAN, and JULIA OXFORD** (Department of Electrical and Computer Engineering, Department of Mechanical and Biomedical Engineering, Department of Computer Science, Department of Business Management, Department of Mathematics, Department of Biological Sciences, Division of Research, Boise State University).

11:30 *Closing Remarks*, **JULIA OXFORD**

Forensic Psychology in Evaluating a Lone Wolf Terrorist: An Analysis of the Norway Killer

PAYETTE RIVER ROOM
Monday
8:40 a.m. – Noon

Program organizer: *Ronn Johnson* (Clinical Mental Health Program, University of San Diego).

Program sponsored by the Pacific Division section on Psychology.

The Norway homegrown lone wolf terrorism case contained several forensic psychological factors. One of the most immediate concerns was whether or not the accused is capable of standing for trial. Assuming that he is, the next set of forensic psychological questions is related to what was his mental state at the time of the offense. Is it expected that he might be able to withstand the course of a trial without psychologically decompensating? If convicted or not convicted, then what role would his mental state play in determining conditions for his sentencing or release. The Norway killings case provides a forensic psychology framework for the science-based application of various clinical tools. In addition, there is an opportunity for examining the extent to which these psychological tools meet Daubert standards. These symposium presentations examine forensic mental health issues related to the Norway killing case with emphasis on his manifesto. Papers are presented in twos followed immediately by a "counter viewpoint" facilitated by discussants.

Program Chair: *Ronn Johnson*

8:40 **21** *Overview and Questions for Forensic Psychology in Homegrown Lone Wolf Terrorism Cases*, **RONN JOHNSON** (Clinical Mental Health Program, University of San Diego).

9:10 **22** *Forensic Psychology Cultural and Ethical Considerations in Homegrown Lone Wolf Terrorism Cases*, **KRISTEN N GREIDER*, CHRIS WEHRLE, NICK BOYD, and RONN JOHNSON** (Clinical Mental Health Program, School of Leadership and Education Sciences, University of San Diego).

9:40 **23** *Identifying, Securing, Organizing and Reviewing Mental Health Data in the Norway Killer Case*, **RONN JOHNSON*, CHRIS WEHRLE, and KRISTEN GREIDER** (Clinical Mental Health Counseling, School of Leadership and Education Sciences, University of San Diego).

10:10 BREAK

10:30 **24** *Opposing Psychological Reports on the Norway Killer Case*, **NICK BOYD*, LINH TRAN, and RONN JOHNSON** (Clinical Mental Health Counseling, School of Leadership and Education Sciences, University of San Diego).

11:00 **25** *Women and Children Suicide Bombers: The Next Terrorist Frontier*, **CHRIS WEHRLE*, ERICA BESSEN, and RONN JOHNSON** (Clinical Mental Health Counseling, School of Leadership and Education Sciences, University of San Diego).

11:30 **26** *Antiterrorism from an Alternate Behavioral Threat Assessment Perspective*, **CHRIS WEHRLE*, KRISTIN, DESCANIO, and RONN JOHNSON** (Clinical Mental Health Counseling, School of Leadership and Education Sciences, University of San Diego).

The Forensic Psychology of Women Death Penalty Cases

PAYETTE RIVER ROOM
Monday
1:30 p.m. – 4:50 p.m.

Program organizer: *Ronn Johnson* (Clinical Mental Health Program, University of San Diego).

Program sponsored by the Pacific Division section on Psychology.

Death penalty cases often contain psychological mitigating factors. For example, Theresa Lewis was a death penalty case where the aforementioned forensic psychological factors were relevant. Lewis was the 12th woman to be executed in the United States since capital punishment was reinstated in 1976. She was convicted in a murder for hire incident but the two male co-conspirators received life sentences. The Theresa Lewis case is significant for several forensic psychological reasons. The questions raised in the Lewis case fueled a scientific interest in evaluating to what extent were forensic psychology issues present in the other women death penalty cases. This symposium includes paper presentations that examine psychological issues related to the 12 most recent women death penalty cases. Papers are presented in twos followed immediately by a "counter viewpoint" facilitated by discussants.

Program Chair: *Ronn Johnson*

1:30 **27** *Overview of Questions for Forensic Psychology*

in Women Death Penalty Cases: Teresa Lewis as a Framework, **RONN JOHNSON* and KRISTEN N GREIDER** (Clinical Mental Health Program, School of Leadership and Education Sciences, University of San Diego).

2:00 **28** *Can a Forensic Psychological Report be Crafted in the Most Recent Women Death Penalty Cases of Lynda Lyon Block and Aileen Wuornos?* **KRISTEN N GREIDER* and RONN JOHNSON** (Clinical Mental Health Program, School of Leadership and Education Sciences, University of San Diego).

2:30 **29** *Forensic Mental Health Cultural and Ethical Considerations in Death Penalty Cases: Wanda Jean Allen, Teresa Lewis, and Frances Newton*, **KELLY RAINS*, KRISTIN DESCANIO, NICK BOYD, and RONN JOHNSON** (Clinical Mental Health Counseling, School of Leadership and Education Sciences, University of San Diego).

3:00 BREAK

3:20 **30** *Dependent Personality Disorder as a Mitigating Factor in Death Penalty Cases*, **ERICA J BESSEN* and RONN JOHNSON** (Clinical Mental Health Counseling, School of Leadership and Education Sciences, University of San Diego).

3:50 **31** *Forensic Psychology in Select Female Death Penalty Cases II: Black Widows*, **CHRIS WEHRLE*, KRISTEN N GRIEDER, and RONN JOHNSON** (Clinical Mental Health Counseling, School of Leadership and Education Sciences, University of San Diego).

4:20 **32** *Forensic Psychology in Select Female Death Penalty Cases III: Other Mental Health Issues*, **LINH TRAN* and RONN JOHNSON** (Clinical Mental Health Counseling, School of Leadership and Education Sciences, University of San Diego).

Computability and Complexity in Mathematics, Session I

PONDEROSA PINES 1 & 2
Monday, 1:30 p.m. – 5:15 p.m.
Tuesday, 9:00 a.m. – 11:25 a.m.

Program organizer: *Liljana Babinkostova* (Department of Mathematics, Boise State University).

Program sponsored by the Pacific Division section on Mathematics.

This program takes advantage of an NSF funded Mathematics Research Experiences for Undergraduates (REU) program that will be in week four of eight weeks at Boise State University during the time of the AAAS, Pacific Division conference. The invited speakers for this program are part of the scientific program of the REU, and will present high level scientific talks in the areas of algebra and geometry, with applications to information security and biology. Participating alumni and graduate students will present master's level research accomplishments in these areas. Mathematics REU student teams will also present during this symposium, affording them the opportunity to disseminate the results of their work in a professional forum and giving them the experience of a conference as an example of an event that is part of a professional STEM career. A Tuesday afternoon workshop will feature the use of genome remodeling processes that occur in ciliates as a computing environment to solve mathematical problems.

Program Chair: *Liljana Babinkostova*

1:30 **33** *DNA-rearrangement During Macronuclear Development in Ciliates*, **FRANZISKA JONSSON** (Department of Health, Institute of Cell Biology, University of Witten/Herdecke, Germany).

2:20 **34** *Genome Remodeling in Developmental Time: Algorithms for Ciliates*, **CHRISTOPHER ANDERSON[1], HELEN WAUCK[2]*, MARLENA WARNER[3] and MINGJIA YANG[4]** ([1]Department of Mathematics, Lewis and Clark College; [2]Department of Mathematics, Gustavus Adolphus College; [3]Department of Psychology and Communication Studies, University of Idaho; [4]Department of Mathematics, Albion College).

2:40 **34** *Genome Remodeling in Developmental Time: Algorithms for Ciliates*, **CHRISTOPHER ANDERSON[1]*, HELEN WAUCK[2], MARLENA WARNER[3] and MINGJIA YANG[4]** ([1]Department of Mathematics, Lewis and Clark College; [2]Department of Mathematics, Gustavus Adolphus College; [3]Department of Psychology and Communication Studies, University of Idaho; [4]Department of Mathematics, Albion College).

3:00 **34** *Genome Remodeling in Developmental Time: Algorithms for Ciliates*, **CHRISTOPHER ANDERSON[1], HELEN WAUCK[2], MARLENA WARNER[3]* and MINGJIA YANG[4]** ([1]Department of Mathematics, Lewis and Clark College; [2]Department of Mathematics, Gustavus Adolphus College; [3]Department of Psychology and Communication Studies, University of Idaho; [4]Department of Mathematics, Albion College).

3:20 **34** *Genome Remodeling in Developmental Time: Algorithms for Ciliates*, **CHRISTOPHER ANDERSON[1], HELEN WAUCK[2], MARLENA WARNER[3] and MINGJIA YANG[4]*** ([1]Department of Mathematics, Lewis and Clark College; [2]Department of Mathematics, Gustavus Adolphus College; [3]Department of Psychology and Communication Studies, University of Idaho; [4]Department of Mathematics, Albion College).

3:40 BREAK

4:00 **35** *Exploring Phylogenetic Relationships in Drosophila with Ciliate Operations*, **MARION SCHEEPERS[1], ANNA NELSON[1]*, and JACOB HERLIN[2].** ([1]Department of Mathematics, Boise State University; [2]Department of Mathematical Sciences, University of Northern Colorado).

4:20 **36** *Geometry, Topology, and Complexity of Virtual Knots*, **ASHLEY EARLS[1]*, GABRIEL ISLAMBOULI[2], and RACHAEL KELLER[3]** ([1]Department of Mathematics, St Olaf College; [2]Department of Mathematics, University of Virginia; [3]Department of Mathematics, Louisiana State University).

4:40 **36** *Geometry, Topology, and Complexity of Virtual Knots*, **ASHLEY EARLS[1], GABRIEL ISLAMBOULI[2]*, and RACHAEL KELLER[3]** ([1]Department of Mathematics, St Olaf College; [2]Department of Mathematics, University of Virginia; [3]Department of Mathematics, Louisiana State University).

5:00 **36** *Geometry, Topology, and Complexity of Virtual Knots*, **ASHLEY EARLS[1], GABRIEL ISLAMBOULI[2], and RACHAEL KELLER[3]*** ([1]Department of Mathematics, St Olaf College; [2]Department of Mathematics, University of Virginia; [3]Department of Mathematics, Louisiana State University).

Program continues on Tuesday, 26 June.
Please refer to page 27 in these *Proceedings.*

Responses of Sagebrush-Steppe Ecosystems to a Changing Climate

SALMON RIVER ROOM
Monday
1:30 p.m. – 4:50 p.m.

Program organizers: *Kevin P. Feris* and *Marie-Anne de Graaff* (Department of Biology, Boise State University).

Program sponsored by the Pacific Division section on Ecology, Organismal Biology, and Environmental Sciences.

Semi-arid and arid ecosystems cover approximately 53,000 km^2 of land, estimated to be more than 35% of Earth's land surface and equivalent of the areas of North America, South America, Europe, and Australia combined (McGinnies et al. 1968). Additionally, these ecosystems are estimated to contain 33% of above and below ground terrestrial carbon reserves (Stone et al., 2008). In the U.S., semi-arid ecosystems comprise over 60 million hectares in land mass (West and Young, 2000). Given the large spatial extent of these ecosystems, small changes in biogeochemical cycling under climate change may have large ramifications for global carbon budgets.

Current rapid increases in greenhouse gas emissions are expected to lead to warming and altered precipitation regimes in the semi-arid ecosystems of the Intermountain West (IPCC, 2007). These changes will alter the pool of terrestrial soil carbon by changing the decomposition rates of soil organic matter (SOM) (Davidson and Janssens et al., 2006).

This session will explore the intricate and interactive responses of semi-arid sagebrush-steppe ecosystems to changes in climate forcing factors.

Session Co-Chairs: *Marie-Anne de Graaff* and *Kevin P Feris*

1:30 **37** *Changes in Soil Aggregate Dynamics and Carbon Storage Following 18 Years of Experimentally Increased Precipitation in a Cold Desert Ecosystem*, **MARIE-ANNE de GRAAFF[1]*, JESS van der VEEN[2], MATTHEW GERMINO[2], and JAMIE HICKS[1]** ([1]Department of Biological Sciences, Boise State University; [2]USGS Forest and Rangeland Ecosystem Science Center, Boise, ID).

2:00 **38** *Influence of Precipitation Regime on Microbial Decomposition Patterns and Community Structure in Semi-Arid Ecosystems: Altered Roles of Bacteria and Fungi*, **KEVIN FERIS[1]*, CARRIE JILEK[1], DAVID HUBER[2], KEITH REINHARDT[2], MARIE-ANNE de GRAAFF[1], KATHERINE LOHSE[2], and MATT GERMINO[3]** ([1]Department of Biological Sciences, Boise State University; [2]Department of Biological Science, Idaho State University, Pocatello; [3]USGS FRESC, Boise ID).

2:30 **39** *Effects of Climate Shifts and Plant-Community Transformations on Carbon and Nitrogen Cycling in Semi-Arid Rangelands*, **DAVID P HUBER[1]*, KATHERINE LOHSE[1], MATT HERMINO[2], KEITH REINHARDT[1], KEVIN FERIS[3], and MARIE-ANNE de GRAAFF[3]** ([1]Department of Biological Science, Idaho State University, Pocatello; [2]USGS FRESC, Boise ID; [3]Department of Biological Sciences, Boise State University).

3:00 BREAK

3:20 **40** *Identifying Holocene Relationships among Climate, Vegetation, Fire and Fire-related Erosion using Alluvial Charcoal and Fossilized Woodrat (*Neotoma*) Middens at City of Rocks National Reserve, Idaho*, **KERRIE WEPPNER[1]*, JEN PIERCE[1], and JULIO BETANCOURT[2]** ([1]Department of Geosciences, Boise State University; [2]USGS NRP, Tucson, AZ).

3:50 **41** *At home on the Range: Loss of Sagebrush May Open New Habitat for Harvester Ants, and Imperil a Threatened Mustard Endemic to Southwest Idaho*, **IAN ROBERTSON** (Department of Biological Sciences, Boise State University).

4:20 **42** *Insect Responses to Intra- and Interannual Variations in Weather: Implications for Climate Change in Sagebrush Steppe*, **ASHLEY ROHDE[1,2]*, DAVID PILLIOD[1], and STEPHEN NOVAK[2]** ([1]U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Boise, ID; [2]Department of Biology, Boise State University).

Expert and Novice Learning in STEM: Exploring Assumptions and Indicators of Success

WILLOWS 1
Monday
1:30 p.m. – 3:30 p.m.

Program organizers: *Louis Nadelson* (Boise State University) and *Carl Maida* (University of California, Los Angeles).

Program sponsored by the Pacific Division section on Science and Technology Education.

As the focus on STEM (Science, Technology, Engineering and Mathematics) professions increases, there is a parallel demand to examine STEM learning and teaching and the relevant cognitive and affective variables. Learning variables can be both domain specific and domain general; thus assessment of these parameters also needs to be considered in terms of the context of STEM. Yet to explore the developments of learning and teaching in STEM, domain specific assessments need to be created and utilized. This session will engage audience members, including K–14 teachers, science educators, and presenters in a professional learning community experience. The intent is to provide an opportunity for collaborative inquiry on current issues and future trends related to STEM teaching and learning. Panelists will discuss best practices, including cognitive and affective approaches, together with assessment and measurement that would provide an empirical foundation for these new approaches. The following questions may be used to guide the learning community discussion of STEM teaching and learning:

- What do we know about how people learn STEM?
- What psychological variables – cognitive and affective – are associated with learning?
- What assessments are available to measuring the variables associated with how people learn STEM?
- What are some burning questions regarding STEM teaching and learning? Keep in mind that what seems obvious may have little or no empirical foundation.
- Where are the gaps in measures of STEM teaching and learning?
- What does successful STEM teaching and learning look like and what is the empirical evidence documenting the effectiveness?

1:30 *Welcome*, **KIMBERLY D TANNER** (San Francisco State University)
1:40 *Introductory Remarks*, **LOUIS NADELSON** (Boise State University).

2:00 *Panel: Expert and Novice Learning In STEM: Exploring Assumptions and Indicators of Success*

Moderator:
Louis Nadelson
Panelists:
Suzanne H. Broughton (Utah State University)
J. Richard Jordan (Timberline High School, Boise)
Jay Vavra (High Tech High, San Diego)
Sasha Wang (Boise State University)
Discussant:
Carl Maida (University of California, Los Angeles)
Discussion:
Audience and Panelists

3:15 *Closing Remarks*, **LOUIS NADELSON**

Tuesday, 26 June 2012

Computability and Complexity in Mathematics, Session II

PONDEROSA PINES 1 & 2
Program continues from Monday.
Please refer to page 24 of these *Proceedings* for the full description of the program.
Tuesday, 9:00 a.m. – 11:25 a.m.

Program Co-Chairs: *Jens Harlander* and *Marion Scheepers*

9:00 **43** *Elliptic Curves: From Diophantus to Modern Cryptography*, **LAWRENCE C WASHINGTON** (Department of Mathematics, University of Maryland, College Park, MD 20742; lcw@umd.edu).

9:50 **44** *Computability and Complexity in Elliptic Curves and Cryptography*, **KEVIN BOMBARDIER[1]*, MATTHEW COLE[2], THOMAS MORRELL[3], and CORY SCOTT[4]** ([1]Department of Mathematics, Wichita State University; [2]Department of Mathematics, University of Notre Dame; [3]Department of Mathematics, Washington University in St. Louis; [4]Department of Mathematics, Colorado College).

10:10 **44** *Computability and Complexity in Elliptic Curves and Cryptography*, **KEVIN BOMBARDIER[1], MATTHEW COLE[2], THOMAS MORRELL[3]*, and CORY SCOTT[4]** ([1]Department of Mathematics, Wichita State University; [2]Department of Mathematics, University of Notre Dame; [3]Department of Mathematics, Washington University in St. Louis; [4]Department of Mathematics, Colorado College).

10:30 **44** *Computability and Complexity in Elliptic Curves and Cryptography*, **KEVIN BOMBARDIER[1], MATTHEW COLE[2], THOMAS MORRELL[3], and CORY SCOTT[4]*** ([1]Department of Mathematics, Wichita State University; [2]Department of Mathematics, University of Notre Dame; [3]Department of Mathematics, Washington University in St. Louis; [4]Department of Mathematics, Colorado College).

10:50 **44** *Computability and Complexity in Elliptic Curves and Cryptography*, **KEVIN BOMBARDIER[1], MATTHEW COLE[2]*, THOMAS MORRELL[3], and CORY SCOTT[4]** ([1]Department of Mathematics, Wichita State University; [2]Department of Mathematics, University of Notre Dame; [3]Department of Mathematics, Washington University in St. Louis; [4]Department of Mathematics, Colorado College).

11:10 **45** *Symmetric Key Cryptography Over Non-binary Algebraic Structures*, **LILJANA BABINKOSTOVA[1], KAMERYN WILLIAMS[1]*, ALYSSA BOWDEN[2], and ANDREW KIMBALL[3]** ([1]Department of Mathematics, Boise State University; [2]Department of Mathematics, Loyola Marymount University; [3]Department of Mathematics and Computer Science, Western Carolina University).

Following this symposium Tuesday afternoon will be the workshop, *Programmed Genome Remodeling in Ciliates and Computing*. In the middle of the workshop will be the contributed paper, *Cantor's Original Proof that the Reals are Uncountable*. For information about the workshop, please refer to page 35 of these *Proceedings*. For information about the oral presentation, please refer to page 40 of these *Proceedings*.

Biofuel: Computational Modeling of Cellulose and Cellulase

DOUGLAS FIR 1 & 2
Tuesday
9:00 a.m. – 11:50 a.m.

Program organizer: *C. Mark Maupin* (Department of Chemical and Biological Engineering, Colorado School of Mines).

Program sponsored by the Pacific Division section on Computer and Information Sciences.

The ever increasing world-wide demands for energy, along with uncertain petroleum sources and the possibility of global climate change, has dictated the necessity for our nation to develop a sustainable and renewable alternative to fossil transportation fuel. Biofuels derived from lignocellulosic biomass are attractive alternatives due to the vast infrastructure already in place for the distribution of a liquid transportation fuel, and the fact that fuel derived from cellulose does not compete with human and livestock food resources. Furthermore, since cellulose is the most abundant renewable biopolymer on earth, the feedstock for cellulosic biofuels is almost inexhaustible and the utilization of cellulose for liquid fuel can achieve zero net carbon dioxide emission, thereby making it a crucial component in our efforts to reduce greenhouse gases.

Cellulosic biofuels are created by hydrolyzing cellulose to glucose and subsequently fermenting the glucose to make biofuel. Several major obstacles remain with regard to the viability of cellulosic biofuels including overcoming the natural resistance of cellulose to enzymatic depolymerization, known as biomass recalcitrance, which is primarily responsible for the high cost of cellulosic biofuels. To formulate ways to overcome biomass recalcitrance, a basic understanding of the substrate and enzymes involved in the hydrolysis

of cellulose are needed. The enzyme-driven hydrolysis of crystalline cellulose to glucose is regulated by three different cellulases: endocellulase (EG), exocellulase (cellobiohydrolase, CBHI and CBHII), and β-glucosidase (BG).

This symposium will focus on the modeling of the substrate and each of the three enzymes in an effort to evaluate their ability to bind substrate and catalyze the hydrolysis reaction.

Session Chair: *C. Mark Maupin*

9:00 **46** *Computational Evaluation of Alternative/Renewable Energy Solutions*, **C MARK MAUPIN** (Department of Chemical and Biological Engineering, Colorado School of Mines).

9:30 **47** *Multi-resolution Computational Studies of Cellulose*, **GIOVANNI BELLESIA, PARTHASARATHI RAMAKRISHNAN, ANURAG SETHI, and S GNANAKARAN*** (Theoretical Biology and Biophysics Group, Los Alamos National Labs).

10:00 **48** *Computer Simulation of Lignocellulosic Biomass*, **LOUKAS PETRIDIS** (Oak Ridge National Laboratory).

10:30 BREAK

10:50 **49** *Identification of Conserved Binding Motifs for Cellulase Enzymes and the Creation of a Novel Approach to Identifying the Enzymatic Mode of Action*, **SAMBASIVARAO V SOMISETTI** (Department of Chemical and Biological Engineering, Colorado School of Mines).

11:20 **50** *Biomass to Biofuels: Computer Modeling of Cellulose and Cellulases*, **MICHAEL F CROWLEY[1]*, GREGG T BECKHAM[2,3], LINTAO BU[2], and JAMES F MATTHEWS[1]** ([1]Biosciences Center, National Renewable Energy Laboratory; [2]National Bioenergy Center, National Renewable Energy Laboratory; [3]Department of Chemical Engineering, Colorado School of Mines).

Water Resource Management in the Arid West: Historical Perspectives and Emerging Issues

PAYETTE RIVER
Tuesday
9:00 a.m. – Noon

Program organizer: *Scott E. Lowe* (Department of Economics, Boise State University).

Program sponsored by the Pacific Division section of Social, Economic, and Political Sciences.

This symposium will encompass state of the art research related to water resources management in the arid western United States. The research presented in this symposium will address the impacts that future climate change predictions may have on managed and unmanaged water resources, and the resulting economic implications of these changes; the impact of institutional constraints (variations in prior appropriation water rights laws) on water resource management; urban, agricultural and industrial adaptation to uncertainty in water supply; the role that major water infrastructure projects have played in addressing the variability and uncertainty in water availability, and the political economy of the investments in the projects; and the impact of property rights for interrelated surface and groundwater resources management.

Program Chair: *Scott E. Lowe*

9:00 *Introductory Comments*, **SCOTT E LOWE**

9:10 **51** *An Evaluation of Water Transactions for Environmental Benefits in the Pacific Northwest*, **KELLY WENDLAND[1]* and SHANNA KNIGHT[2]** ([1]Department of Conservation Social Sciences, University of Idaho; [2]Department of Law, University of Idaho).

9:40 **52** *Fixed Yet Variable: The Effects of Water Rights Institutions on Agricultural Land Use in the Arid West*, **SCOTT LOWE and WENCHAO XU*** (Department of Economics, Boise State University).

10:10 BREAK

10:30 **53** *Enhancing Economic Effectiveness of Water Use within Prior Appropriations Doctrine in the Western United States*, **LEVAN ELBAKIDZE and HANNAH VINSON*** (Department of Agricultural Economics and Rural Sociology, University of Idaho).

11:00 **54** *Calculator: Optimized Surface Water Allocation in Drought (OSWAD)*, **DAVID J HOEKEMA* and JAE RYU** (Department of Biological and Agricultural Engineering, University of Idaho).

11:30 **55** *The Political Economy of Major Water Infrastructure Investments in the Western United States and the Impact on Agriculture: An Historical Analysis*, **ZEYNEP K HANSEN[1], GARY D LIBECAP[2], and SCOTT E LOWE[1]*** ([1]Department of Economics, Boise State University; [2]Bren School of Environmental Science and Management, University of California, Santa Barbara).

Modeling, Simulation, and Data Visualization

DOUGLAS FIR 1 & 2
Tuesday
1:00 p.m. – 5:20 p.m.

Program organizers: *Tim Andersen* (Department of Computer Science and Engineering, Boise State University) and *Jeff Habig* (Department of Chemistry and Biochemistry, Boise State University).

Program sponsored by the Pacific Division section of Computer and Information Sciences.

The aim of this symposium is to promote and foster collaboration among Idaho researchers involved in modeling, simulation, visualization and numerical algorithm development in science and engineering applications. A secondary aim is to make researchers aware of computational resources available to them in Idaho to carry out their research.

Program Co-Chairs: *Tim Andersen* and *Jeff Habig*

1:00 **56** *Modeling Spatiotemporal Dynamics in Viral and Bacterial Systems with Discrete Models*, **SUZY VASA, JAMESON MILLER, and MORGAN C GIDDINGS*** (College of Arts and Sciences, Boise State University; [2]Department of Microbiology and Immunology, University of North Carolina, Chapel Hill).

1:30 **57** *A New Bioinformatics of Shape for Regenerative Science*, **DANIEL LOBO* and MICHAEL LEVIN** (Center for Regenerative and Developmental Biology, and Department of Biology, Tufts University).

2:00 **58** *Automating Discovery of Agent-based Models of Complex Pattern Formation – Development to Regeneration*, **JEFF HABIG[1]* and TIM ANDERSEN[2]** (Departments of [1]Chemistry and Biochemistry and [2]Computer Science, Boise State University).

2:30 **59** *Systems Modeling of Retinoid Metabolism in Alcoholic Disease*, **JENNIFER R CHASE** (Department of Biology, Northwest Nazarene University).

3:00 **BREAK**

3:20 **60** *Inverse Modeling for Advanced Simulation*, **JODI MEAD** (Department of Mathematics, Boise State University).

3:50 **61** *Immersive Visualization: An Interactive Interface to Multivariate Data*, **ALARK JOSHI** (Department of Computer Science, Boise State University).

4:20 **62** *Volume Visualization and Statistical Analysis of Rotating and Sheared Homogeneous Turbulence*, **FRANK G JACOBITZ[1]*, KAI SCHNEIDER[2], WOUTER J T BOS[3], and MARIE FARGE[4]** ([1]Mechanical Engineering Program, University of San Diego; [2]M2P2-CNRS and CMI, Université de Provence, France; [3]LMFA-CNRS, Ecole Centrale de Lyon, Université de Lyon, France; [4]LMD-CNRS, Ecole Normale Supérieure, France).

4:50 **63** *Massively Parallel Multiphysics Simulation of Complex Processes*, **DEREK GASTON** (Computational Frameworks Group Lead, Fuel Modeling and Simulation Department, Idaho National Laboratory).

Transport Across Membranes

PAYETTE RIVER
Tuesday
1:30 p.m. – 3:30 p.m.

Program organizers: *Daniel Fologea* (Department of Physics, Boise State University) and *James R. Groome* (Department of Biology, Idaho State University, Pocatello).

Program sponsored by the Pacific Division sections on Cell and Molecular Biology, and Chemistry and Biochemistry.

Highly selective molecular transport through biological membranes is essential for life. Directed flows of ions and macromolecules are main pieces of complex life-sustaining processes such as intra- and inter-cellular communication, transport of molecules, ions, and nutrients, energy production, motility, information storage and transmission, and maintenance of electrochemical gradients. Specific components of the transport mechanisms play key roles as targets for viruses and pharmaceuticals, and their malfunctioning often lead to various diseases, even death.

The main goal of this symposium is to shed more light on the mechanistic of transport across biological membranes, and to improve our understanding with respect to physiological, biological, and medical relevance. This symposium is open to researchers, students, and professionals interested in this fascinating inter-disciplinary field.

Session Co-Chairs: *Daniel Fologea* and *James R.Groome*

1:30 **64** *Atomic Force Microscopy: Potential Applications on the Study of Transmembrane Proteins*, **BYUNG KIM** (Department of Physics, Boise State University).

2:00 **65** *Multivalent Ions Control the Transport through Lysenin Channels*, **DANIEL FOLOGEA** (Department of Physics, Boise State University).

2:30 **66** *Modulation of Ionic Transport through Lysenin Channels by Charged Nanoparticles*, **SHEENAH BRYANT*, DANIEL FOLOGEA, JORDAN CHESS, GORDON ALANKO, and ALEX PUNNOOSE** (Department of Physics, Boise State University).

3:00 **67** *State Transitions in Sodium Channels: Role of the Voltage Sensing Module*, **JAMES GROOME* and VERN WINSTON** (Department of Biology, Idaho State University, Pocatello).

Science-Themed Fiction

SALMON RIVER
Tuesday
1:30 p.m. – 4:20 p.m.

Program Organizer: *Robert L. Chianese* (Emeritus, Department of English, California State University Northridge).

Program sponsored by the Pacific Division section on General and Interdisciplinary Studies.

We are quite familiar with the popular genre of science fiction, but we give much less attention to science-themed fiction, works of literature in the form of novels and short stories, that derive some or much of their content from science ideas or figures. Issues and themes from astronomy to zoology – including cosmology, biology, ecology, genetics, medicine, mathematics – can form key elements of both historical and contemporary fiction. This symposium explores the use of science by fiction writers and the more general theoretical connections between literature and science.

Program Chair: *Robert L. Chianese*

1:30 **68** *Broken Webs in T. C. Boyle's Eco-novel When the Killing's Done*, **ROBERT LOUIS CHIANESE** (Emeritus, Department of English, California State University Northridge).

2:00 **69** *Cosmology in Literature*, **JOHN WILLIAM (BILL) COPELAND**.

2:30 **70** *George G. Simpson, Concession to the Ineluctable in His Sci-fi Novel, The Dechronization of Sam Magruder*, **LÉO F LAPORTE** (Emeritus, University of California Santa Cruz).

3:00 **BREAK**

3:20 **71** *The Emergence of Consciousness in Neurobiologist Terrence Deacon and Novelist James Joyce*, **JESSE J THOMAS** (Department of Religious Studies, San Diego State University).

3:50 **72** *The Tragic Commons: Population, Resources, and Freedom in Garrett Hardin and Jonathan Franzen*, **CARL A MAIDA** (Institute of the Environment and Sustainability, University of California, Los Angeles).

Mechanisms of Tumor Progression and Cancer Therapeutics

SNAKE RIVER
Tuesday
1:30 p.m. – 4:50 p.m.

Program organized by: *Cheryl Jorcyk* (Department of Biology, Boise State University).

Program sponsored by the Pacific Division sections of Cell and Molecular Biology, and Health Sciences.

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*

1:30 **73** *Breast Cancer Metastasis: A Role for the Inflammatory Cytokine Oncostatin M?* **CHERYL JORCYK** (Department of Biological Sciences, Boise State University).

2:00 **74** *A Brief History of Myeloma: How Bench Research Has Transformed Treatments at the Bedside*, **PAUL MONTGOMERY** (St. Luke's Mountain States Tumor Institute, Boise, ID).

2:30 **75** *Zinc Oxide Nanoparticle Toxicity Against Tumor Cells*, **JOHN RASMUSSEN** (Department of Biological Sciences, Boise State University).

2:45 **76** *Stromal Signaling in the Pathogenesis of Breast Cancer*, **MINOTI HIREMATH[1]*, LAURA BOND[1], and JOHN J WYSOLMERSKI[2]** ([1]Department of Biological Sciences, Boise State University; [2]Department of Internal Medicine, Section of Endocrinology, Yale University).

3:00 **BREAK**

3:20 **77** *The Role of Autophagy in the Development and Treatment of Colon Cancer*, **TOM DONNDELINGER* and JOELLA SKYLES** (Department of Pathology, St. Alphonsus Hospital, Nampa, ID).

3:50 **78** *Inter-omic Analysis of Breast Cancers to Uncover How Genomic Aberrants Lead to Cancer Phenotypes*, **MORGAN C GIDDINGS*, BRIAN RISK, JOHN WROBEL, and JAINAB KHATUN** (School of Arts and Sciences, Boise State University).

4:20 **79** *Oncostatin M Interacts with ECM Components: Implications for Chronic Inflammation and Tumor Metastasis*, **RANDALL RYAN*, BRYAN MARTIN, LILIANA MELLOR, OWEN McDOUGAL, REED JACOB, CHERYL JORCYK, and JULIA OXFORD** (Department of Biological Sciences, Department of Chemistry and Biochemistry, Biomolecular Research Center, Boise State University).

Wednesday, 27 June 2012

Emerging and Re-Emerging Infectious Diseases

DOUGLAS FIR 1 & 2
Wednesday
8:00 a.m. – Noon

Program organized by: *Michael J. Aldape* (Veterans Affairs Medical Center).

Program sponsored by the Pacific Division section of Health Sciences.

Well-characterized pathogens are now evolving into more virulent organisms at the same time that new diseases are constantly being identified world-wide. While many infectious diseases have been effectively controlled with the help of decades of scientific research, the constant burdens created by these long-standing and novel infectious organisms has demanded the need for further research into disease pathogenesis, virulence factors, patterns of transmission, host susceptibility and drug resistance. In addition, the development of novel technologies and therapeutic interventions such as vaccines and diagnostic procedures are also essential to controlling the advancement and spread of these diseases. This program will provide a scientific platform for the expert review of several pathogens associated with current and reemerging infectious diseases. Issues presented will include detailed mechanisms associated with the pathogenesis, novel strategies in controlling infectious disease, as well as clinical updates. This symposium is designed for undergraduate and graduate students, internists, family physicians, infectious disease specialists, nurses, pharmacists, and others who research or manage patients with infectious diseases.

Session Chair: *Michael J. Aldape*

8:00 **80** *Toxin Production by Methicillin Resistant Strains of* Staphylococcus aureus *(MRSA): The Effect of Antibiotics*, **DENNIS L STEVENS[1,2]*, AMY E BRYANT[1,2,3], STEPHANIE HAMILTON[1,3] and YONGSHENG MA[1]** ([1]Department of Veterans Affairs Medical Center; [2]University of Washington School of Medicine; [3]Department of Life Sciences, University of Idaho).

8:30 **81** Yersinia pestis *Ompx Virulence Factor and Role in Host Cell Attachment, Internalization, and Immune Modulation*, **ANNA M KOLODZIEJEK[1]*, SCOTT A MINNICH[1], CAROLYN J HOVDE[1], and GREGORY A BOHACH[2]** ([1]School of Food Science, University of Idaho; [2]Division of Agriculture, Forestry and Veterinary Medicine, Mississippi State University, Starkville).

9:00 **82** *Construction and Characterization of Non-toxic Bacterial Enterotoxins as Vaccine Adjuvants*, **LAVANYA VEMPATI* and JULIETTE TINKER** (Department of Biological Sciences, Boise State University).

9:30 **83** *Norovirus Genotype Dynamics Among Outbreak Associated Strains in Alaska, Idaho, Montana, and Wyoming 2010-2012*, **AMANDA J BRUESCH and CHRISTOPHER L BALL*** (Idaho Bureau of Laboratories, Boise, ID).

10:00 BREAK

10:30 **84** Campylobacter jejuni *Exploits Host Cell Processes to Enhance Disease*, **MICHAEL E KONKEL** (School of Molecular Biosciences, Washington State University).

11:00 **85** *Effects of Selective and Non-selective NSAIDs on Initiation, Progression and Antibiotic Efficacy of Experimental Group A Streptococcal Myonecrosis*, **STEPHANIE HAMILTON[1,2]*, CLIFFORD R BAYER[1], DENNIS L STEVENS[1,3], and AMY E BRYANT[1,2,3]** ([1]U.S. Department of Veterans Affairs Medical Center, Boise, ID; [2]Department of Life Sciences, University of Idaho; [3]University of Washington School of Medicine).

11:30 **86** *Modeling HIV-1 Latency in Primary Central Memory Lymphocytes*, **LAURA MARTINS*, ALBERTO BOSQUE, MARYLINDA FAMIGLETTI, PETER RAMIREZ, CAMILLE NOVIS, and VICENTE PLANELLES** (Division of Microbiology and Immunology, Department of Pathology, University of Utah).

Recent Advances in Pharmacology and Toxicology

PAYETTE RIVER
Wednesday
8:30 a.m. – 11:45 a.m.

Program organizer: *Kristen Mitchell* (Department of Biolo-ical Sciences, Boise State University).

Program sponsored by the Pacific Division sections of Cell and Molecular Biology, and Health Sciences.

The development of novel therapeutic strategies requires a detailed understanding of mechanisms that regulate homeostasis, along with an appreciation of the balance that exists

between the therapeutic and toxic effects of chemical compounds. This session will focus on recent advances in understanding the pharmacological and toxicological effects of drugs, chemicals and environmental contaminants. Investigators are invited to present research on the identification of targets for new drug development, new drug screening strategies, and novel mechanisms of drug action. Emphasis will also be placed on the identification of mechanisms of toxicity for drugs, chemicals and environmental contaminants.

Session Chair: *Kristen Mitchell*

8:30 **87** *Inhibition of Growth of Cervical Cancer Cells by a Chymotrypsin-Like Protease Inhibitor*, **KIMBERLY J JURGENSEN*, KRISTIN A ECKERT, and GARY A CLAWSON** (Jake Gittlen Cancer Research Foundation, Pennsylvania State University College of Medicine).

8:55 **88** *From Our Phones To Our Bones: Mechanisms of Cadmium-Induced Osteotoxicity*, **SARA J HEGGLAND (**Department of Biology, The College of Idaho).

9:20 **89** *Mechanism of Acrylonitrile Carcinogenesis in Rat Brain: The Potential Involvement of Oxidative Stress*, **XINZHU PU[1]*, ZEMIN WANG[2], SHAOYU ZHOU[2], LISA M KAMENDULIS[2], and JAMES E KLAUNIG[2]** ([1]Department of Biological Sciences, Boise State University; [2]Department of Environmental Health, Indiana University).

9:45 **90** *Modulation of Atrogin-1 and the Ubiquitin Proteasomal System by Anthracyclines in Left Ventricular Tissue in Rats*, **NICOLE FRANK[1,2]*, SUELA KUMBULLA[1], ADITI JAIN[1], JAMES C K LAI[1,2], RICHARD OLSON[1,2], BARRY CUSACK[1,2,3], and ALOK BHUSHAN[1,2]** ([1]Department of Biomedical and Pharmaceutical Sciences, College of Pharmacy and ISU Biomedical Institute, Idaho State University, Pocatello; [2]Mountain States Tumor and Medical Research Institute, Boise; [1]Research Service, Department of Veterans Affairs Medical Center, Boise).

10:10 BREAK

10:30 **91** *The Role of Anti-mesothelial Cell Antibodies in Asbestos-Induced Pleural Disease*, **JEAN C PFAU* and KINTA SERVE** (Department of Biological Sciences, Idaho State University, Pocatello).

10:55 **92** *Assessment of Amphiphilic Quantum Dot Disposition in Two Human Liver Models*, **WESLEY E SMITH[1]*, JESSICA BROWNELL[3], COLLIN C WHITE[1], ZAHRA ASHFARINAJAD[1], JESSE TSAI[1], XIAOGE HU[2], STEVEN J POLYAK[3], XIAOHU GAO[2], TERRANCE J KAVANAGH[1] and DAVID L EATON[1]** (Departments of [1]Environmental and Occupational Health Sciences, [2]Bioengineering and [3]Global Health/Pathobiology, University of Washington).

11:20 **93** *Modulation of Hepatic Stellate Cell Activation by Ah Receptor Ligands*, **KRISTEN A MITCHELL (**Department of Biological Sciences, Boise State University).

Biophysical Insights from Experimental Approaches to Computational Simulations

WILLOWS 1 & 2
Wednesday
8:30 a.m. – 4:30 p.m.

Program organizer: *Dong Xu* (Department of Chemistry and Biochemistry, Boise State University).

Program sponsored by the Pacific Division sections of Cell and Molecular Biology, Chemistry and Biochemistry, Health Sciences, and Physics and Materials Science.

This symposium focuses on the experimental and computational methods used in studying the conformations and dynamics of biological molecules and systems. The purpose of the symposium is to provide a dynamic forum to engage scientists across the nation, particularly from the Pacific Northwest region, in a dialogue about the latest advances in biophysical and biomedical research, and the state-of-the-art techniques used in the research.

Program Chair: *Dong Xu*

8:30 **94** *Discovery of a Nanoscale Clamp for Protein and Chromatin Binding*, **RICCARDO BARON** (Department of Medicinal Chemistry, College of Pharmacy, The Henry Eyring Center for Theoretical Chemistry, University of Utah).

9:00 **95** *Deconstructing and Reconstructing a Protein Capsid*, **KENNETH WOYCECHOWSKY** (Department of Chemistry, University of Utah).

9:30 **96** *Determining Realistic Structural Ensembles for Intrinsically Disordered Proteins*, **F MARTY YTREBERG** (Department of Physics, University of Idaho).

10:00 BREAK

10:30 97 *Chromatographic Stationary Phase Development for the Analysis of Solute Interactions with Phospholipid Membranes*, **ERIC E ROSS** (Department of Chemistry and Biochemistry, Gonzaga University).

11:00 98 *Biomolecular Motors and Switches: From Machines to Drugs*, **BARRY J GRANT** (Center for Computational Medicine and Bioinformatics, University of Michigan Medical School).

11:30 99 *An Unusual HMG-CoA Reductase from* Burkholderia cenocepacia*: Kinetic and Structural Characterization*, **JEFF WATSON** (Department of Chemistry and Biochemistry, Gonzaga University).

12:00 LUNCH

1:30 100 *Simulation of Drug-Binding Kinetics*, **CHUNG F WONG** (Department of Chemistry and Biochemistry and Center for Nanoscience, University of Missouri-Saint Louis).

2:00 101 *Computational Studies of Ras Dynamics, Membrane Binding and Assembly*, **ALEMAYEHU (ALEX) GORFE** (Integrative Biology and Pharmacology, University of Texas Medical School – Houston).

2:30 102 *Observing Intermolecular Unbinding Mechanisms Through Forced Unbinding Studies Using AFM*, **JONATHAN WALSH** (Department of Physics, Boise State University).

3:00 BREAK

3:30 103 *Ab initio QM/MM Molecular Dynamics with AMBER and TeraChem: Exploring Environmental Effects on the Absorption Spectrum of Photoactive Yellow Protein*, **ANDREAS W GOETZ** (San Diego Supercomputer Center).

4:00 104 *Characterizing the Conformations and Dynamics of PEGylated Human Interferon ß-1a via Molecular Dynamics Simulation*, **NIKOLAI SMOLIN** (Department of Chemistry and Biochemistry, Boise State University).

II. WORKSHOPS

Monday, 25 June 2012

The following Monday workshops are sponsored by NORM 12. AAASPD registrants are invited to attend these as interests dictate. Please refer to the NORM 12 program for details of each of these workshops.

Planning Your Job Search
Monday
8:00 a.m. – 9:30 a.m.

Preparing A Resumé
Monday
9:30 a.m. – 11:00 a.m.

Effective Interviewing
Monday
11:00 a.m. – 12:30 p.m.

A New Look at Spectrophotometry – And Some Other Things You can Do with Computers: Using Computers to Cut Costs and Buy Time for Inquiry
Monday
9:00 a.m. – Noon

Strategies for Supporting STEM Student Learning with Process Oriented Guided Inquiry Learning (POGIL)
Monday
1:30 p.m. – 4:30 p.m.

Tuesday, 26 June 2012

Programmed Genome Remodeling in Ciliates and Computing
PONDEROSA PINES 1 & 2
Tuesday
1:30 p.m. – 4:20 p.m.

Two hour workshop organized by *Marion Scheepers* (Department of Mathematics, Boise State University).

Ciliates are single cell organisms that harbor two types of nuclei, one type an encrypted version of the other. Certain events trigger replacement of the current nuclei by decryption of the encrypted versions. The remodeling processes performing the decryption solve very complex combinatorial problems. Experimental evidence suggests that the decryption can be reliably manipulated to yield results different from the standard. This workshop will present an overview of the ciliate decryption process, with special emphasis on the programmable aspects of the process, and the computational capabilities of the process. Participants will learn about the cryptographic relationship between the two types of nuclei per ciliate, how information can be encoded in DNA and how to reprogram the ciliate decryption program. The workshop will span three hours with a ten minute break between hours. After this workshop, participants will be in a position to appreciate the known mathematical findings regarding this living computing environment, and the untapped potential of this *in vivo* computing environment. No fee other than meeting registration. Limited to twenty-five (25) participants.

NOTE: This workshop is part of the Mathematics program for this meeting, which includes the symposium, *Computability and Complexity in Mathematics* (see page 24 of these *Proceedings* for information); contributed oral papers given on Monday morning (see page 39), Tuesday afternoon (in the middle of this workshop – see page 40) and on Wednesday morning (see page 41); and a poster presented on Monday afternoon (see page 45). Additionally, at the end of the contributed oral presentations on Wednesday will be a *Graduate School Panel Discussion*.

Wednesday, 27 June 2012

DockoMatic: Calculations and Homology Modeling

DOUGLAS FIR 1 & 2
Wednesday
1:30 p.m.

Half-day workshop organized by *C. Mark Maupin* (Chemical and Biological Engineering Department, Colorado School of Mines).

This workshop will focus on the use of the program DockoMatic. Created at Boise State University, this program is a wrapper that links several different codes, including Autodock4 and Modeller, into a single, user friendly graphical interface (GUI). During this workshop, particants will be guided through the use of DockoMatic to create a homology model of a macromolecule. After the successful creation of the 3-D structure for the macromolecule, DockoMatic will then be used to automate docking calculations between the macromolecule and a ligand. The workshop will finish up with a quick analysis of the calculations and a question/answer phase to help participants formulate ways in which to use DockoMatic.

No fee other than meeting registration.

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

Monday, 25 June 2012

Joint Session of AAASPD Sections of
Chemistry and Biochemistry
Health Sciences
Oral Biology and Dental Medicine
Physics and Materials Science
WILLOWS 1
Monday
8:20 a.m. – Noon

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

Organizer for the Health Sciences Section: *H.K. Choi* (Department of Biology, California State University Dominguez Hills).

Organizer for the Oral Biology and Dental Medicine Section: *Francesco Chiappelli* (University of California Los Angeles School of Dentistry).

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

Health Sciences

Session Chair: *H.K. Choi*

8:20 **105** *Psychoanalysis and Conflict Between the Mutual Nurturance Drive and Social Survival*, **RODERIC GORNEY** (Department of Psychiatry, Semel Institute, University of California Los Angeles).

8:40 **106** *Delta Dental of Idaho School-Based Dental Sealant Program: An Evaluation of Sealant Retention and Dental Caries Prevention*, **ERIC S DONAHUE* and LEE HANNAH** (College of Health Science, Boise State University).

9:00 **107** *Metformin Pharmacology and Pharmacogenomics of Organic Cation Transporter 3 (OCT3), SLC22A3*, **LIGONG CHEN*, LU XU, EUGENE CHEN and KETHLEEN GIACOMINI** (Department of Bioengineering and Therapeutic Sciences, University of California San Francisco).

Oral Biology and Dental Medicine

9:20 **108** *Pilot Study of Oncogenic HPVs in Oral Lavage Samples from HIV Positive Senegal Women*, **JULIET DANG[1]*, NANCY KIVIAT[2], QINGHUA FENG[3] and STEPHEN HAWES[4]** ([1]Department of Oral Biology, [2]Department of Pathology, [3]Department of Pathology, [4]Department of Epidemiology, University of Washington).

9:40 **BREAK**

Chemistry and Biochemistry

Session Chair: *Owen M. McDougal*

10:00 **109** *Molecular Docking, Synthesis of Novel Quinazolin Analogues as Inhibitors of Transcription Factors NF-κB Activation and their Anti-cancer Activities*, **LU XU* and WADE A RUSSU** (Department of Pharmaceutics and Medicinal Chemistry, Thomas J. Long School of Pharmacy and Health Sciences, University of the Pacific).

10:20 **110** *Separation and Characterization of Multiple Component Detergent Systems Used in Industrial Sanitation Processes*, **ASHLEY A FISHER*, EMILY DRUSSEL, PETR MALEK, and OWEN M MCDOUGAL** (Department of Chemistry and Biochemistry, Boise State University).

10:40 **111** *Oxalate Metabolism by* Sclerotinia sclerotiorum*, a Fungal Pathogen in Soybeans*, **ANNE MBIRI[1,2]*, ERUSTUS GATEBE[1], MARY NDUNG'U[1], DANIEL KARIUKI[1], and ERUSTUS MWANGI[1]** ([1]Department of Chemistry, Jomo Kenyatta University of Agriculture Technology, Nairobi, Kenya; [2]Department of Pure and Applied Sciences, The Mombasa Polytechnic University College, Mombasa).

Physics and Materials Science

Session Chair: *George Quainoo*

11:00 **112** *Growth and Magnetic Properties of Co-deposition Ni-Mn-Ga via Radio Frequency and Direct Current Physical Vapor Deposition*, **KIMO WILSON*, PETER MÜLLNER, and WILLIAM**

KNOWLTON (Department of Materials Science and Engineering, Boise State University).

11:20 **113** *The Effect of Natural Aging and Grain Size on the Mechanical Properties of AA6111 Aluminum for Auto Panel Application*, **GEORGE K QUAINOO* and DALLIN BAKER** (Department of Physics, Materials Science and Engineering, Southern Oregon University).

11:40 **114** *An Upside-Down Reality: The Matter-Time Universe*, **STEPHEN F AGNEW** (Columbia Energy and Environmental Services, Inc., Richland, WA).

Joint Session of the AAASPD Sections of Agriculture and Horticultural Sciences Earth Sciences Ecology, Organismal Biology, and Environmental Sciences

WILLOWS 2
Monday
8:40 a.m. – Noon

Organizer for the Agriculture and Horticultural Sciences Section: *Michael D. MacNeil* (Delta G, Miles City, MT).

Organizer for the Earth Sciences Section: *Jad D'Allura* (Emeritus, Department of Geology, Southern Oregon University).

Organizer for the Ecology, Organismal Biology, and Environmental Sciences Section: *Richard Van Buskirk* (Pacific University).

Ecology, Organismal Biology, and Environmental Sciences

Session Chair: *Richard Van Buskirk*

8:40 **114a** *Flowering Patterns following Tephra Disturbance of Understory Herbs in Old-growth Subalpine Forest*, **DONALD ZOBEL[1] and JOSEPH ANTOS[2]** ([1]Botany and Plant Pathology, Oregon State University; [2]Biology, University of Victoria).

9:00 **115** *Testing Monophyly and Phylogenetic Relationships of Smittium (Harpellales) using a Five-Gene Molecular Phylogenetic Analysis*, **YAN WANG[1]*, ERIC D TRETTER[1], ERIC M JOHNSON[1], PRASANNA KANDEL[1], ROBERT W LICHTWARDT[2], and MERLIN M WHITE[1]** ([1]Department of Biological Sciences, Boise State University; [2]Department of Ecology & Evolutionary Biology, University of Kansas).

9:20 **116** *Investigating the Presence and Impacts of Wolbachia, a Bacterial Symbiont, on a Threatened Butterfly*, **AMY TRUITT* and CATHERINE De RIVERA** (Department of Environmental Science and Management, Portland State University).

9:40 **117** *Enlisting Citizen Scientists in a Search for Zombie Bees*, **JOHN E HAFERNIK[1,3]*, ASIM UTKU ZIHNIOGLU[2,3], JONATHAN IVERS[1,3], CHRISTOPHER D QUOCK[1,3], ROBERT MCKIMMIE[1,3], ANDREW G ZINK[1,3], and DRAGUTIN PETKOVIC[2,3]** ([1]Department of Biology, [2]Department of Computer Science, [3]Center for Computing for Life Sciences, San Francisco State University).

10:00 **118** *Determinants of Territory Quality and Male Reproductive Success in Southern Sea Otters (*Enhydra lutris nereis*)*, **LILY MAXINE TARJAN** (Department of Ecology and Evolutionary Biology, University of California Santa Cruz).

10:20 BREAK

Earth Sciences

Session Chair: *Jad D'Allura*

10:40 **119** *The Occurrence of the Ancestral Santa Lucia Fir (Abies SECTION Bracteatae) of California in the Mid-Cenozoic of Colorado*, **ESTELLA B LEOPOLD and STEPHANIE ZABORAC-REED*** (Department of Biology, University of Washington).

11:00 **120** *Evaluating the Ti-in-Quartz Deformation Temperatures in the Scandinavian Caledonides*, **ANDREA M WOLFOWICZ*, MATTHEW J KOHN, and CJ NORTHRUP** (Department of Geosciences, Boise State University).

Agriculture and Horticultural Sciences

Session Chair: *Michael D. MacNeil*

11:20 **121** *Towards a Yield-Scale Assessment of Greenhouse Gas Emissions in Agriculture*, **CHRIS VAN KESSEL[1]*, JAN WILLEM VAN GROENIGEN[2], and BRUCE LINQUIST[1]** ([1]Department of Plant Sciences, University of California, Davis; [2]Wageningen University, Department of Soil Quality, Wageningen, The Netherlands).

11:40 **122** *Effect of Weather Patterns on Beef Production in the Northern Great Plains*, **MICHAEL D MacNEIL* and LANCE T VERMEIRE (**USDA Agricultural Research Service, Miles City, MT).

Mathematics

PONDEROSA PINES 1 & 2
Monday
10:30 a.m. – 11:25 a.m.

Organizer for the Mathematics Section: *Liljana Babinkostova* (Department of Mathematics, Boise State University).

Session Chair: *Liljana Babinkostova*

10:30 **123** *Perfect Stripes from a General Turing Model in Different Geometries*, **JEAN SCHNEIDER** (Department of Mathematics, Boise State University).

10:50 **124** *Markov Chains on the Symmetric Groups Converging to Non-uniform Measures*, **YUNJIANG JIANG** (Department of Mathematics, Stanford University).

11:10 **125** *Nondefective Secant Varieties of Split Varieties*, **DOUGLAS A TORRANCE** (Department of Mathematics, University of Idaho).

Mathematics oral presentations continue on Tuesday, 26 June. Please refer to page 40 of these *Proceedings*.

Tuesday, 26 June 2012

Cell and Molecular Biology Section

WILLOWS 2
Tuesday
8:40 a.m. – Noon

Organizer for the Cell and Molecular Biology Section: *Kristen Mitchell* (Department of Biological Sciences, Boise State University).

Session Chair: *Kristen Mitchell*

8:40 **126** *A Role for Inflammatory Cytokines in Breast Cancer Cell EMT*, **HUNTER COVERT*, NICOLE ANKENBRANDT, RANDY RYAN, and CHERYL JORCYK** (Department of Biological Sciences, Boise State University).

9:00 **127** *The Role of Autophagy in the Development and Treatment of Colon Cancer*, **TOM DONNDELINGER* and JOELLA SKYLES** (Department of Pathology, St. Alphonsus Hospital).

9:20 **128** *Quantitative Evaluation of the Inductive Effects of OSM-Signaling on Breast Cancer Metastasis to Bone*, **JIM MOSELHY[1]*, KEN TAWARA[1], JEFF REDSHAW[1], CELESTE BOLIN[1], ROBIN ANDERSON[2], and CHERYL L JORCYK[1]** ([1]Department of Biological Sciences, Boise State University; [2]Peter MacCallum Cancer Centre, Melbourne, Victoria, Australia).

9:40 **129** *A Molecular Mechanism for Metastatic Breast Cancer-Mediated Bone Destruction*, **KEN TAWARA* and CHERYL JORCYK** (Department of Biological sciences, Boise State University).

10:00 BREAK

10:20 **130** *Inflammatory Monocyte Populations During Liver Regeneration*, **STEPHANIE WYLER* and KRISTEN MITCHELL** (Department of Biological Sciences, Boise State University).

10:40 **131** *Asymmetry in Chromatin Patterns in All Cancer Daughter Cells*, **TOM DONNDELINGER, JOELLA SKYLES, and KAILEY TRAUTMANN*** (Department of Pathology, St. Alphonsus Hospital).

11:00 **132** *Characterization of Lung Metastasis in an Inflammatory Cytokine Model of Breast Cancer*, **CELESTE BOLIN[1]*, JOEL GARBOW[2], KEN TAWARA[1], JEFF REDSHAW[1], ROBIN ANDERSON[3], and**

CHERYL JORCYK[1] ([1]Department of Biological Sciences, Boise State University; [2]Washington University School of Medicine; [3]The Sir Peter MacCallum Department of Oncology, The University of Melbourne, Melbourne, Australia).

11:20 **133** *Modeling HIV-1 Latency in Primary Central Memory Lymphocytes*, **LAURA MARTINS*, ALBERTO BOSQUE, MARYLINDA FAMIGLETTI, PETER RAMIREZ, CAMILLE NOVIS, and VICENTE PLANELLES** (Division of Microbiology and Immunology, Department of Pathology, University of Utah).

11:40 **134** *Digging Deeper: The Immunotoxicology of Erionite*, **NASH ZEBEDEO* and JEAN C PFAU** (Department of Biological Sciences, Idaho State University, Pocatello).

Joint Session of the AAASPD Sections of Anthropology and Archaeology Social, Economic, and Political Sciences

WILLOWS 1
Tuesday
9:00 a.m. – Noon

Organizer for the Anthropology and Archaeology section: *Stephen Frost* (University of Oregon).

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

Anthropology and Archaeology

Session Chair: *Stephen Frost*

9:00 **135** *Modeling Clovis Adaptive Systems: Decision-Making on the Late Pleistocene Landscape c. 13,000 ya*, **E S LOHSE** (Department of Anthropology, Idaho State University).

9:20 **136** *Pastoral and Foraging Economy of the Evenki: Understanding the Role of Movement in a Taiga Environment*, **KARL MERTENS* and JOHN ZIKER** (Department of Anthropology, Boise State University).

9:40 **137** *Are Other Hominins Alive today? – The Relict Hominoid Inquiry*, **JEFF MELDRUM** (Department of Biological Sciences, Idaho State University Pocatello).

10:00 **138** *Footprint Evidence of the Nguoi Rung – the Vietnamese Forest People*, **JEFF MELDRUM** (Department of Biological Sciences, Idaho State University Pocatello).

10:20 **BREAK**

Social, Economic, and Political Sciences

Session Chair: *Carl A. Maida*

10:40 **139** *Fragmented Ties and the Colombian Diaspora: Considering Historical Trauma as a Factor for Mistrust, and Fragmented Solidarity*, **CAROLINA VALDERRAMA ECHAVARRIA** (Department of History, Boise State University).

11:00 **140** *Forest-Sector "Development," Flooding, and Socio-Economic Impact in Pakistan*, **JEFFREY GRITZNER** (Department of Geography, The University of Montana).

11:20 **141** *The Political Economy of International Aid, Industrialization and the 'Arsenic Crisis' in Bangladesh*, **CLAUDIA J CARR** (Environmental Science, Policy and Management Department, University of California, Berkeley).

11:40 **142** *Accounting Systems and High-Growth Startup Companies*, **MICHAEL LEE and SPENCER COBIA*** ([1]Department of Accountancy, College of Business and Economics, Boise State University).

Mathematics

PONDEROSA PINES 1 & 2
Tuesday
2:30 p.m. – 3:00 p.m.
Program continues from Monday, 25 June.
Please refer to page 39 of these *Proceedings*.

Session Chair: *Liljana Babinkostova*

2:30 **143** *Cantor's Original Proof that the Reals are Uncountable*, **JASON SMITH** (College of Western Idaho).

Mathematics oral presentations continue on Wednesday, 27 June. Please refer to page 41 of these *Proceedings*.

Wednesday, 27 June 2012

Joint Session of the AAASPD Sections Education (Science and Technology) History and Philosophy of Science

MERLINS
Wednesday
10:00 a.m. – Noon

Organizer for the Education Section: *Kimberly Tanner* (San Francisco State University).

Organizer for the History and Philosophy of Science Section: *Donald J. McGraw* (Ephraim, UT).

Education

Session Chair: *Kimberly Tanner*

10:00 144 *Technologies of the Future: An Exploration- and Design-Based Survey Course on Modern Topics in Bioinspired Design and Nanoscale Engineering for Non-Science Majors*, **KELLAR AUTUMN[1], ANNE K BENTLEY[2], JULIO DePAULA[2], and JONATHAN B PUTHOFF[1]*** ([1]Department of Biology, [2]Department of Chemistry, Lewis & Clark College).

10:20 145 *Independent Science and Engineering Research Program for High School Students*, **BEVIN C DAGLEN*, ROBERT L ORR*, KRISTEN M S MYERS*, and WILLIAM G LAMB**, (Science Department, Oregon Episcopal School).

History and Philosophy of Science

Session Chair: *Donald J. McGraw*

10:40 146 *Histories of Conservation and Science: Comparing National Parks in Patagonian and Amazonian South America*, **EMILY WAKILD** (Department of History, Wake Forest University).

11:00 147 *Millennial Biology: The National Science Foundation and the Life Sciences, 1975-2005*, **DONALD J McGRAW** ("Dr. Donald J. McGraw, Independent Scholar/Contractor," Ephraim, UT).

11:20 148 *A Novel Explanation of Creationism's Frustrating Persistence*, **LAWRENCE H WOOD** (Physicist, Retired, Lacey, WA).

11:40 149 *From 1953 Genetics: Molecular Biology to the Wider Pictures of Both Science and its Religious Basis*, **DANIELLE MIHRAM[1]* and G ARTHUR MIHRAM[2]** ([1]USC Libraries and Department of French and Italian, University of Southern California; [2]Princeton, NJ).

Mathematics

PONDEROSA PINES 1 & 2
Wednesday
10:00 a.m. – 12:30 p.m.
Program continues from Tuesday, 26 June.
Please refer to page 40 of these *Proceedings*.

Program Chair: *Liljana Babinkostova*

10:00 150 *Non-Hodgkin-Huxley Model of Cardiac Function*, **DAVID BLACKMAN** (Retired University of California, Berkeley and Honorary Professor, Albert Schweitzer International University).

10:30 151 *Experimentation at the Frontiers of Reality in Schubert Calculus*, **ZACH TEITLER** (Department of Mathematics, Boise State University).

11:00 152 *Driving Hazards in 2-Spheres*, **JENS HARLANDER (**Department of Mathematics, Boise State University).

11:30 *Graduate School Panel Discussion*.

IV. CONTRIBUTED POSTER PRESENTATIONS

189 poster number is also the abstract number
193 (number italicized and underlined) identifies a student presentation
*identifies the presenter from among several authors listed

Boards on which to attach poster presentations will be set up in GOLDEN EAGLE. 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 are expected to use the appropriately numbered board for your poster.

AAASPD Posters: Posters can be set up starting Monday morning. All set up must be finished no later than 12:45 p.m. The NORM 12 poster session is from 1:00 p.m. – 3:00 p.m. The AAASPD poster session is from 3:00 p.m. – 5:00 p.m. All presenters must be present with their posters for the duration of the session in which they are presenting in order to discuss their work. No posters are to be removed before 5:00 p.m. All posters must be removed no later than 8:00 p.m. that evening.

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 Wednesday afternoon.

Quick Directory of Sponsoring Sections and Their Posters

Monday, 25 June 2012

AAASPD POSTER SESSION

PHYSICS and MATERIALS SCIENCE

153 *Pushing the Neutral Atom Microscope Past Conventional Optical Resolution*, **PHILIP WITHAM* and ERIK SÁNCHEZ** (Department of Physics, Portland State University).

154 *Can Light be Used as a Sensor to Detect and Monitor the Corrosion of Metals?* **RUKMINI A RAVI[1]*, VILUPANUR A RAVI[2], and THUAN K NGUYEN[2]** ([1]Claremont High School, ; [2]Department of Chemical and Materials Engineering, Cal Poly Pomona).

CHEMISTRY and BIOCHEMISTRY

155 *DockoMatic: An Education Resource for Molecular Docking and Peptide Interactions*, **KEN WEEKES*, REED B JACOB, and OWEN M McDOUGAL** (Department of Chemistry and Biochemistry, Boise State University).

156 *Inverse Virtual Screening using DockoMatic*, **THOMAS PEAVEY*, REED B JACOB, GREG HAMPIKIAN, and OWEN M McDOUGAL** (Departments of Biological Sciences and Chemistry and Biochemistry, Boise State University).

157 *Utilization of Blender in Figure Generation for Biochemical Processes*, **NICHOLAS L BAKER** (Department of Chemistry and Biochemistry, Boise State University).

158 *Simple Detection of Alkaloids from* Veratrum californicum, **MAYRA ESTRADA*, CHRIS CHANDLER, JESSICA BROOKHOUSE, ASHLEY FISHER, and OWEN McDOUGAL** (Department of Chemistry and Biochemistry, Boise State University).

ENGINEERING, TECHNOLOGY and APPLIED SCIENCES

159 *Sound-Field Mapping in Liquid-Filled Containers*, **AARON DIAZ[1]*, KAYTE DENSLOW[1], MONDELL deWAYNE WELLS[2]*, and ANTHONY CINSON[1]** ([1]Pacific Northwest National Laboratory; [2]Department of Mechanical Engineering, Maseeh College of Engineering and Computer Science, Portland State University).

160 *Current Transmission Hysteresis in Electron Hop Funnels*, **MARCUS PEARLMAN*, TYLER ROWE*, and JIM BROWNING** (Department of Electrical and Computer Engineering, Boise State University).

161 *The Impact of Traffic and Heavy Vehicles on Air quality: A Case Study in Portland, Oregon*, **ADILENE AMARO-ZURITA** (Department of Civil Engineering, Portland State University).

CELL and MOLECULAR BIOLOGY

162 *Tetracycline-Inducible Overexpression of Human Oncostatin M in Breast Cancer*, **DOLLIE LaJOIE* and CHERYL L JORCYK** (Department of Biological Sciences, Boise State University).

163 *In Vitro Investigation of Cytokine-Induced Osteoclastogenesis by Mammary Tumor Cells*, **ERIK STOLL*, CELESTE BOLIN, and CHERYL JORCYK** (Department of Biological Sciences, Boise State University).

164 *The Effect of JMJD Inhibitors on Head and Neck Cancer Cell Proliferation*, **MARIA VIDAL*[1], NAILAH WADE*[1], DAVID BAE[2], ERIC TANG[2], CUN-YU WANG[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program; [2]UCLA School of Dentistry).

165 *Role of IL-6 Family Cytokines in Breast Tumor Cell Expression of VEGF*, **MADHURI NANDAKUMAR*, DANIELLE HEDEEN and CHERYL JORCYK** (Department of Biological Sciences, Boise State University).

166 *Parathyroid Hormone Related Protein (PTHrP) Regulates Expression Of Estrogen Receptor In Bone And Breast*, **KELSEY BRUCH, HANNAH DYAR* and MINOTI HIREMATH** (Department of Biological Sciences, Boise State University).

167 *Does Oncostatin M Induce Morphological Changes in Human Breast Cancer Cells?* **NICOLE ANKENBRANDT*, HUNTER COVERT, and CHERYL JORCYK** (Department of Biology, Boise State University).

168 *The Effects of Chemotherapy Drugs, Paclitaxel and Cisplatin, Combined with NAC on Pancreatic Cancer Stem Cells*, **CARLOS ANAYA[1]*, KATELYNN BARKLEY[1]*, HAN-CHING HELEN TSENG[2], GABRIELLA ORONA[2], and ANAHID JEWETT[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program at UCLA; [2]The Weintraub Center for Reconstructive Biotechnology; UCLA School of Dentistry).

169 *Do Human Multiple Myeloma Cells Express IL-6 Family Inflammatory Cytokines?* **DANIELLE HEDEEN*, DOLLIE LaJOIE, and CHERYL JORCYK** (Department of Biological Sciences, Boise State University).

170 *Overexpression of SOX4 Leads to Down Regulation of UBC9*, **JOHANNA LEWIS*[1], RUBY ENRIQUEZ*[1], MIN ZHANG[2], and SHEN HU[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program; [2]UCLA School of Dentistry).

171 *TCDD Treatment Suppresses Vitamin A Storage and Activates LX-2 Human Hepatic Stellate Cells*, **WENDY A HARVEY*, JALISA J ROBINSON, REILLY J CLARK, CALEB D HUANG, and KRISTEN A MITCHELL** (Department of Biology, Boise State University).

172 *Stress Enhanced Fear Learning Conditioning's Effect on Gamma-Aminobutyric Acid Type A Receptors in the Cortex*, **RAUDEL HERNANDEZ*[1], EDWARD MEYER[2], ALEXAUNDREA SMITH[2], and IGOR SPIGELMAN[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program; [2]UCLA School of Dentistry).

173 *Stimulation of Adenosine A_1 Receptors in the Nucleus Accumbens Reduces Dopamine D_1 Receptor-induced Reinstatement by Antagonizing D_1-mediated Enhancements in Glutamate Transmission*, **BENJAMIN D HOBSON*, CASEY E O'NEILL, and RYAN K BACHTELL** (Department of Psychology and Neuroscience and Center for Neuroscience, University of Colorado Boulder).

174 *Investigating the Interaction of Osteogenic Cell Sheets with Osteoblast Cells*, **EDWIN SALVATIERRA[1]*, RAJITA KODALI KANURU[2], and OGAWA TAKAHIRO[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program, UCLA School of Dentistry; [2]The Weintraub Center for Reconstructive Biotechnology, UCLA School of Dentistry).

175 *The Effects of Bmi-1 in Pulp Cells*, **LAUREN WILLIAMS*[1], KATHERINE CATALAN*[1], ZI XIAO LIU[2], JU EUN OH[2], SHEBLI MEHRAZARIN[2], and MO KANG[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program, UCLA School of Dentistry; [2]UCLA School of Dentistry).

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abstracts contain complete contact information for authors
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*identifies the presenter from among several authors listed

EARTH SCIENCES

176 *Characterization of the Geothermal System near Paisley, Oregon*, **KYLE A MAKOVSKY (**Department of Geosciences, Boise State University).

177 *Petrologic and Geochemical Evolution of Lower Oligocene to Lower Miocene Volcanic Rocks of the Western Cascades Volcanic Series, Southwest Oregon*, **JAD A D'ALLURA** (Department of Chemistry, Physics, Materials, and Engineering, Southern Oregon University).

ECOLOGY, ORGANISMAL BIOLOGY, and ENVIRONMENTAL SCIENCES

178 *Characterizing a Local Model System for Studies of Ecological Stoichiometry of Trophic Interactions*, **CAROLYN F WEBER*, JEFFREY P HILL, and AMOEBA** (Department of Biological Sciences, Idaho State University).

179 *Defining Microalgae Growth Conditions That Eliminate Competitive Exclusion and Maximize Lipid Production for the Purpose of Biofuel Production*, **HERBERT A POLLARD IV*, WILLIAM HEWITT*, and LUKE SUGDEN*** (Department of Biology, Boise State University).

180 *A Reconnaissance Study of Microbiota as Environmental Monitors*, **DEIRDRE McATEER*, JESSE ZANEVELD, and BECKY VEGA THURBER** (Oregon State University, Department of Microbiology).

181 *Remodeling a Model System for Studies of Ecological Stoichiometry in Plants*, **JEFFREY P HILL*, CAROLYN F WEBER, and AMOEBA** (Department of Biological Sciences, Idaho State University).

MATHEMATICS

182 *A Radial Basis Function Partition of Unity Method for Transport on the Sphere*, **GRADY WRIGHT and KEVIN AITON*** (Department of Mathematics, Boise State University).

EDUCATION

183 *Who is Teaching with Electronic Books and Why? A Survey of Oregon State University Faculty*, **LAUREL KRISTICK* and MARGARET MELLINGER** (Oregon State University, 121 The Valley Library).

184 *AMOEBA: Authentic Mentoring of Engaged Biologists Alliance at Idaho State University*, **JEFFREY P HILL*, BRUCE P FINNEY, and CAROLYN F WEBER** (Department of Biological Sciences, Idaho State University).

HISTORY and PHILOSOPHY of SCIENCE

185 *Rediscovering Emilie du Chatelet: A Scientist and Pholosophe of the French Enlightenment*, **NICHOLE SNYDER** (Department of History, Boise State University).

ANTHROPOLOGY and ARCHAEOLOGY

186 *Investigation of Histomorphometric Values in an East Arctic Foraging Group, the Sadlermiut*, **JOSEPH PURCELL[1]*, MARGARET STREETER[1], EMILINE RAGUIN[2], BRIDGET DENNY[1], MICHELLE DRAPEAU[2], and RICHARD LAZENBY[3]** ([1]Department of Anthropology, Boise State University; [2]Departement d' anthropologie, Universite de Montreal; [3]Department of Anthropology, University of Northern British Columbia).

187 *Analysis of Human Remains from the Siriki Shell Mound, Northwestern Guyana*, **BEKI JUMONVILLE*, JOSEPH PURCELL, MARGARET STREETER, MARK PLEW, and CHRISTOPHER WILLSON** (Department of Anthropology, Boise State University).

HEALTH SCIENCES

188 *Development of a New Approach to Kill Non-Small Cell Lung Cancer with Resistance to Standard Chemotherapy*, **NICHOLAS M ANDERSON[1]*, DIANA C MÁRQUEZ-GARBÁN[1], GANG DENG[2], MICHAEL E JUNG[2], and RICHARD J PIETRAS[1]** ([1]Department of Medicine, Division of Hematology/Oncology; [2]Department of Chemistry and Biochemistry, University of California Los Angeles).

189 *A Novel Method of Estimating Adhesivity of Airway Mucus Enable Investigating Its Role on Mucus Displacement during Cough Inside a Model Trachea Accurately*, **ANPALAKI J RAGAVAN[1]*, CAHIT A EVRENSEL[1,2], and PETER KRUMPE[1,3]** ([1]Graduate Program of Biomedical Engineering, [2]Department of Mechanical Engineering, University of Nevada, Reno; [3]VA Sierra Nevada Health Care Systems, Reno, NV).

190 *New Mucomodulator Therapy for Improved Clearance of Airway Mucus during Cough Inside a Model Trachea*, **ANPALAKI J RAGAVAN** (Graduate Program of Biomedical Engineering, University of Nevada, Reno).

191 *Tooth Micro-hardness Changes After Applying Bioactive Glass-containing, Anti-microbial Sealants*, **VALERIA URSU[1]*, JOHN C MITCHELL[2], MIKE MELANSON[3], SARA HAYS[4], SATIN SALEHI[2], JOHN ENGLE[2], WHITNEY ANHORN[5], WILL MARRA[5], CATHRINE MARTELL[5], MANSEN WANG[6], and JACK L FERRACANE[2]** ([1]Oregon State University, Biochemistry and Biophysics; [2]Oregon Health and Science University, Department of Restorative Dentistry, Division of Biomaterials and Biomechanics; [3]Oregon Health and Science University**,** Department of Pediatric Dentistry; [4]Sunset High School; [5]Oregon Health and Science University; [6]Biostatistical Analyst, Banfield Applied Research and Knowledge, Portland, OR).

192 *Met and Unmet Need for Dental Services in a National Sample of Children with Varying Disabilities*, **VANESSA LAM*, JACLYN AVILA*, RICHARD MORRIS*, YAN WANG, HONGHU LIU, and MARVIN MARCUS** (UCLA School of Dentistry Post-Baccalaureate Program, Division of Public Health and Community Dentistry).

193 *Active Dental Caries and Adults' Use of Antidepressants in a National Probability Sample*, **OGORCHUKWU OLELE*, ADRIANNA JAUREGUI*, YAN WANG, HONGHU LUI, and MARVIN MARCUS** (UCLA School of Dentistry Post-Baccalaureate Program, Division of Public Health and Community Dentistry).

GENERAL and INTERDISCIPLINARY

194 *Psychostimulant Use Among College Students During Periods of High and Low Stress: An Interdisciplinary Approach Utilizing Both Self-Report and Unobtrusive Chemical Sample Data*, **RAMSEY LARSON[1]*, MIKAEL FERM[1], DAVID MOORE[1], and DAN BURGARD[2]** ([1]Department of Psychology, [2]Department of Chemistry, University of Puget Sound).

ORAL BIOLOGY and DENTAL MEDICINE

195 *The Status of Cancer Stem Cells in Multistep Oral Carcinogenesis*, **DON MACFOY*[1], CHRISTOPHER PRIDE*[1], VIKKI LEE[2], and KI-HYUK SHIN[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program, [2]UCLA School of Dentistry).

196 *The Mitigation Effects of Bio-Radioprotectors Pentoxifylline and Norfloxacin on Radiated Bone Marrow Mesenchymal Stem Cells In-Vitro*, **IMANI SMITH[1]*, CECILIA REYES[1]*, YOSHIMOTO HONDA[2], SIL PARK[2], and ICHIRO NISHIMURA[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program; [2]The Weintraub Center for Reconstructive Biotechnology, UCLA School of Dentistry).

197 *Multilocus Sequence Typing of fomA in Eight Strains of* Fusobacterium nucleatum, **CRYSTAL MACKEY*[1], AMANDA FERRER[2], MICHAELA CHANG[2], SUSAN HAAKE[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program; [2]UCLA School of Dentistry).

198 *Infraorbital Nerve Constriction in Rats to Quantify Neuropathic Pain Symptoms using Novel Thermal Operant Assay*, **ZAYLA COLQUITT*[1], YATENDRA MULPURI[2], and IGOR SPIGELMAN[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program; [2]UCLA School of Dentistry).

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abstracts contain complete contact information for authors
193 (number italicized and underlined) identifies a student presentation
*identifies the presenter from among several authors listed

ABSTRACTS

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 LECTURES

Monday Noon Public Lecture
Monday, 12:15 p.m. in SUMMIT

1 *Reckoning with Redox in the RNA World*, **CYNTHIA J BURROWS** (Department of Chemistry, University of Utah, 315 S. 1400 East, Salt Lake City, UT 84112; burrows@chem.utah.edu).

Among the most fundamental questions scientists can pose is that of the origin of life on Earth. The quest to find life elsewhere in the solar system will rely not only on specialized instrumentation for detection of the signatures of life, but also on imagining probable alternative chemistries of life so that they can be recognized when present. Present hypotheses include the "metabolism first" concept in which biomolecular synthesis originated from mineral-rich deep sea vents where a redox gradient permitted the emergence of a primitive metabolism. Alternative postulates point to the abiotic synthesis of RNA molecules that would serve as both the carriers of information and the catalysts for biosynthesis. Yet, the functions ascribed to ribozymes do not typically include redox chemistry, which most scientists agree is a fundamental component of life. We propose that redox-active bases in RNA might bridge this gap between the iron-sulfur world and the RNA world. The modern-day coenzymes $FADH_2$ and NADH are themselves small bits of RNA with redox functions. We ask how these coenzymes evolved, and what the driving forces were for developing an organic redox system during the RNA world.

Monday Evening Public Lecture
Monday, 8:00 p.m. in SUMMIT

2 *Aukera: A History of the Basques in Idaho*, **JOHN BIETER** (Department of History, Boise State University, 1910 University Drive, Boise, ID 83725; johnbieter@boisestate.edu).

This audio-visual presentation on the history of the Basques in Idaho is built around a Basque application of Marcus L. Hansen's "Law of Third Generation Return." In short, what the son wishes to forget, the grandson wishes to remember. Bieter focuses on each of these generations and the organizations that they established, and what they felt they needed at that time in Idaho. He first examines the immigrant generation (from 1890 until the early 1920's), then focuses on the Basque-American generation (from the 1920's until about 1949), and finally looks at the American-Basque generation (from about 1950 to the present). Each generation has a different perspective to their culture and a different experience in Idaho.

Tuesday Noon Public Lecture
Tuesday, 12:15 p.m. in SUMMIT

3 *Correcting DNA Errors: From Amanda Knox's Wrongful Conviction, to Sexual Assaults in Georgia***,** presented by **GREG HAMPIKIAN** (Professor of Biological Sciences and Criminal Justice, Boise State University, 1910 University Drive, Boise, ID 83725; greghampikian@boisestate.edu).

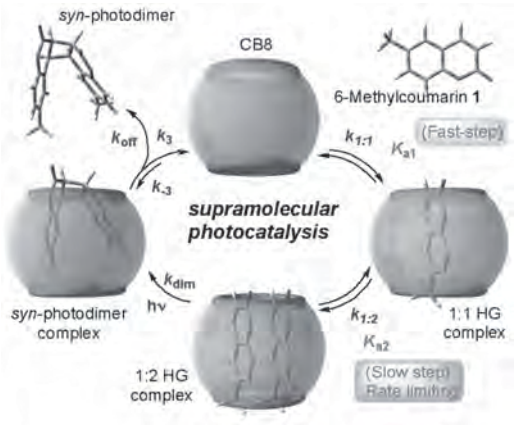
No abstract was submitted for this presentation.

Wednesday Noon Public Lecture
Wednesday, 12:15 p.m. in SUMMIT

4 *Learning from Nature: Bio-mimetic Supramolecular Photocatalysis*, **JAYARAMAN SIVAGURU (SIVA)** (Department of Chemistry and Biochemistry, 1231 Albrecht Blvd., Dunbar and Ladd Hall, North Dakota State University, Fargo, ND USA 58108-6050; sivaguru.jayaraman@ndsu.edu).

Chemical transformations catalyzed by enzymes stand out for their elegance and simplicity. Catalytic light induced transformations provide an intriguing challenge to chemists as controlling product selectivity during the photoprocess within the short lifetime of the reactive intermediates/transition states is often difficult. Supramolecular photocatalysis within cucurbiturils presents an ideal opportunity to develop environmentally benign chemical methodologies. To successfully employ cucurbit[8]urils (CB[8]) as nano-reaction vessels for manipulating synthetic transformations, in particular photochemical transformations, it is critical to employ them in catalytic amounts. This helps to overcome a fundamental bottleneck *viz*., the increased solubility of CB[8] at concentrations (>0.2 mM), typically employed for synthetic reactions. The presentation will focus on employing a CB[8] in catalytic amounts to control photochemical reactions.

The [2+2] photodimerization of coumarin derivatives will be presented as a model system. The presentation will focus on the plausible reasoning for the observed product selectivity, kinetic/thermodynamic aspects and photophysics of encapsulated guest molecules leading to supramolecular photocatalysis.



Some relevant references:
1. Barooah, N; Pemberton, BC; and Sivaguru, J* *Org. Lett.* 2008, *10*, 3339-3342.
2. Pemberton, BC; Barooah, N; Srivatsava, DK; and Sivaguru, J.* *Chem. Commun.* 2010, *46*, 225-227.
3. Pemberton, BC; Kumarasamy, E; Jockusch, S; Srivatsava, DK; and Sivaguru, J* *Can. J. Chem.,* 2011, 89, 310-316.
4. Pemberton, BC; Raushan Singh; Jockusch, S; Da Silva, JP; Ugrinov, A; Turro, NJ; Srivatsava, DK; and Sivaguru J* *Chem. Commun.,* 2011, 47, 6323–6325

SYMPOSIA

Library Science and Archives
Monday, 8:25 a.m. in SNAKE RIVER

5 *A Course in Scholarly Publishing for Undergraduates at the University of Utah*, **PETER L KRAUS** (University of Utah, J. Willard Marriott Library, 295 South 1500 East, Salt Lake City, UT 84112; peter.kraus@utah.edu).

A new avenue of education at the J. Willard Marriott Library at the University of Utah which addresses the undergraduate teaching mission of the university is the development of a new course for undergraduates in the area of scholarly publishing. Upon completion of this course, students have the basic tools to pursue publishing a journal article. A unique feature of the course is that students not only study the craft of creating an article, but also develop sound and efficient research strategies that they can apply in graduate and professional schools. As competition for graduate school admissions and funding becomes more competitive, motivated undergraduates who publish in peer-reviewed journals increase their chances for graduate admissions and graduate funding and reflect positively on the institutions that have prepared them. These undergraduates bring not only prestige to themselves and the university, but positive attention to the library. This session will focus on how such a course was implemented and promoted at the University of Utah.

6 *Using the Institutional Repository as an Affordable Learning Solution*, **CRYSTAL GOLDMAN* and SILKE HIGGINS** (King Library, San Jose State University, One Washington Square, San Jose, CA 95192-0028; crystal.goldman@sjsu.edu, silke.higgins@sjsu.edu).

Finding effective Affordable Learning Solutions (ALS) is a task many universities face amidst contracting budgets and shrinking student retention rates. As access to information has been identified as one of the main barriers to learning, campuses and their faculty increasingly shift away from the mandatory use of expensive textbooks, the high cost of which place an immense burden on many students.

Several potential options have been suggested for ALS. Some recommend students buy or rent eBooks in lieu of print books, while others believe that materials from subscription databases or eBooks licensed by the library are the better solution. Based on their experience as co-managers of a digital Institutional Repository (IR) at a large state university, the authors of this paper propose that these depositories have a largely untapped potential - to become a suitable and effective tool for supplying ALS to students.

For many universities, the IR has become the main storage center for student theses and dissertations, but it also provides the ability to house materials created by faculty, including the traditional journal article, as well as conference presentations, data sets, images, videos, etc., all of which can be used in the classroom as part of ALS.

This paper will further argue that involving the Institutional Repository in campus-wide initiatives such as Affordable Learning Solutions provides many potential benefits, including the ability to use ALS as a platform to enhance student learning, engage faculty and administrators on a new level, and raise awareness of scholarly communication issues.

7 *Identifying University Publishing Trends Through Institutional Repository Data*, **MICHELLE ARMSTRONG** (Albertsons Library, Boise State University, 1910 University Drive, Boise, ID 83725-1430; michellearmstrong1@boisestate.edu).

Universities are charged with both the discovery and dissemination of new knowledge. However faculty are often left to their own devices when sharing their work. Individual professors must navigate the publishing process, including negotiating copyright agreements. These agreements may be acceptable for a single publication, but can have significant implications when considering the full scope of a university's

scholarship. If universities are going to fulfill their mission of sharing new knowledge, they must also understand how that scholarship is disseminated and how to best support those efforts.

One strategy that can be used in accomplishing this goal is the development of institutional repositories (IRs) which are designed to disseminate and provide long-term stewardship of a university's scholarly record. One example of this approach is ScholarWorks, Boise State's institutional repository. Using publisher copyright policy information collected while working with faculty publications, staff at Albertsons Library have started to identify publishing trends at their university. Repository staff examine what is being produced and who is publishing Boise State's research. Additionally publisher copyright policies are reviewed to determine how they impact what a professor can do with their work. This presentation will explore the processes used at Boise State and what has been discovered.

8 *An Overview of Special Collections and Archives Content in the Institutional Repository at Boise State University*, **JULIA STRINGFELLOW** (Special Collections and Archives, Albertsons Library, Boise State University, 1910 University Drive, Mail Stop 1430, Boise, ID 83725-1430; juliastringfellow@boisestate.edu).

This oral contributed paper will look at the work the Special Collections and Archives department at Boise State University has done with the University Documents collections in the institutional repository ScholarWorks. This project began in early 2011 and has focused on adding both paper-based and born-digital university publications that are housed in Special Collections. Providing open access to these items in electronic format has greatly benefited their preservation needs and access, as well as assisted several classes researching the university's history. This paper will explore the methodology, benefits, and usage of these collections.

9 *Assessing the Strategic Credibility of Special Collections*, **ERIN PASSEHL[1]* and RICK STODDART[2]*** ([1]Western Oregon University, Hamersly Library, 345 N. Monmouth Ave., Monmouth, Oregon 97361; passehle@wou.edu; [2]Oregon State University, 121 The Valley Library, Corvallis, Oregon 97331-4501; Richard.Stoddart@OregonState.edu).

In this time of often precarious funding at many colleges and universities, any case that can be made to illustrate how a department strategically fits into the overall university mission is not only worth merit, but an essential survival technique. This "strategic credibility" within the university is a vital form of currency in determining institution-wide resources prioritization, collaboration opportunities between organizational units, and overall direction of departments. This paper presents a case study of academic special collections in the Northwest and examines the methods these departments use to demonstrate value to the university. This paper considers how well do special collections align their efforts toward a university's strategic goals or mission, as well as what efforts they undertake to maintain credibility within the larger institutional context. Outcomes of this paper include a potential methodology for all library departments to assess their "strategic credibility" and suggestions on how to communicate this value to the library and within the university as a whole.

10 *More Than Asphalt and Snowplows: Preserving Idaho's Transportation Past*, **MICHAL WALDEN** (Idaho State Archives, Idaho State Historical Society, 2205 Old Penitentiary Road, Boise, ID 83712; michal.walden@ishs.idaho.gov).

If a picture is worth a thousand words, then the Idaho Transportation Department (ITD) has a lot to say with their extensive and expansive collection of over 100,000 transportation related images.

In the spring of 2010, ITD approached Idaho State Archives (ISA) with the idea of forming a partnership to digitize transportation images, negatives, and slides housed at ITD headquarters, the various district offices, and already within collections at ISA. While a number of the images have been indexed, an overwhelming number of photographs, negatives and slides remain a mystery. In addition to funding the digitization endeavor, ITD also sought to create a database of images not only for agency-wide use, but also with a public database component for use by the citizens of Idaho as well as any other interested researchers.

The project began in July of 2010 by reviewing and prioritizing the transportation images in the initial group, assigning unique reference numbers, and indexing each image for the eventual database. Many of the images need preservation prior to being scanned, so with two full-time employees, the days are spent rotating between scanning and preservation work.

The images in the collection vary greatly and range from historic images of highways being constructed with steam shovels and road dedications to city improvements and buildings once owned by ITD. These images help to tell the story of Idaho and the hope is to use the collection to get more and more people interested in the gems found at ISA. So far the main outreach for the project has been through presentations, online and newsletter articles, and simply word of mouth. However, from those small ventures, the project is definitely getting people interested and excited.

Each outreach endeavor is undertaken with the goal that the fruits of the Idaho Transportation Department Digitization Project will not only be utilized by ITD staff and researchers at ISA, but also as part of a larger outreach tool for ITD and ISA. Since the project is an example of innovative partnerships and unusual funding streams, the interest level in the project has ranged from researchers and other state agencies to the National Trust for Historic Preservation,

which has been extremely exciting and rewarding.

The More Than Asphalt and Snowplows presentation will discuss the set up and organization of the Idaho Transportation Department Digitization Project before going into a discussion of the current status of the project, the lessons learned so far, and current outreach undertakings.

11 *Assessing Value from the Digital Collection End-User: The Western Writers Series Digital Editions Experience*, **RICK STODDART[1]* and THOMAS HILLARD[2]*** ([1]Oregon State University, 121 The Valley Library, Corvallis, Oregon 97331-4501; Richard.Stoddart@OregonState.edu ; [2]Boise State University, 1910 University Drive, Boise, Idaho 83725-1525; ThomasHillard@BoiseState.edu).

How end-users and stakeholders value a digital collection is one of the most compelling questions in library assessment. This presentation reports on a series of interviews with stakeholders and potential end-users of the digital collection "Western Writers Series Digital Editions." These interviews were undertaken to determine in what ways these digital humanities materials might be used by scholars and incorporated into their research process. Interview participants were identified through scholarly citations and works cited lists. The outcomes of these interviews are supplemented by additional interviews with the editors of the original print editions of the Western Writers Series, as well as the librarians who host the materials. This holistic view of the multiple stakeholders involved in a library's digital collection presents a more refined picture of how such resources may be valued by end-users.

12 *Case Study: Design, Workflows, and Final Results of a Large-scale and In-house Oral History Digitization Project At a Small Institution*, **KENT RANDELL** (Albertsons Library, Special Collections and Archives, 1910 University Drive, Boise, ID 83725-1430; kentrandell@boisestate.edu).

In the 1970s, Suomi College (now Finlandia University) received a grant from the National Endowment of the Humanities to pursue a large-scale oral history program titled *Finnish Folklore and Social Change in the Great Lakes Mining Region*. After about thirty-five years, the cassette tapes from this valuable collection were reaching an age where degradation, if it had not already begun, could quickly become an issue. In 2010 a grant proposal was submitted to the Keweenaw National Historic Park Advisory Commission in Calumet, Michigan by the Finnish American Historical Archive and Museum (FAHAM) at Finlandia University. The grant project was funded in full and the author of this paper, then the archivist at the FAHAM, served as Project Manager.

The paper will analyze ways the original oral history project allowed for a later digitization, such as securing proper copyright clearance and gathering consistent metadata. Specific details about the workflows developed to digitize all 250 hours of transcribed interviews and about 150 hours of non-transcribed interviews will also be given. Each interview was described using Library of Congress Subject Headings, audio excerpts were created for online delivery, and .pdf files with searchable text were created for all extant transcripts.

The details of this case study will assist other archives, libraries, and historical societies that are considering undertaking an oral history digitization project. In addition to the workflow specifics, the paper will also include a breakdown of the money which was spent (and saved) by completing the project "in-house," thus allowing future organizations to analyze and assess the fees charged by third-party digitization vendors.

Long Term Space Flight and Health
Monday, 8:30 a.m. in SALMON RIVER

13 *Long term Space Flight and Health*, **JULIA THOM OXFORD** (Department of Biological Sciences, Biomolecular Research Center, Musculoskeletal Research, 1910 University Drive, Boise State University, Boise, ID 83725; joxford@boisestate.edu).

Like every other living creature we know of, humans evolved at the bottom of a gravity well. We take the Earth's tug for granted, and so do our bodies. So it's not surprising that our bodies behave oddly in orbit. What is surprising is that humans turn out to adapt remarkably well to zero-g (more precisely, microgravity).Weightlessness itself is the most important and the most obvious influence on life in space. Weightlessness complicates the business of daily life, from eating to sleeping. And space adaptation involves some very complex changes in the human body, both short-term and long-term. These changes can cause health problems both in space and on return to Earth. There are other factors, too. Outside the protective shield of the Earth's atmosphere, astronauts have to contend with high radiation levels. These have long-term effects: an increase in the risk of cancer in later life, for example. This symposium is designed for anyone interested in the effects of microgravity on physiological systems including cardiovascular, balance, musculoskeletal, and vision. Research opportunities for undergraduate and graduate students, postdoctoral fellows, and faculty will also be discussed.

14 *Changes in Solvent Accessibility of Wild-type and Deamidated bB2-crystallin Following Complex Formation with aA-crystallin Chaperone*, **KIRSTEN J LAMPI[1]*, CADE B FOX[1], and LARRY L DAVID[2]** (Oregon Health and Science University, Integrative Biosciences, 611 SW Campus Dr., Portland, OR 97239, USA; [2] Oregon Health and Science University, Biochemistry and Molecular Biology, 3181 S.W. Sam Jackson Park Rd., Portland, OR 97239, USA; lampik@ohsu.edu).

Cataract formation is due to aberrant protein interactions

leading to aggregation and insolubilization. Deamidation, a prevalent age-related modification in the lens of the eye may also take place as a result of long term spaceflight, leading to a decrease in stability of the major lens proteins, crystallins. Deamidation is loss of a tertiary amino group on an Asn or Gln resulting in a carboxyl group with a net negative charge. Nonenzymatic deamidation may be facilitated by UV exposure. The mechanism of deamidation altering interactions between the αA-crystallin chaperone and βB2-crystallin was investigated by thermally inducing complex formation. Changes in solvent accessibility were detected by analysis with hydrogen/deuterium exchange coupled to high-resolution mass spectrometry. The mechanism of deamidation-dependent mechanisms of cataract formation through destabilization of crystallins before they can be rescued by α-chaperone will be discussed.

15 *Effects of Simulated Microgravity on Articular Chondrocytes*, **LILIANA MELLOR[1]*, LINDSEY CATLIN[1], RAQUEL BROWN[1], WARREN KNUDSON[2], and JULIA THOM OXFORD[1]** ([1]Boise State University, Biomolecular Research Center, Boise, ID 83725; [2]East Carolina University, Brody School of Medicine, Greenville, NC 27834; lilianamellor@boisestate.edu).

Astronauts experience bone density loss after space flight resembling osteoporotic conditions due to prolonged exposure to microgravity. Although bone density loss in space is a growing field of interest, little is known about the effects of microgravity on the adjacent articular cartilage. Articular cartilage of the synovial joints such as hip and knee, are constantly exposed to mechanical forces produced by daily activities here on Earth. Similar to bone, cartilage is a type of connective tissue that requires a balance between synthesis and degradation of extracellular matrix components to maintain tissue homeostasis; changes in this balance leads to cartilage degradation. However, unlike bone tissue, cartilage lacks innervation, blood supply and cell-cell contact, and has a very limited regeneration capacity. Proper communication between individual chondrocytes and the extracellular matrix is crucial to maintain cartilage homeostasis, and disruption in cell-matrix interactions can trigger cartilage degradation. We use two chondrocyte cell lines widely used in arthritis cell research, RCS (rat chondrosarcoma cells) and C-28/I2 (immortal human chondrocytes), and expose them to a modeled simulated microgravity environment using a rotating wall vessel (RWV) bioreactor. We optimized culture conditions for each cell line in a 3-D environment by testing different microcarriers and assessing cell viability after several days in the bioreactor. A better understanding of the molecular signaling pathways involved in cartilage degradation, will not only help prevent astronauts developing osteoarthritis from exposure to microgravity, but will also help us prevent further degradation in patients experiencing early stages of arthritis on Earth.

16 *A Role for PTHrP in Expression of Minor Fibrillar Collagens*, **NEDA SHEFA*, MINOTI HIREMATH, and JULIA THOM OXFORD** (Biological Sciences Department, Boise State University, 1910 University Dr. Boise, ID 83725; nedashefa@boisestate.edu).

Astronauts lose an average of 1-2% in bone mineral density for every month spent in microgravity. Bone remodeling is a tightly regulated system that involves formation of new bone by osteoblasts and resorption of old bone by osteoclasts. Microgravity uncouples bone remodeling and causes increased bone resorption. Many attempts have been made to understand the underlying causes of bone loss in microgravity but with limited success. Parathyroid hormone-related protein (PTHrP) produced by bone cells stimulates bone formation. Spaceflight causes an 80-90% decrease in PTHrP mRNA levels. The uncoupling of bone remodeling in spaceflight could be a downstream effect of decreased PTHrP. Here, we test the hypothesis of PTHrP acting via collagen proteins in the extracellular matrix to regulate bone remodeling. Pre-osteoblasts were treated with PTHrP to assess the expression of minor fibrillar collagens by reverse transcriptase PCR. Recent studies show that Col5a3 is specifically expressed in newly synthesized bone, suggesting that PTHrP-mediated regulation of Col5a3 may contribute to new bone formation. Additionally, we treated C2C12 pre-osteoblast cells with BMP-2 to differentiate them into osteoblasts and then treated them with PTHrP. We observed that PTHrP also changes the expression of different Col11a1 isoforms in osteoblasts. In summary, our results demonstrate a crosstalk between PTHrP and the minor fibrillar collagens that may mediate bone formation during development and bone remodeling during exposure to microgravity.

17 *Interactions of Osteoblasts, Inflammation, and the Extracellular Matrix in Simulated Free Fall*, **JAKE GOYDEN*, BENJAMIN DAVIS, JULIA THOM OXFORD, and CHERYL JORCYK** (Department of Biological Sciences, Biomolecular Research Center, Musculoskeletal Research, Boise State University, 1910 University Dr., Boise, ID 83725; jakegoyden@u.boisestate.edu).

Healthy bone repairs damage and adapts to changing mechanical demands by regulating the balance between bone destruction by osteoclasts and bone construction by osteoblasts. In space travel and significant terrestrial diseases like osteoporosis, bone is lost because osteoblasts activity falls behind relatively normal osteoclast activity. Osteoblast differentiation and activity interact with many systems, including the inflammatory microenvironment and the extracellular matrix. Sustained free fall in long term spaceflight may suppress osteoblast function by disrupting these interactions or alter these systems by disturbing osteoblast function.

We explore the relationships between osteoblasts, inflammation, the extracellular matrix, and the mechanical environment. Using the Rotary Cell Culture System, we show how

osteoblasts are affected by changes in inflammtory signaling and the extracellular matrix and cause changes in turn. This data may provide insight into processes with relevance to diverse issues in human health, from cancer to space travel.

18 *Going Green in Space?* **KEITH LAMPI** (Hydration Technology Innovations, LLC, Vice President of Operations, 2484 Ferry St. SW, Albany, OR 97322; klampi@htiwater.com).

Hydration Technology Innovations has worked with NASA for 15 years providing materials and research for life support systems focusing on water reuse. The brief talk will relay these findings and discuss technology transfer for both industrial and humanitarian opportunities and conclude with the results of testing of an emergency hydration pouch by Commander Chris Ferguson on the Space Shuttle Atlantis (STS 135).

19 *Calcium Flux During Cell-Cell Communication – BSU Microgravity University 2012*, **REILLY CLARK, LINDSEY CATLIN*, LANDON NYE, KELLEN MATHER, TRAVIS BAKER, DAVID CONNOLLY, MATTHEW DOLAN, JASON ARCHER, EUGENE CASTRO, AUDRA PHELPS, NIC BAUGHMAN, DANIEL LAMBERT, MARIE THARP, JOSHUA ANGHEL, BENJAMIN DAVIS, ROBERT HAY, ALARK JOSHI, SARAH HAIGHT, ELISA BARNEY SMITH, JULIA OXFORD, and BARBARA MORGAN** (Department of Biological Sciences, Department of Electrical and Computer Engineering, Department of Mathematics, Department of Mechanical and Biomedical Engineering, Department of Business Management, Department of Computer Science, Division of Research, Boise State University, Boise, ID 83725; reillyclark@u.boisestate.edu)

Osteocytes integrate mechanical information into chemical signals relayed to osteoclast and osteoblast cell populations. In effect, these signals orchestrate bone resorption and formation by the osteoclasts and osteoblasts, respectively. While these activities are essential for the maintenance of healthy bone, imbalances in these processes by exposure to extreme environments, such as microgravity, are hypothesized to lead to highly detrimental bone loss. Changes in free calcium concentration, known as calcium flux, is an intermediate step in the chemical signaling processes of the osteoctyes. To determine how environments of continually alternating forces affect the bones of the human body, it is important to study how those environments affect calcium flux. To this end, this experiment examined how osteocyte and osteoblast mono- and co-cultures respond to the periods of micro-and hyper-gravity experienced onboard NASA's Weightless Wonder. Calcium flux in the three cell cultures was fluorescently monitored through the use of a lens and imaging-based system. The cellular calcium concentrations increased during periods of hyper-gravity and decreased during periods of microgravity.

20 *Device Design and Development for Imaging Cellular Behavior – BSU Microgravity University 2012*, **DAVID CONNOLLY, MATTHEW DOLAN*, JASON ARCHER, EUGENE CASTRO, REILLY CLARK, KELLEN MATHER, LINDSEY CATLIN, LANDON NYE, TRAVIS BAKER, AUDRA PHELPS, NIC BAUGHMAN, DANIEL LAMBERT, MARIE THARP, JOSHUA ANGHEL, BENJAMIN DAVIS, ALARK JOSHI, ROBERT HAY, SARAH HAIGHT, ELISA BARNEY SMITH, BARBARA MORGAN, and JULIA OXFORD** (Department of Electrical and Computer Engineering, Department of Mechanical and Biomedical Engineering, Department of Computer Science, Department of Business Management, Department of Mathematics, Department of Biological Sciences, Division of Research, Boise State University, Boise, ID 83725; davidconnolly@u.boisestate.edu).

This year's Boise State Microgravity University team is building a system which excites osteocyte mono-cultures and osteocyte-osteoblast co-cultures at 350nm and then images the Indo-1 dye at 485nm and 405nm based on whether the dye is unbound or bound to calcium, respectively. In order to image these wavelengths, the system built needed enough resolution to image 96 5mm wells in a 3x5 inch 96 well microtiter plate. Another complexity of the system is that it needed to image these wells during a 30s period of micro or hyper gravity, requiring the exposure time and time between captures to be small. The imager itself needed to be sensitive enough that it can capture the wavelengths without introducing unnecessary noise even though the signal does not have significant luminosity. Two mono-chrome imagers using C-mount band-pass filters were used in order to isolate the 405nm and 485nm emissions simultaneously. Capturing images was done using Aptina proprietary software and C programming language utilizing multi-threading to capture images from both cameras simultaneously. After capturing the RAW images, the edges of each cell were detected, and the contents were analyzed to determine how much luminosity from each well was caused by unbound or bound dye, allowing a quantification of free calcium.

Forensic Psychology in Evaluating a Lone Wolf Terrorist: An Analysis of the Norway Killer

Monday, 8:40 a.m. in PAYETTE RIVER

21 *Overview and Questions for Forensic Psychology in Homegrown Lone Wolf Terrorism Cases*, **RONN JOHNSON** (Clinical Mental Health Program, University of San Diego, 5998 Alcalá Park, San Diego, CA, 92110; ronnjohn@sandiego.edu).

Police and public safety personnel often make decisions designed to protect citizens. These decisions are frequently made with a degree of uncertainty when it comes to acts of terror. Nonetheless, clinical mental health professionals are

frequently involved in a key role during prevention, profiling and intervention as part of a multidisciplinary team. At a minimum, the role and responsibilities of a mental health professional by default requires advanced clinical skills, knowledge of the criminal justice system, as well as competencies for appropriately responding to cultural, ethical and forensic mental health issues emerging from Lone Wolf Terrorism cases. For example, are their forensic mental health standards for profiling practices that might be sufficient to compel police and public safety personnel to consider in their potential actions? This forensic mental health science symposium presents a conceptual framework of the issues that surround forensic practices in Lone Wolf Terrorism (LWT) cases. The symposium uses forensic psychology as a platform to examine several mental health factors related to LWT. A question and answer period follows a counter-point discussion of each paper presented. This presentation offers more informative questions than answers relative to the mindset of a terrorist. It also provides profiling caveats related to conceptualizing a terrorist. For example, is there a maladaptive cognitive schema or classification format (e.g., GRIPE Model) that might allow security experts to better understand terrorists? An internalized homeland security directive to "think like a terrorist" is instructive for antiterrorism efforts. What is lacking, however, is a clearer understanding of the motives behind strategic options terrorists are exercising and possible antiterrorism responses. Effective counterstrategies are difficult to craft without understanding the logic that fuels acts of terrorism. The presenter provides advice on ways a reasonable assessment may be employed as a way of organizing knowledge or disaggregating a largely new behavioral frontier.

22 *Forensic Psychology Cultural and Ethical Considerations in Homegrown Lone Wolf Terrorism Cases*, **KRISTEN N GREIDER*, CHRIS WEHRLE, NICK BOYD, and RONN JOHNSON** (Clinical Mental Health Program, School of Leadership and Education Sciences, University of San Diego, 5998 Alcalá Park, San Diego, CA, 92110; kgreidero@gmail.com, ronnjohn@sandiego.edu).

The role of forensic psychologists in international and national security related work has been a long debated ethical concern amongst the American Psychological Association (APA). Many government agencies are utilizing the expertise of forensic psychologists to aid in the interrogation, profiling, and psychological analysis of homegrown lone wolf terrorism cases. Depending upon the agency and capacity of the forensic psychologists work, one may ask the question, "Whose ethics do we follow?" The APA has developed a special task force to address psychological ethics and national security concerns in the wake of 9/11. This paper discusses the ethical obligations forensic psychologists must adhere to when engaging in security related work. Vignettes as outlined in APA's Presidential Task Force Manual are thoroughly examined through case scenario perspective. The authors also address cultural considerations when developing psychological evaluations of homegrown lone wolf terrorists.

23 *Identifying, Securing, Organizing and Reviewing Mental Health Data in the Norway Killer Case*, **RONN JOHNSON*, CHRIS WEHRLE, and KRISTEN GREIDER** (Clinical Mental Health Counseling, School of Leadership and Education Sciences, University of San Diego, 5998 Alcalá Park, San Diego, CA, 92110; ronnjohn@sandiego.edu).

When a mental health professional becomes involved in what some have labeled a Lone Wolf case like the Norway Killings, there is information that must be taken into consideration. This forensic psychological data is relevant for evaluating, treating and making clinical judgments (i.e., mental state at the time of the offense MSO) regarding the accused. Before any mental health professional can determine what information is required, clearly defined roles must be established because the information needed may vary depending upon the mental health professional's role as an expert witness, a consultant, or a therapist. Once roles are defined the mental health professional must have an understanding of legal and behavioral issues regarding the case. They must also determine the information they will need to fulfill their roles and gather that information. School, psychiatric, psychological, criminal, and employment records need to be secured in order to review relevant background information regarding the accused. Once information is gathered, mental health professionals must organize it in a relevant, informative, and defensible manner in order to serve their intended psycho-legal purpose. Mental health professionals must craft a forensic report that is relevant to the forensic questions being raised (e.g., insane or sane, competent or incompetent to stand trial). The forensic standards vary from country to country as well as state to state. Forensic work in these cases can be extremely time-consuming for mental health professionals. This paper examines the pertinent information relating to the Norway Killer case. Some attention is given to an effort to forensically analyze material developed by Anders Behring Breivik. Understanding what is needed before court proceedings begin can help mental health professionals to better manage their time and resources during often lengthy and high profile trials.

24 *Opposing Psychological Reports on the Norway Killer Case*, **NICK BOYD*, LINH TRAN, and RONN JOHNSON** (Clinical Mental Health Counseling, School of Leadership and Education Sciences, University of San Diego, 5998 Alcalá Park, San Diego, CA, 92110; ebessen@sandiego.edu, ronnjohn@sandiego.edu).

When Anders Behring Breivik, the Norway Killer, was found in connection with mass murder that shook Europe and its Norwegian community, many questions followed as to his motives, ideology, background, and mental state. With the case currently on trial, new developments, questions, and answers continue to unfold. As we look to interpret Anders

Behring Brevik's, his self-published internet Manifesto and opposing psychiatric accounts provide groundwork into further understanding the case complexities. Initial assessments concluded bizarre and persistent delusions affecting perception, interrupted or sudden thoughts, and other associated symptoms consistent with the International Classification of Diseases (ICD-10) requirements in rendering a diagnosis of Paranoid Schizophrenic. Additional evaluation by opposing psychiatric professionals determined Anders Breivik to not be in a psychotic mental state during the time of his offenses. This presentation will look to provide an introduction in the determining psychological factors of opposing opinions, other relevant psychological considerations, and further presenting issues.

25 *Women and Children Suicide Bombers: The Next Terrorist Frontier*, **CHRIS WEHRLE*, ERICA BESSEN, and RONN JOHNSON** (Clinical Mental Health Counseling, School of Leadership and Education Sciences, University of San Diego, 5998 Alcalá Park, San Diego, CA92110; cwehrle@sandeigo.edu, ebessen@sandigo.edu, ronnjohn@sandiego.edu).

Terrorist organizations rely on tactful and creative measures in executing deadly attacks against their enemies. Surprise is the essence of the terrorist attack because it serves both the practical function of attacking the vulnerable who are not adequately prepared, while instilling psychological fear into the targeted population due to the unpredictably of such attacks. Contributing to this fear is the difficultly of identifying the members of such lethal organizations in civilian life. Orphaned, mentally disabled, and religious extremist children are all being used as suicide bombers in Iraq, Afghanistan, and the Gaza strip. There is also an increase in female suicide bombers in these regions, many of whom seek out terrorist organizations to become "martyrs." The authors also investigate the psychological profiling, demographic, and motivations of women and children operatives who are considered to be "lone wolves". The cases of sixteen-year-old suicide bomber Issa Bdeir of Palestine, eleven-year-old Abdullah's attempted suicide bombing, Roshonara Choudhry's attempted assassination of a former government minister, and the attempted assassination of Gerald Ford by Sara Jane Moore are examined thoroughly. This paper examines the recruitment methods terrorist organizations utilize, while presenting interventions for children terrorists in government captivity.

26 *Antiterrorism from an Alternate Behavioral Threat Assessment Perspective*, **CHRIS WEHRLE*, KRISTIN, DESCANIO, and RONN JOHNSON** (Clinical Mental Health Counseling, School of Leadership and Education Sciences, University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; cwehrle@sandiego.edu, ronnjohn@sandiego.edu).

The authors examine several alternate behavioral threat assessment perspectives to contribute to domestic counter terrorism (CT) theory. Culturally biased views of terrorists that American citizens and risk assessment analysts hold hinder CT strategy in many ways. The common misnomer in American culture that terrorists are of Muslim decent, and commit acts of violence to achieve Jihad, are not only grave stereotypes, but are arguably dangerous viewpoints to hold because it creates space for other operatives to capitalize on. The fact is that such operatives have not carried out the large majority of terrorist acts in the United States post 9/11. This paper asks us to assume that the behavioral threats that exist "currently" differ from our own preconceived expectations. The authors suggest the importance of examining the more "general" threats that terrorism possess to society in order to develop a foundational perspective that analysts can then build upon. Examining empirical evidence in order to identify trends and patterns of terrorist behavior is the next essential step of threat assessments. Case analysis of Clayton Waagner, Maj. Nidal Hasan, and Theodore Kaczyinski offer examples of why security experts must be alert to their own misguided stereotypes.

The Forensic Psychology of Women Death Penalty Cases

Monday, 1:30 p.m. in the PAYETTE RIVER

27 *Overview of Questions for Forensic Psychology in Women Death Penalty Cases: Teresa Lewis as a Framework*, **RONN JOHNSON and KRISTEN N GREIDER** (Clinical Mental Health Program, School of Leadership and Education Sciences, University of San Diego, 5998 Alcalá Park, San Diego, CA, 92110; ronnjohn@sandiego.edu).

In the current era, 1973 to the present, 174 women have received death sentences in the United States of America. Of these women, twelve have been executed. The purpose of this article is to critically review the current research on female offenders and the death penalty in the context of forensic psychology. Death penalty cases often contain mental health mitigating factors. Theresa Lewis was a death penalty case where forensic mental health factors were relevant. Lewis was the 12th woman to be executed in the United States since capital punishment was reinstated. She was convicted in a murder for hire incident but the two male co-conspirators, who shot and killed the victims, received life sentences. The Theresa Lewis case and other women death penalty cases offer a useful framework for examining forensic mental health practice. Relevant forensic psychological issues will be explored in the context of gender and cultural factors unique to women on death row. Mental health professionals working with women on trial will need to consider unique mitigating factors, e.g., Battered Woman Syndrome or Postpartum Psychosis, and their possible role in the trial. These forensic psychological issues and others will be discussed in the context of women death penalty cases.

28 *Can a Forensic Psychological Report be Crafted in the Most Recent Women Death Penalty Cases of Lynda Lyon Block and Aileen Wuornos?* **KRISTEN N GREIDER* and RONN JOHNSON** (Clinical Mental Health Program, School of Leadership and Education Sciences, University of San Diego, 5998 Alcalá Park, San Diego, CA, 92110; kgreidero@gmail.com, ronnjohn@sandiego.edu).

The death penalty cases of Lynda Lyon Block and Aileen Wuornos, both executed in 2002, will be examined from a forensic mental health perspective during this presentation. The primary focus is on the construction of forensic psychological reports for each of these women. Reports were crafted by reviewing court documents, primary sources, and credible interviews from a biopsychosocial framework. The purpose of constructing these reports is to conceptualize these women as if they were presenting for treatment by a mental health professional within the context of their legal case. Psychological factors for consideration in Lynda Lyon Block's case include her extreme political views and her insistence to waive counsel during her trial. Lynda Lyon Block and her common-law husband, who also received the death penalty, were on the run after a warrant was issued due to their failure to appear for a charge of aggravated battery and burglary of Lyon's 79-year-old former husband when they shot and killed a police officer and then led police on a high-speed chase. Aileen Wuornos is famously portrayed in the movie *Monster*, and is unique in that she killed seven men over a relatively short period of time and displayed both bizarre and non-bizarre delusions during her trial. Forensic psychological analysis of these cases is pertinent because although women are a minority on death row, in 2011 women represented 6.4% (5/78) of people sentenced to death, which is the highest representation of women on death row.

29 *Forensic Mental Health Cultural and Ethical Considerations in Death Penalty Cases: Wanda Jean Allen, Teresa Lewis, and Frances Newton*, **KELLY RAINS*, KRISTIN DESCANIO, NICK BOYD, and RONN JOHNSON** (Clinical Mental Health Counseling, School of Leadership and Education Sciences, University of San Diego, 5998 Alcalá Park, San Diego, CA, 92110; krains3@hotmail.com, ronnjohn@sandiego.edu).

In this presentation, the death penalty cases of Wanda Jean Allen, Frances Newton, and Teresa Lewis will be examined with an emphasis on cultural factors and ethical considerations for forensic mental health practices. Wanda Jean Allen was the first of two black women to be executed in the modern era of the death penalty and is also unique in that she received the death sentence for killing her lesbian partner during a dispute. In addition, a psychological evaluation of Allen suggested that she suffered deficits due to a traumatic brain injury experienced as an adolescent. Frances Newton was the second black woman in the modern era to be executed on death row. She consistently maintained that she was not guilty for the murders of her husband, her seven-year-old son, and her 21-month-old daughter. Frances Newton was convicted of their deaths despite her assertion that they were killed from drug-related violence, as her husband was a drug dealer. The third case that will be examined is Teresa Lewis's case and execution, which received significant media attention due to controversy over her diagnosis of borderline mental retardation. Psychological evaluations during the trial showed that Lewis's IQ was only one or two points higher than most states' maximum IQ cut-off to make her ineligible for execution under *Atkins v Virginia*, which bans the execution of people with mental retardation. Each of these three cases has relevant cultural considerations for future forensic mental health practices.

30 *Dependent Personality Disorder as a Mitigating Factor in Death Penalty Cases*, **ERICA J BESSEN and RONN JOHNSON** (Clinical Mental Health Counseling, School of Leadership and Education Sciences, University of San Diego, 5998 Alcalá Park, San Diego, CA, 92110; ebessen@sandiego.edu, ronnjohn@sandiego.edu).

Three females convicted of murder in the United States: Karla Faye Tucker, Marilyn Kaye Plantz, and Betty Lou Beets were put to death for their crimes. Their execution made them three of only twelve female death row inmates executed since 1976. Although each of these women on death row committed different types of crimes, all three cases encompassed at least two themes in common: the role of their motives and the aggravating factors surrounding their cases in the jury's decision to sentence them to death. Motives include any reasons used to explain why people commit crimes while aggravating factors are elements of a crime presented to a jury by the prosecution to demonstrate circumstances in which the harshest possible sentence should be given the circumstance surrounding the case. Karla Faye Tucker was an especially controversial case of a female being executed because of her drastic transformation to a born-again Christian in the years prior to her execution and the very public protest that occurred during that time. This presentation will review the cases of these three women from a forensic clinical mental health perspective. The primary focus is on the motives and aggravating factors that contributed to them receiving death sentences.

31 *Forensic Psychology in Select Female Death Penalty Cases II: Black Widows*, **CHRIS WEHRLE*, KRISTEN N GRIEDER, and RONN JOHNSON** (Clinical Mental Health Counseling, School of Leadership and Education Sciences, University of San Diego, 5998 Alcalá Park, San Diego, CA92110; cwehrle@sandeigo.edu, kgreidero@gmail.com, ronnjohn@sandiego.edu).

Female defendants in death penalty cases often face stereotypes based on characterizations of female sexuality and gendered evil, unlike their male counterparts. Velma Barfield

and Judy Buenoano are two women that were executed on death row that were characterized as "black widows." This presentation will focus on a forensic mental health analysis of the court documents and media portrayal of each of these women. Velma Barfield was the first woman to be executed after the reinstatement of the death penalty in the modern era, and is one of the few convicted American female serial killers in the modern era. Her case is representative of the "gendered" factors in death penalty cases in that she implemented the use of poison in the majority of the murders and that she killed people she had romantic, familial, or care-taking relationships with. Judy Buenoano was the third woman to be executed after the reinstatement of the death penalty. Buenoano was sentenced to death for poisoning her husband with arsenic, a life sentence for poisoning and drowning her adult son, who was physically disabled due to the arsenic poisoning; and convicted of attempted murder of her fiancé. She was also suspected in other deaths and was charged with acts of arson and insurance fraud. Forensic mental health analysis of the cases of these two black widows yields important considerations for psychological evaluations, mitigating factors, and aggravating factors in current death penalty cases.

32 *Forensic Psychology in Select Female Death Penalty Cases III: Other Mental Health Issues*, **LINH TRAN* and RONN JOHNSON** (Clinical Mental Health Counseling, School of Leadership and Education Sciences, University of San Diego, 5998 Alcalá Park, San Diego, CA 92110; linht@sandiego.edu, ronnjohn@sandiego.edu).

In the cases of Christina Marie Riggs and Lois Nadean Smith, both defendants were convicted of murder and sentenced to death. Although both cases had significant evidence suggesting guilt, including the direct confession from Ms. Riggs herself, the mental state of the defendants was not considered mitigating factors during their trials. Both defendants were under the influence of drugs and alcohol, which impaired judgment at the time of the incident, however there were other mental health issues that were pertinent to their case that was minimally explored. Christina Riggs had a long history of sexual abuse and suffered from depression that increased after a miscarriage and a failed marriage, as well as psychotic features. She injected herself and her children with lethal doses of potassium chloride but survived, and received the death penalty for their deaths. Lois Smith was also a victim of abuse at the hands of her ex-husband, Jim Smith, who once broke her arm and leg in a domestic altercation. The defense suggested that Smith suffered from organic brain damage as a result of a serious car accident in 1966. Smith's possible drug and alcohol use, in addition to organic brain damage, may have resulted in impaired impulse control. This presentation will focus on forensic psychological considerations of the Riggs and Smith cases.

Computability and Complexity in Mathematics

Monday, 1:30 p.m. in PONDEROSA PINES 1 and 2
Tuesday, 9:00 a.m. in PONDEROSA PINES 1 and 2

33 *DNA-rearrangement During Macronuclear Development in Ciliates*, **FRANZISKA JONSSON** (Department of Health, Institute of Cell Biology, University of Witten/Herdecke, Stockumer Strasse 10, Witten 58453, Germany; Franziska.Joensson@uni-wh.de).

Ciliates are single-cell eukaryotes characterized by having two morphologically and functionally different nuclei, a micronucleus (MIC) and a macronucleus (MAC). A MAC is necessary for vegetative growth. A MIC is required for sexual reproduction.

MIC DNA and MAC DNA are organized differently: MACs host short DNA molecules, called nanochromosomes. These terminate in the same telomeric sequence at both ends. In strichotrichous ciliates (e.g. Stylonychia lemnae) a nanochromosome contains one gene. The MIC genome is organized like conventional eukaryotic genomes: MIC chromosomes are long DNA molecules whose gene-coding sequences are separated by long non-coding regions. In contrast to conventional eukaryotic genomes, MIC gene-coding sequences are disrupted by short non-coding segments called internal eliminated sequences (IES). Each IES flank contains a short sequence repeat, called a pointer. Thus, MIC gene-coding loci consist of coding segments called macronuclear destined sequences (MDSs) separated by IESs flanked by pointer repeats. In many micronuclear gene loci in stichotrichous ciliates MDSs are in different order from their MAC order. Moreover, the MIC orientation of an MDS can be the inverse of its MAC orientation.

During sexual reproduction a new MAC differentiates from a micronuclear derivative. Extensive DNA rearrangement and excision over a short time-period produce a new functional MAC. These processes are precise: Non functional genes lead to cell death. Information encoded in DNA sequences and information from the old MAC regulate these processes. Old MAC information seems to arrive in the developing new MAC in form of templates that aid in correctly assembling individual macronuclear nanochromosomes.

34 *Genome Remodeling in Developmental Time: Algorithms for Ciliates*, **CHRISTOPHER ANDERSON[1]*, HELEN WAUCK[2]*, MARLENA WARNER[3]* and MINGJIA YANG[4]*** ([1]Department of Mathematics, Lewis and Clark College, 0615 S.W. Palatine Hill Road, Portland, OR 97219, canderson@lclark.edu; [2]Department of Mathematics, Gustavus Adolphus College, 800 W College Ave., Saint Peter, MN 56082, hwauck@gustavus.edu; [3]Department of Psychology and Communication Studies, University of Idaho, Moscow, ID 83844, Marlena.warner@gmail.com; [4]Department of Mathematics, Albion College, Albion, MI 49224, my13@albion.edu).

Ciliates are single celled organisms hosting two types of nuclei, one an encrypted version of the other. In some species this encryption is nontrivial. During certain events in the ciliate life-cycle nuclei are updated through a process that involves decryption of the encrypted version. Mathematical models for the decryption process postulate certain specific molecular computations that achieve this decryption. In this work we seek to: (1) determine the molecular computational steps taking place during decryption by examining intermediate DNA products of the process; (2) determine the elements of the symmetric group that are invertible by the ciliate decryption apparatus; (3) determine the computational complexity of the several steps to be taken in modeling elements and operations of symmetric groups in the ciliate computing environment.

All four authors contributed equally under the mentorship of Prof. Marion Scheepers, Boise State University. We acknowledge NSF grant DMS 1062857 and Boise State University for supporting this work.

35 *Exploring Phylogenetic Relationships in Drosophila with Ciliate Operations*, **MARION SCHEEPERS[1], ANNA NELSON[1]*, and JACOB HERLIN[2].** ([1]Department of Mathematics, Boise State University, 1910 University Drive, Boise, ID 83725; [2]Department of Mathematical Sciences, University of Northern Colorado, 2901 South 27th Avenue, Greeley, CO 80631; annanelson1@u.boisestate.edu).

Phylogenetics is the study of evolutionary relationships among groups of organisms. It is known that the genomes of some species are related by permutations of gene locations on chromosomes. The central research question that arises from this finding is to find mathematical operations on permutations that most faithfully model the evolutionary steps by which genome rearrangements arise. Classical work on the question hypothesize that genome rearrangements arise through reversals only. Data about the developmental genome remodeling events in ciliates suggest that there are additional genome rearrangement operations that could also be routinely involved in the evolutionary process. Ciliates are capable of permuting DNA segments using merge, swap, and reverse operations. We created a deterministic algorithm that simulates permuting DNA sequences using these three ciliate operations. It determines in polynomial time evolutionary distances among scrambled genomes. After implementing our algorithm in Python we applied it to extensive data about genome rearrangements in fruit-fly species. We found a correlation between the published evolutionary distances of the fly species, found by other means by others, and the number of ciliate reversal operations used by our algorithm. For all but one of the eight species we found this correlation also held for the total number of uses of the reversal and swap operations used. Our research was supported by the NSF Mathematics REU site grant DMS 1062857 and by Boise State University.

36 *Geometry, Topology, and Complexity of Virtual Knots*, **ASHLEY EARLS[1]*, GABRIEL ISLAMBOULI[2]*, and RACHAEL KELLER[3]*** ([1]Department of Mathematics, St Olaf College, 1500 St. Olaf Ave, Northfield, MN 55057, earls@stolaf.edu; [2]Department of Mathematics, University of Virginia, Charlottesville, VA 22904, gfi8ps@virginia.edu; [3]Department of Mathematics, Louisiana State University, Baton Rouge, LA 70803, rkell18@tigers.lsu.edu).

Knots, strings tangled in 3-space, are objects with which everyone is familiar. The mathematical theory of knots is highly sophisticated, incorporating many classical areas including topology, geometry, combinatorics and group theory. Currently, the study of knots is finding application in fields as diverse as biology, physics and computing.

A knot, when drawn on a piece of paper, is a planar 4-regular graph. A virtual knot, from a graph theoretic point of view, is an arbitrary (not necessarily planar) 4-regular graph. Many questions which have been answered for classical knots are still unanswered for virtual knots. In our talk we will introduce virtual knots and explain their relevance to long standing conjectures, such as Whitehead's asphericity conjecture.

All three authors contributed equally under the mentorship of Prof. Jens Harlander, Boise State University. We acknowledge NSF grant DMS 1062857 and Boise State University for supporting this work.

Responses of Sagebrush-Steppe Ecosystems to a Changing Climate

Monday, 1:30 p.m. in SALMON RIVER

37 *Changes in Soil Aggregate Dynamics and Carbon Storage Following 18 Years of Experimentally Increased Precipitation in a Cold Desert Ecosystem*, **MARIE-ANNE de GRAAFF[1]*, JESS van der VEEN[2], MATTHEW GERMINO[2], and JAMIE HICKS[1]** ([1]Department of Biological Sciences, Boise State University, Boise, ID 38725; [2]USGS Forest and Rangeland Ecosystem Science Center, Boise, ID 83706; marie-annedegraaff@boisestate.edu).

Climate change is expected to alter the amount and timing of precipitation in semi-arid ecosystems of the Intermountain West, and the net effect of these changes on soil C sequestration is not well understood. Soil C sequestration is regulated by the incorporation of C into soil aggregates, where they are physically protected from microbial degradation. With this study we assessed: (1) how precipitation shifts affect soil aggregate formation and associated soil organic carbon (SOC) contents in semi arid ecosystems, and (2) how plants mediate precipitation impacts on soil C sequestration. Soil was collected from an ecohydrology study situated at INL. The experimental field site consists of subplots planted with either sagebrush (*Artemisia tridentata*) or crested wheatgrass (*Agropyron cristatum*) and has been exposed to three precipitation treatments: ambient (i.e.control), winter (200mm) or summer (4x50mm) for 18

years. Soils were collected from directly beneath plants and from plant-interspaces, after which they were fractionated into macroaggregates, free microaggregates and free silt and clay fractions. Further, macroaggregates were separated into particulate organic matter (POM), microaggregates and silt and clay fractions. We measured the relative abundance of soil fractions, and SOC within the fractions. Results showed that increased precipitation decreased SOC in all treatments, but not in soils underneath sagebrush, where SOC incorporation into more stable soil fractions was enhanced. Our data suggest that precipitation in semi arid ecosystems deplete SOC contents, and that plant species mediate the impact of precipitation on soil C dynamics.

38 *Influence of Precipitation Regime on Microbial Decomposition Patterns and Community Structure in Semi-Arid Ecosystems: Altered Roles of Bacteria and Fungi*, **KEVIN FERIS[1]*, CARRIE JILEK[1], DAVID HUBER[2], KEITH REINHARDT[2], MARIE-ANNE de GRAAFF[1], KATHERINE LOHSE[2], and MATT GERMINO[3]** ([1]Department of Biological Sciences, Boise State University, 1910 University Dr. Boise, ID 83725; [2]Department of Biological Science, Idaho State University, Pocatello, ID; [3]USGS FRESC, Boise ID, 83725; kevinferis@boisestate.edu).

In water-limited semi-arid sagebrush steppe ecosystems changes in climate may manifest as a shift from historically winter/snow-dominated precipitation regimes to one dominated by spring rains. In these ecosystems soil microorganisms play a vital role in linking the effects of water availability and plant productivity to biogeochemical cycling. Patterns of soil microbial catalyzed organic matter decomposition patterns (i.e. patterns of extracellular enzyme activity (EEA)) and soil community structure may respond both directly and indirectly to climate-induced changes in precipitation regime. For example, EEA patterns are thought to depend upon the quantity and quality of soil organic matter (SOM), pH, and mean annual precipitation. However, sagebrush-steppe plant communities respond strongly to changes in the timing and magnitude of precipitation, and preliminary findings by our group suggest that corresponding changes in SOM quantity, quality, N-cycle dynamics, and soil structure are occurring. Other groups have demonstrated shifts from a bacterial to fungal dominated community as precipitation regime shifts from winter to summer precipitation. We hypothesized: 1) Shifts in the timing and magnitude of precipitation indirectly affect soil microbial decomposition patterns via responses in the plant community structure and subsequent effects on soil organic matter quantity/quality; and 2) Changes in precipitation patterns may both directly and indirectly affect soil community structure, potentially uncoupling interactions between plant and soil community structure. We tested these hypotheses in a long-term (> 15 year) precipitation manipulation experiment in the sagebrush-steppe. Results are presented in the context of biotic responses to climate and subsequent alterations in C and N cycling.

39 *Effects of Climate Shifts and Plant-Community Transformations on Carbon and Nitrogen Cycling in Semi-Arid Rangelands*, **DAVID P HUBER[1]*, KATHERINE LOHSE[1], MATT HERMINO[2], KEITH REINHARDT[1], KEVIN FERIS[3], and MARIE-ANNE de GRAAFF[3]** ([1]Department of Biological Science, Idaho State University, Pocatello, ID, 83207; [2]USGS FRESC, Boise ID, 83725; [3]Department of Biological Sciences, Boise State University, 1910 University Dr. Boise, ID 83725; hubedavi@isu.edu).

Semi-arid rangelands are being impacted by climate shifts and plant-community transformations. However, little is known about how these ecosystems will respond to long-term changes in climate or how shifts in vegetation will modulate ecosystem processes. We used an established long-term ecohydrologic experiment (Est. 1993) in southeastern Idaho to evaluate ecosystem response to altered precipitation patterns and changing plant communities (sagebrush vs. Crested Wheatgrass (CWG)). We also assessed how response patterns varied due to landscape heterogeneity (i.e. inter-plant vs. under-plant patches and shallow vs. deep soils).

Preliminary results show increased precipitation altered available N pools, with NH_4^+ increasing and NO_3^- decreasing relative to controls. Surprisingly, vegetation dynamics, not precipitation patterns controlled overall N pools and processes. Sagebrush systems have greater NO_3^- pools than CWG, which reflects the high rates of N mineralization and nitrification under sagebrush vs. high rates of N immobilization under CWG. These patterns may make sagebrush systems more vulnerable to invasive plant species and nutrient losses.

Inter-plant patches responded to precipitation treatments more strongly than under-plant soils, showing increased nutrient pools and process rates and reducing landscape resource heterogeneity. Deep soils had greater carbon pools and available N than shallow soils. Shallow soils showed differential control on C and N pools for sagebrush vs. CWG systems, exaggerating N transformation rates for sagebrush but muting rates for CWG.

Overall, these results suggest that plant community dynamics and landscape heterogeneity may play a larger role in dictating ecosystem response to future changes in climate than expected previously.

40 *Identifying Holocene Relationships among Climate, Vegetation, Fire and Fire-related Erosion using Alluvial Charcoal and Fossilized Woodrat (Neotoma) Middens at City of Rocks National Reserve, Idaho*, **KERRIE WEPPNER[1]*, JEN PIERCE[1], and JULIO BETANCOURT[2]** ([1]Department of Geosciences, Boise State University, 1910 University Dr. Boise, ID 83725; [2]USGS NRP, 1955 E 6th St., Tucson, AZ 85719; kwepp@yahoo.com).

Climate change and land use could trigger extensive and possibly abrupt shifts in vegetation, wildfire regimes, and fire-related erosion. Our ability to anticipate such changes depends on our understanding of these past relationships. However, detailed records of vegetation, fire and geomorphic regimes are rarely all available at sensitive sites, for example along the edges of species distributions. At City of Rocks National Reserve (CIRO), south-central Idaho, we used fossil woodrat middens to reconstruct local vegetation and alluvial charcoal stratigraphy to evaluate fire and fire-related geomorphic responses at the migrating front of single-needle pinyon (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*), the dominant trees in the Great Basin. Frequent fires burned in the periods 10,700-9500 cal yr BP and 7200-6700 cal yr BP. Fire-free conditions characterized the intervals 9500-7200 and 6700-4700 cal yr BP. Episodic debris flows were deposited during early and late Holocene wetter climate, when vegetation was denser. Frequent sheetfloods were deposited during mid-Holocene drier climate. Utah juniper colonized CIRO at ~3800 cal yr BP. Frequent fires were recorded 2400-2000, 850-700 and 550-400 cal yr BP. Although single-needle pinyon colonized by 2800 cal yr BP, it did not expand broadly across CIRO until after 700 yr BP. Replication of our methodologies at other sites in the region may confirm associations and causal relationships between Holocene changes in vegetation, fire, and sedimentation.

41 *At home on the Range: Loss of Sagebrush May Open New Habitat for Harvester Ants, and Imperil a Threatened Mustard Endemic to Southwest Idaho*, **IAN ROBERTSON** (Department of Biological Sciences, Boise State University, 1910 University Drive, Boise, ID 83725; iroberts@boisestate.edu).

Throughout the Great Basin, disturbance events such as wildfire are causing sagebrush stands to be replaced by open grassland. In southwestern Idaho, the shift from sagebrush to grassland may allow Owyhee harvester ants, *Pogonomyrmex salinus*, to colonize areas that historically were unsuitable for nesting. Because harvester ants are generalist granivores, large influxes of ants could have a profound effect on plant communities, with the rarest species being most vulnerable. We have been studying the dynamics of harvester ant colonization in areas occupied by slickspot peppergrass, *Lepidium papilliferum*, a rare mustard endemic to southwest Idaho. Several years of monitoring suggest that Owyhee harvester ant numbers are on the rise. For example, between 2010 and 2011 the number of ant colonies recorded at 15 populations of *L. papilliferum* increased by 7.6% (from 841 to 905 colonies over 85.3 ha surveyed). At one location there has been a 64% increase in harvester ant colonies over the past three years (from 53 to 87 colonies over a 5.1 ha area). The abundance of harvester ant colonies is negatively associated with sagebrush cover and positively associated with the availability of non-Bromus grasses. Foraging studies have shown that *P. salinus* prefer the seeds of *Poa secunda* (Sandberg bluegrass) and various mustards over the seeds of *Bromus tectorum* (cheatgrass). Slickspot peppergrass seeds are among those readily consumed by *P. salinus*. Thus, the expansion of harvester ant colonies into *L. papilliferum* habitat represents a serious threat to the survival and long-term viability of this threatened mustard.

42 *Insect Responses to Intra- and Interannual Variations in Weather: Implications for Climate Change in Sagebrush Steppe*, **ASHLEY ROHDE[1,2]*, DAVID PILLIOD[1], and STEPHEN NOVAK[2]** ([1]U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, 970 Lusk St. Boise, ID 83706; [2]Department of Biology, Boise State University, Boise, ID 83725; arohde@usgs.gov; dpilliod@usgs.gov; snovak@boisestate.edu).

Climate has shaped the distribution of plants and animals throughout biological evolution and the recent accelerated climate change caused by human activities is no exception. Species distributions are expected to shift as local and regional climates change, but this process may be inhibited by modern landscapes that are fragmented by human infrastructure and land use. Reductions in biodiversity due to climate change are predicted to be most severe in grassland ecosystems, such as sagebrush steppe. These systems are particularly susceptible to climate change because of their aridity, high level of conversion, and low level of protection relative to other major habitat types. The goal of this study is to document the climatic conditions associated with distinct insect communities and determine how land management actions may influence these relationships. We identified >50,000 insects to family using pitfall and flight traps placed in arrays within the Bureau of Land Management Jarbidge Field Office in southwestern Idaho. Sampling was conducted from 2009-11. We examined the relative influence of weather and habitat conditions to determine the most important factors influencing insect community composition. Preliminary results from this study show that intra- and inter-annual weather patterns, particularly temperature, have a strong effect on insect community composition.

Computability and Complexity in Mathematics

Tuesday, 9:00 a.m. in PONDEROSA PINES 1 and 2

43 *Elliptic Curves: From Diophantus to Modern Cryptography*, **LAWRENCE C WASHINGTON** (Department of Mathematics, University of Maryland, College Park, MD 20742; lcw@umd.edu).

What do the motion of a pendulum, the possible areas of right triangles with rational sides, and identity based cryptography have in common? They all involve elliptic curves.

We'll give a sampling of them from their historical origins to their current use in cryptography.

44 *Computability and Complexity in Elliptic Curves and Cryptography*, **KEVIN BOMBARDIER[1]*, MATTHEW COLE[2]*, THOMAS MORRELL[3]*, and CORY SCOTT[4]*** ([1]Department of Mathematics, Wichita State University, 1845 Fairmount St. Wichita, Kansas 67260 , wildcat_ecoi@hotmail.com; [2]Department of Mathematics, University of Notre Dame, Notre Dame, Indiana 46556, mcole5@nd.edu; [3]Department of Mathematics, Washington University in St. Louis, One Brookings Drive, St. Louis, MO 63130, tmorrell@wustl.edu; [4]Department of Mathematics, Colorado College, 14 East Cache La Poudre Street Colorado Springs, CO 80903, Cory.Scott@coloradocollege.edu).

The underlying algebraic structure is important in both public key and symmetric key cryptography. It is well-known that for public-key cryptosystems the choice of algebraic platform for the system influences both the complexity of implementing the cryptosystem and the level of security offered by the system. Elliptic Curve groups, which have applications in public key cryptography, give an example of this. This phenomenon has not been investigated much for symmetric key systems and their extensions.

In this talk we present our findings from investigating this phenomenon for the Rijndael block cipher and its extensions for various algebraic platforms. This includes Elliptic Curve groups arising from Bachet's equation, as well as their structure.

All four authors contributed equally under the mentorship of Prof. Liljana Babinkostova, Boise State University. We acknowledge NSF grant DMS 1062857 and Boise State University for supporting this work.

45 *Symmetric Key Cryptography Over Non-binary Algebraic Structures*, **LILJANA BABINKOSTOVA[1], KAMERYN WILLIAMS[1]*, ALYSSA BOWDEN[2], and ANDREW KIMBALL[3]** ([1]Department of Mathematics, Boise State University, 1910 University Drive, Boise, ID 83725; [2]Department of Mathematics, Loyola Marymount University, Pereira Hall, 1 LMU Drive, Los Angeles, CA 90045; [3]Department of Mathematics and Computer Science, Stillwell 426, Western Carolina University, Cullowhee, NC 28723; kamerynwilliams@u.boisestate.edu).

Most modern symmetric-key cryptosystems are developed to be used on electronic binary computers. As such, their underlying algebraic systems are based on the binary set {0,1}. We consider two major symmetric-key cryptosystems: Luby-Rackoff cryptosystems which are based on a Feistel network and the Advanced Encryption Standard (AES) based on substitution-permutation network. We generalize these cryptosystems by considering arbitrary finite groups of characteristic greater than 2 and arbitrary finite dimensional vector spaces over Galois fields. We investigate the algebraic properties of these new cryptosystems and how this relates to their security.

Biofuel: Computational Modeling of Cellulose and Cellulase

Tuesday, 9:00 a.m. in DOUGLAS FIR 1 & 2

46 *Computational Evaluation of Alternative/Renewable Energy Solutions*, **C MARK MAUPIN** (Department of Chemical and Biological Engineering, Colorado School of Mines, Golden, CO 80401; cmmaupin@mines.edu).

The ever increasing worldwide demands for energy, along with uncertain petroleum sources and the possibility of global climate change, has dictated the necessity for our nation to develop a sustainable and renewable alternative to fossil transportation fuel. Biofuels derived from lignocellulosic biomass are attractive alternatives due to the vast infrastructure already in place for the distribution of a liquid transportation fuel, and the fact that fuel derived from cellulose does not compete with human and livestock food resources. Furthermore, since cellulose is the most abundant renewable biopolymer on earth the feedstock for cellulosic biofuels is almost inexhaustible, and the utilization of cellulose for liquid fuel can achieve zero net carbon dioxide emission thereby making it a crucial component in our efforts to reduce greenhouse gases. Cellulosic biofuels are created by hydrolyzing cellulose to glucose and subsequently fermenting the glucose to make biofuel. Several major obstacles remain with regard to the viability of cellulosic biofuels including overcoming the natural resistance of cellulose to enzymatic depolymerization, known as biomass recalcitrance, which is primarily responsible for the high cost of cellulosic biofuels. To formulate ways to overcome biomass recalcitrance, a basic understanding of the solvent, substrate and enzymes involved in the hydrolysis of cellulose are needed. During this symposium introductory statement a brief overview of molecular docking and dynamic simulations used to explore the interactions between solvent, substrate, and cellulase enzymes will be presented.

47 *Multi-resolution Computational Studies of Cellulose*, **GIOVANNI BELLESIA, PARTHASARATHI RAMAKRISHNAN, ANURAG SETHI, and S GNANAKARAN** (Theoretical Biology and Biophysics Group, Los Alamos National Labs, Los Alamos, NM 87545; gnana@lanl.gov).

Cellulose, an assembly of polymers of glucose, is an important renewable energy resource coming from plant biomass. A critical roadblock to lignocellulosic biofuel is the efficient degradation of crystalline fibers of cellulose to glucose. It is caused by the unusually high thermal and mechanical stability of cellulose. The redundancy in hydrogen (H-) bonding pattern, the intertwinement of intra- and intermolecular H-bonds and stacking interaction between sheets ensure this high stability. We have performed computations both at atomistic and coarse-grained levels to reveal how these different interactions lead to high thermal stability of cellulose and to the plasticity of hydrogen bonding network

in cellulose. Atomistic studies include Quantum Chemical calculations, Replica Exchange Molecular Dynamics (MD) and conventional MD simulations. Coarse-grained studies include statistical mechanical and phenomenological models. Importantly, our computations provide useful clues on rational procedure for the efficient degradation of cellulose.

48 *Computer Simulation of Lignocellulosic Biomass*, **LOUKAS PETRIDIS** (Oak Ridge National Laboratory, 1 Bethel Valley Rd, Oak Ridge TN 37919; petridisl@ornl.gov).

The temperature-dependent structure and dynamics of individual softwood lignin polymers in aqueous solution have been examined using extensive molecular dynamics simulations. With decreasing temperature the lignins are found to transition from mobile, extended to glassy, compact states. The low-temperature collapse is thermodynamically driven by the increase of the translational entropy and density fluctuations of water molecules removed from the hydration shell, thus distinguishing lignin collapse from enthalpically driven coil-globule polymer transitions and providing a thermodynamic role of hydration water density fluctuations in driving hydrophobic polymer collapse. Lignin also forms aggregates in vivo and poses a barrier to cellulosic ethanol production. Neutron scattering experiments and molecular dynamics simulations reveal that lignin aggregates are characterized by a surface fractal dimension that is invariant under change of scale from 1-1000Å . The simulations also reveal extensive water penetration of the aggregates and heterogeneous chain dynamics corresponding to a rigid core with a fluid surface. Finally, the interaction of lignin with cellulose is examined and differential binding to crystalline and amorphous cellulose explained thermodynamically.

49 *Identification of Conserved Binding Motifs for Cellulase Enzymes and the Creation of a Novel Approach to Identifying the Enzymatic Mode of Action*, **SAMBASIVARAO V SOMISETTI** (1613 Illinois Street, Golden, CO 80401; somissv@tigermail.auburn.edu).

Docking calculations have been conducted between 30+ cellulase enzymes and cellobiose to determine the various binding motifs and to create a model capable of predicting the enzymatic mode of action (i.e., endo-, exo-, or mixed endo-/exo-). It is found that the binding motifs between cellobiose and cellulase enzymes are highly conserved across species and between endocellulase and cellobiohydrolase (exocellulase CBHI and CBHII) enzymes. The various binding pose distributions have been classified into two dominant structural features, a single maximum pyramidal distribution that is indicative of cellobiohydrolase enzymes and a bimodal distribution indicative of endocellulase enzymes. The observed binding patterns are found to depend on a specific number of critical enzyme-substrate interactions that are highly conserved across species. Utilizing a coarse grained technique to systematically and unambiguously interpret the docking results has resulted in the ability to identify/predict the enzyme mode of action based on the cellobiose-cellulase binding poses. To gain further insights into the structural requirements that determine the enzymatic mode of action, a pattern recognition relationship (PRR) has been studied. The PRR correlation for exo-cellulases resulted in an r^2 value of 0.96 showing good predictive performance with an adjusted r^2 value of 0.81. The identified conserved docking poses and the correlation of a PRR provide valuable insights into the structure function relationship in cellulase enzymes while also serving as a predictive tool for the implementation of structure-based intelligent design of endo- and exocellulase enzymes.

50 *Biomass to Biofuels: Computer Modeling of Cellulose and Cellulases*, **MICHAEL F CROWLEY[1], GREGG T BECKHAM[2,3], LINTAO BU[2], and JAMES F MATTHEWS[1]** ([1]Biosciences Center, National Renewable Energy Laboratory, 15013 Denver West Parkway, Golden, CO; [2]National Bioenergy Center, National Renewable Energy Laboratory, 15013 Denver West Parkway, Golden, CO; [3]Department of Chemical Engineering, Colorado School of Mines, Golden, CO; michael.crowley@nrel.gov).

One of the important contributions to solving the world's energy needs for the future will come from the sustainable use of biomass to produce fuels. These renewable fuels are immediately essential as fungible replacements for liquid transportation fuels but there is still much work that can be done to improve the economic viability of the industrial implementation. We will present our efforts to improve enzymatic conversion of cellulosic biomass to sugars, which can be easily converted to liquid fuels such as ethanol in the present and more advanced, higher energy dense fuels in the future. We present the computational modeling and analysis of cellulose structure and thermodynamics, cellulase structure and function, and cellulosome assembly and interaction with biomass in the form of plant cell walls. We use molecular dynamics simulations to extract the dynamical and thermodynamic properties of cellulose in multiple shapes and crystalline forms and its response to temperature changes that occur in biomass pretreatment. We show the dependence of the twisting behavior of cellulose on fiber diameter and explain the origin of the twist. We use thermodynamic sampling methods to determine the free energy of decrystallization, enzyme binding affinities, and product expulsion energies of both native and mutated cellulases. Our computer simulations inform the molecular biologists of possible improvements that can be made to enzymes and biomass for cheaper biofuels.

Water Resource Management in the Arid West: Historical Perspectives and Emerging Issues

Tuesday, 9:00 a.m. in PAYETTE RIVER

51 *An Evaluation of Water Transactions for Environmental Benefits in the Pacific Northwest*, **KELLY WENDLAND[1]* and SHANNA KNIGHT[2]** ([1]Department of Conservation Social Sciences, University of Idaho, Moscow, ID 83844-1139; [2]Department of Law, University of Idaho, Moscow, ID 83844-2321; kwendland@uidaho.edu).

The Columbia Basin Water Transactions Program (CBWTP) was established in 2003 to support federal and state agencies in the Pacific Northwest at increasing instream flows for fish listed as threatened or endangered under the Endangered Species Act. Operating in Oregon, Washington, Idaho and Montana, the CBWTP works with seven *qualified local entities* (QLEs) that negotiate water leases and purchases with farmers and ranchers. To date, the CBWTP has funded over 300 water transactions for instream flows; however, there is wide variation in the number of transactions across states and QLE. Using an online database on these transactions and interviews with key informants in the QLEs, we analyze how the number of transactions and price paid per acre-feet of water varies according to political, economic, social, and ecological factors in the PNW. We use these results to interpret how institutional and socioeconomic factors influence the implementation of market-based mechanisms for environmental benefits and the impact of transaction costs on program success.

52 *Fixed Yet Variable: The Effects of Water Rights Institutions on Agricultural Land Use in the Arid West*, **SCOTT LOWE and WENCHAO XU*** (Department of Economics, Boise State University, Boise, ID 83725-1620; wenchaoxu@boisestate.edu).

Conclusions regarding the impacts of climate change on agriculture are incomplete if the effects of water institutions are not fully considered. As western agriculture is extensively reliant on irrigation water, it is also profoundly influenced by the institutional structures, appropriations and the administration of water rights. Water institutions, mutually interacting with other environmental and socioeconomic factors, could create interregional differences in water supply capacities and advantages in water use. Pragmatically measured by the vintage of the water right, water-use advantages will determine both the short- and long-run water capacity, and subsequently the farmer's land use decisions. This research provides a better understanding of the institutional effects of water rights on the agricultural landscape. Our empirical analysis utilizes a unique farm-level panel dataset for the entire State, combining key geospatial data such as cropping patterns, water rights, water supply capacities, climate and soil quality. Our findings indicate that the impacts of water right vintage on the farmland value are strong but that they vary across space, clear evidence of interregional advantages in water use. These results also suggest that farmers respond to climate volatility by adjusting both crop water use and output value, and that the motivation to adapt is even more pronounced for water appropriators who demonstrate heightened sensitivities to water shortage with comparatively "localized" disadvantage in water use.

53 *Enhancing Economic Effectiveness of Water Use within Prior Appropriations Doctrine in the Western United States*, **LEVAN ELBAKIDZE and HANNAH VINSON*** (Department of Agricultural Economics and Rural Sociology, University of Idaho, Moscow, ID 83844-2334; hannah.d.vinson@gmail.com).

Water resource management in the Western US has relied on Prior Appropriations Doctrine where older water rights take precedence over junior water rights during water shortages. Prior Appropriations can coincide with most effective use of water in agricultural production in terms of land productivity if most senior water rights are attached to most productive lands. However, if water rights are not distributed so that the most senior water user also has the most productive land, then in the absence of possibility to redistribute water use, economic efficiency may not be achieved in terms of maximizing total economic rent derived from water use for irrigation. This inefficiency becomes more important as water becomes scarcer, as is anticipated under many scenarios of climate change.

Past studies have pointed out that hydrologic externalities are one of the major obstacles for implementation of water markets in agricultural contexts. The purpose of this presentation is to discuss the framework for modeling redistribution of water use within Prior Appropriations system in the Eastern Snake River Plain Aquifer (ESRPA) explicitly taking into account hydrologic externalities associated with such transactions. This presentation will include maps of the ESRPA, including soil type, irrigation technology, irrigation water source, agricultural activity, and figures of hydrologic response functions for incorporating hydrologic externalities. Information about the necessary data and the features of the area will be presented. Furthermore, integration of hydrologic and economic components needed for evaluating redistribution of water use will be discussed.

54 *Calculator: Optimized Surface Water Allocation in Drought (OSWAD)*, **DAVID J HOEKEMA* and JAE RYU** (Department of Biological and Agricultural Engineering, University of Idaho, 322 E. Front Street, Boise, ID 83702; hoek8591@vandals.uidaho.edu).

In the Snake River Plain, current water resource allocation planning models do not consider how agricultural economics impacts water demand. The OSWAD calculator, presented here, illustrates how the price of commodities can impact water demand.

The calculator developed to help individuals in the Salmon Tract optimize the crop mix and amount of acreage that should be planted in a given year based on water supply forecasts and commodity prices. On April 11th this calculator was presented to irrigators on the tract, where it generated significant interest.

The Salmon Tract relies on the highly variable and heavily over-allocated water supply of Salmon Falls Creek. Water is delivered to the Salmon Tract from the Salmon Falls Reservoir, formed by construction of Salmon Falls Dam (1908-1911). The dam and canal system used to divert water to the tract are owned and operated by the Salmon River Canal Company in Hollister, ID. In estimating yield risk and profit implications of drought, the OSWAD calculator estimates water supply available considering system wide impacts on water allocation including reservoir storage, forecasted stream flow exceedance probabilities, the variability of crop water demand, and system delivery losses. The model also includes farm scale factors such as number and size of available fields, carryover storage, number of shares, and supplemental groundwater available, production costs and expected price of commodities.

The algorithms in the model will be applied in the future to a water planning model used to determine the economic advantages of further water conservation within the Tract.

55 *The Political Economy of Major Water Infrastructure Investments in the Western United States and the Impact on Agriculture: An Historical Analysis*, **ZEYNEP K HANSEN[1], GARY D LIBECAP[2], and SCOTT E LOWE[1]*** ([1]Department of Economics, Boise State University, Boise, ID 83702-1620; [2]Bren School of Environmental Science and Management, University of California, Santa Barbara, Santa Barbara, CA 93106-5131; scottlowe@boisestate.edu).

Greater historical perspective is needed to enlighten current debate about future human responses to higher temperatures and increased variation in precipitation. Our goal is to identify the major players in the water infrastructure projects and analyze the site location decision and the factors (political, economic, and geographic) that influence the location decisions. We assembled data on dams and other major water infrastructure and congressional committee memberships (committees for water resources, agriculture and appropriations). Using this state-level data set, we examine the importance of political influence in dam construction. Specifically, we are interested in the long-run impact of Congressional influence on the location of major water infrastructure projects. Our preliminary results indicate that congressional committee session-seat representation generally has a positive and significant impact on the number of dams constructed in a state during a Democratic majority, and a negative impact during a Republican majority.

Modeling, Simulation, and Data Visualization

Tuesday, 1:00 p.m. in DOUGLAS FIR 1 & 2

56 *Modeling Spatiotemporal Dynamics in Viral and Bacterial Systems with Discrete Models*, **SUZY VASA, JAMESON MILLER, and MORGAN C GIDDINGS*** (College of Arts and Sciences, Boise State University, Boise ID 83752; [2]Department of Microbiology and Immunology, University of North Carolina, Chapel Hill, Chapel Hill, NC 27599; morgan@giddingslab.org).

Integrating across various molecular and phenotypic data types to obtain biological meaning is difficult when "omics" data are produced in terabyte per day quantities. Computer models hold promise for data integration, and come in a variety of types - from network models that show protein interactions to flux models that show dynamical changes in the cell. Yet static network-interaction models yield little insight into temporal interactions, and bulk or flux models cannot readily provide insight into the details of patterned spatial interactions. An example is RNA transcription, often controlled by complex spatial interactions between small numbers of transcription factors and their cofactors arrayed at discrete positions on the DNA. These can't be readily mapped to tractable bulk models.

To address these challenges, we apply discrete modeling with agent-based tools to examine behaviors and interactions in three distinct microbiological systems. We model bacterial signal transduction, chemotaxis in *E. coli* to understand how receptor interactions lead to signal gain*;* we develop a multi-scale (molecular and cellular) model of bacterium *B. subtilis* to understand the switch between distinct phenotype states via a bistable switch when food becomes scarce; and, we model assembly of the BK Virus in the nucleus of a host cell, including transcription and translational processes, entry and exit of key molecules via the nuclear barrier, and spatial assembly of the virion. I discuss the strengths and limitations of the models, and the prospects for future use in making sense of the influx of "omics" data now available.

57 *A New Bioinformatics of Shape for Regenerative Science*, **DANIEL LOBO* and MICHAEL LEVIN** (Center for Regenerative and Developmental Biology, and Department of Biology, Tufts University, Medford, MA 02155; daniel.lobo@tufts.edu).

Molecular biologists are producing a very large body of experimental data in the hopes of deciphering the mechanisms underlying the regenerative abilities of organisms such as the planarian worm, which can regenerate a complete body (including a new head, brain, eyes, etc.) after almost any kind of injury or amputation. However, no comprehensive mechanistic models exist that can account for more than one or two characteristics of planarian regeneration. Indeed, the difficulty of formulating testable models of pattern

regulation consistent with all known results increases with the continuous addition of new data. Fundamentally, a major disconnect exists between functional genetic data on mechanisms required for regeneration and constructive models that explain the control of complex 3-dimensional shape. Transformative insight and practical control of pattern formation for biomedical applications are held back by the lack of both comprehensive representations and central repositories of morphological experimental data.

In this talk, I will present a novel Bioinformatics of Shape based on a mathematical formalization of biological morphologies, manipulations, and experiments. This formalization has allowed us to produce a centralized database of planarian regeneration, storing unambiguously more than 800 experiments published in the literature. To facilitate the input and mining of knowledge from the database, we have created a user-friendly software tool named Planform (Planarian formalization), which is freely available on the web. This approach will assist and accelerate the finding of comprehensive regenerative and patterning models by the research community. Crucially, this formalized dataset of experiments will make possible the application of artificial intelligence tools to foster the discovery of testable, mechanistic models of regeneration to help us to understand the key properties of pattern formation during regeneration.

58 *Automating Discovery of Agent-based Models of Complex Pattern Formation – Development to Regeneration*, **JEFF HABIG[1]* and TIM ANDERSEN[2]** (Departments of [1]Chemistry and Biochemistry and [2]Computer Science, Boise State University, Boise, ID 83715; jeffreyhabig@boisestate.edu).

How do living structures, at many levels of scale and organization, reliably self-assemble into the precise and incredibly complex forms found in nature? This question is of fundamental importance to understanding biological development and regeneration. Living things start life as a single cell, then reliably self-assemble into a myriad complex forms through an orchestrated process integrating many cellular properties - growth, division, death, metabolism, and communication. Multicellular organisms exhibit uncanny regularity and reliability during embryogenesis and development despite variations in external conditions, disturbances, or damage. Similarly, some creatures, such as planarian flatworms, are able to faithfully regenerate large parts of their body in response to many types of minor or major perturbations. Thus, living systems constantly monitor their shape for deviations and often can initiate processes to correct the damage and thus restore their "target morphology".

A descriptive model of the regenerative properties of planaria has eluded scientists for centuries, and has not been informed by the expanding array of genetic and biochemical data. We will present our progress in developing an automated discovery tool that combines cell-centric agent-based modeling, evolutionary search techniques, high performance computing, and the "Bioinformatics of Shape" database described in a separate talk (Lobo). Our aim is to use this system to identify plausible biologically-rooted models encompassing a vast array of experimental data to describe planaria regeneration and inform future experimentation. This work will serve as a proof of principle to study other emergent complex patterning systems in and out of the biological sciences.

59 *Systems Modeling of Retinoid Metabolism in Alcoholic Disease*, **JENNIFER R CHASE** (Department of Biology, Northwest Nazarene University, 623 S. University Blvd., Nampa, ID 83686; jrchase@nnu.edu).

While an estimated 1% of world disease burden is the result of consumption of alcohol, it is not clear by what molecular mechanism(s) ethanol's effects are mediated. It has been long hypothesized that ethanol interferes by competitive inhibition of vitamin A (retinol) oxidation by alcohol dehydrogenases (ADH). This mechanism could affect cancer, since this would alter the levels of transcription regulator retinoic acid (RA). Substantial differences in the animal enzymes relative to human and the presence of several human ADH isoforms make direct assessment of this hypothesis difficult. We have constructed both kinetic and structural models of the system to assess the probable effects of ethanol on retinoic acid metabolism in human tissues. A full kinetic model of 4 reactions was created in ScrumPy for each of the human ADH isoforms. Retinol oxidation rate as a function of ethanol and acetaldehyde was calculated at steady state for each. Structural models were created for overall retinoid metabolism in human in CellNetAnalyzer (in Matlab). The elementary modes were calculated, and subsets evaluated for the use of ADH and NAD(H) in the synthesis of RA. Retinol oxidation is strongly inhibited in most ADH isoforms (25-95%) by ethanol but not by acetaldehyde. Structural modeling revealed that only half of the elementary modes that make RA include ADH, leaving many alternate RA synthetic routes despite ethanol inhibition of ADH. The combination of kinetic and structural modeling helps reconcile *in vivo* observations and highlights the weaknesses of some explanations of the basis of alcoholic diseases.

60 *Inverse Modeling for Advanced Simulation*, **JODI MEAD** (Department of Mathematics, Boise State University, Boise, ID 83725; jmead@boisestated.edu).

Computational modeling in science and engineering is used to simulate complex systems that may not be directly observable or well understood. Important aspects of a simulation include computational efficiency, model identification, incorporation of uncertainty, and hypothesis testing. We will discuss numerical algorithms that incorporate direct measurements, prior information, uncertainty, and model hypotheses. The approach is a general framework that can be

viewed as writing the simulation process as an inverse problem. The inverse problem is "solved" using chi-squared tests to estimate unknown information about the model, quantify uncertainty and test model hypotheses. The resulting method identifies the behavior of the system in a computational efficient manner by reducing the number of simulations.

61 *Immersive Visualization: An Interactive Interface to Multivariate Data*, **ALARK JOSHI** (Department of Computer Science, Boise State University, Boise, ID 83725; alarkjoshi@boisestate.edu).

In this talk, I will describe our work on a novel immersive visualization environment called Remote Sensing Visualization Platform (RSVP). Remote sensing involves the acquisition of data in terms of images, point clouds and so on. One of the major challenges with remote sensing datasets is managing and understanding the massive amounts of data that is collected. In many instances, scientists acquire data for the same region using varied sensing devices. Remote sensing scientists would like to fuse and examine this data acquired from different sensing devices to further explore the region under investigation.

Immersive visualization has emerged as an ideal solution for three-dimensional exploration of multimodal remote sensing data. The ability to manipulate data interactively in true 3D (using stereo) with interfaces designed specifically for the immersive environment can significantly speed up the exploration process. We have developed a visualization platform (RSVP) that facilitates the fusion of multiple modalities of remote sensing data and allows a scientist to learn more about the data obtained from different sensing devices. It is currently being used in research labs at Idaho State University and at the Idaho National Labs.

62 *Volume Visualization and Statistical Analysis of Rotating and Sheared Homogeneous Turbulence*, **FRANK G JACOBITZ[1]*, KAI SCHNEIDER[2], WOUTER JT BOS[3], and MARIE FARGE[4]** ([1]Mechanical Engineering Program, University of San Diego, 5998 Alcalá Park, San Diego, CA 92110, USA, jacobitz@sandiego.edu; [2]M2P2-CNRS & CMI, Université de Provence, 39 rue Joliot-Curie, 13453 Marseille Cedex 13, France, kschneid@cmi.univ-mrs.fr; [3]LMFA-CNRS, Ecole Centrale de Lyon, Université de Lyon, 69134 Ecully Cedex, France, wouter.bos@ec-lyon.fr; [4]LMD-CNRS, Ecole Normale Supérieure, 24 rue Lhomond, 75231 Paris Cedex 5, France, farge@lmd.ens.fr).

The structure and dynamics of rotating and sheared homogeneous turbulence is investigated using direct numerical simulations. Turbulent shear flow without rotation, with moderate and with strong rotation, where the rotation axis is either parallel or anti-parallel to the mean flow vorticity is considered. For moderate rotation, an anti-parallel configuration increases the growth of the turbulent kinetic energy for a limited range of rotation ratios, while the parallel case reduces the growth as compared to the non-rotating case. For strong rotation, energy decay is observed and linear effects dominate. Flow visualizations show that the inclination angle of vortical structures depends on the rotation rate and orientation. The inclination angle is also related to the growth rate of the turbulent kinetic energy and the anisotropy properties of the flow.

63 *Massively Parallel Multiphysics Simulation of Complex Processes*, **DEREK GASTON** (Computational Frameworks Group Lead, Fuel Modeling and Simulation Department, Idaho National Laboratory, Idaho Falls, ID 83401; derek.gaston@inl.gov).

As computational technology advances, scientists are increasingly being asked to study complex tightly-coupled multi-scale nonlinear problems on a massive scale. MOOSE: Multiphysics Object Oriented Simulation Environment, a parallel computational framework targeted at the solution of such systems, is presented. As opposed to traditional data-flow oriented computational frameworks, MOOSE is founded on the mathematical principle of Jacobian-free Newton-Krylov (JFNK) methods. Utilizing the mathematical structure present in JFNK, physics expressions are modularized, allowing for rapid production of new simulation tools. In addition, systems are solved implicitly and fully coupled, employing physics based preconditioning, which provides flexibility in the presence of variance in time scales. Further, a hybrid parallel model employing both threading and MPI allows for efficient utilization of a wide range of computational hardware. A variety of applications including: nuclear fuel performance, groundwater migration and material microstructure evolution will be presented.

Transport Across Membranes
Tuesday, 1:30 p.m. in PAYETTE RIVER

64 *Atomic Force Microscopy: Potential Applications on the Study of Transmembrane Proteins*, **BYUNG KIM** (Department of Physics, Boise State University, 1910 University Drive, Boise, ID 83725; byungkim@boisestate.edu).

Transmembrane proteins are molecular structures spanning the bilayer lipid membrane of cells. Their presence assures the sophistication required by many vital functions: molecular transport, energy conversion, protein trafficking, communication, and signaling. To better understand their biological function as an integral part of the membrane, one should understand how they work. A special focus on the conformational changes accompanying the transition between one or more physiologically-relevant states will provide a valuable mechanistic insight on the transmembrane proteins' functionality. In this endeavor, a review of how Atomic Force Microscopy (AFM) can be applied for functional and structural

investigations of transmembrane proteins is provided. Furthermore, the recent technological progress in AFM techniques and sample preparation is presented in conjunction with the tremendous benefit for exploring in more detail the molecular mechanisms and the physical nature of relevant biological interactions.

65 *Multivalent Ions Control the Transport through Lysenin Channels*, **DANIEL FOLOGEA** (Department of Physics, Boise State University, 1910 University Drive, Boise, ID 83725; DanielFologea@boisestate.edu).

Lysenin, a 297 amino acid Pore-Forming Protein extracted from the earthworm *E. foetida*, inserts stable and large-conductance channels into natural and artificial lipid bilayers containing sphingomyelin. The macroscopic currents through lysenin channels strongly decrease in the presence of multivalent cations in a concentration dependent manner. The decrease in conductance is reversible, and removal of the multivalent ions by addition of chelators or precipitating agents restores the initial macroscopic conductance in most cases. Single-channel analysis reveals that multivalent ions induce conformational changes resulting in individual channel closing upon interaction with multivalent metal cations. While trivalent metals elicit channel closing in a single-step, divalent metals force the channel into a sub-conducting state characterized by a non-zero ionic current. Experiments performed with various cations carrying different charges and having different sizes indicates that charge density plays a crucial role in establishing the closing pathway, as opposed to charge alone. The inhibition in macroscopic conductance manifests for various multivalent metals, which indicates a tremendous potential for detecting the presence of such metals in water. Among divalent metals, Cu demonstrates the highest inhibition efficiency, and this feature is further explained by its ability to fully close the lysenin channels in two steps. Among trivalent metals, Cr yields a sigmoidal inhibition curve, suggesting cooperativity. The observed properties of lysenin channels may be further exploited for further development of high-sensitivity sensors, or controlled transport across bilayer membranes.

66 *Modulation of Ionic Transport through Lysenin Channels by Charged Nanoparticles*, **SHEENAH BRYANT*, DANIEL FOLOGEA, JORDAN CHESS, GORDON ALANKO, and ALEX PUNNOOSE** (Department of Physics, Boise State University, 1910 University Drive, Boise, ID 83725; sheenahbryant@u.boisestate.edu).

Nanosize particles possess exciting physical and chemical properties compared to their bulk counterpart, which make them ideal candidates for innovative applications ranging from engineering to health care. Their technological and economic impact might be restricted by potentially dangerous and unpredictable effects on living systems. While their cell specific cytotoxicity may be a useful tool in developing new clinical approaches for fighting against certain diseases, their potential impact on healthy cells needs to be understood. The present work focuses on understanding how nanoparticles interfere with the channels-mediated transport across biological membranes. Our studies comprised using Lysenin as a model biological channel inserted into artificial Bilayer Lipid Membranes, and assessing the impact of positively-charged ZnO nanoparticles on the macroscopic ionic transport through lysenin channels. Addition of nanoparticles to the bulk solution dramatically reduced the macroscopic ionic conductance of lysenin channels, demonstrating that such nanoparticles can affect cells' viability without internalization. Further experiments suggested an electrostatic interaction between lysenin channels and nanoparticles as responsible for the observed ionic transport inhibition. Such observations shed more light on the intricate interactions between nanomaterials and living systems, while opening new avenues for developing applications based on specific interactions between nanomaterials and components of the cell membrane.

67 *State Transitions in Sodium Channels: Role of the Voltage Sensing Module*, **JAMES GROOME and VERN WINSTON** (Department of Biology, Idaho State University, 650 Memorial Drive, Pocatello, ID 83209; groojame@isu.edu).

We have used mutagenesis and an *in silico* approach to investigate the voltage-gating functions of the mammalian skeletal muscle sodium channel hNaV1.4. Specifically, we have investigated the role of negatively charged residues that may regulate voltage-sensitive state transitions of this transmembrane protein. The voltage-sensing module S1-S4 (VSM) from the crystal structure of the bacterial sodium channel Na_VAb (3RVY.pdb) was used as the template for models of the VSM in each of four domains of $hNa_V1.4$. These models show that side chains of negative charges in S1, S2 and S3 segments are oriented towards positive charges of voltage sensing segment S4, supporting our hypothesis that electrostatic interactions of charge in the VSM dictate voltage sensing functions of the protein. We then characterized mutations of negative charges using electrophysiology, in a heterologous expression system. We show that negative charges in the extracellular region (site 1) are crucial for activated sodium channels to enter the fast-inactivated state. Negative charges in the intracellular region (site 2) have an important role in limiting the entry of channels into fast inactivation without opening. Negative charges in the hydrophobic constriction region (site 3) interact with both the S4 charge R3 and other VSM residues to regulate several aspects of channel function.

Science-Themed Fiction
Tuesday, 1:30 p.m. in SALMON RIVER

68 *Broken Webs in T. C. Boyle's Eco-novel When the Killing's Done*, **ROBERT LOUIS CHIANESE** (Emeritus, Department of English, California State University Northridge; present address: 2465 Hall Canyon Road, Ventura, CA; robert.chianese@csun.edu).

In *When the Killing's Done* (Viking Press/Penguin, 2011), T. C. Boyle sets two characters and points of view in violent opposition—biologist Alma Boyd Takesue and radical preservationist Dave LaJoy. She manages the government project to destroy invasive and introduced species on two of Southern California's Channel Islands. He fights to spare all creatures great and small from extermination. The conflict pits one form of environmental purity against another—only biologically-correct indigenous life versus any and all life.

Both forms of purity involve sacrifice and killing, and the webs of life on the islands suffer. Boyle presents these environmental realities with great ecological care. However, both scientific culling and rabid preservation fly beyond the control of either character or their environmental agendas, and we discover that the broken webs on the islands result from the broken social web of life in the lives of the characters past and present.

Nature becomes a clandestine third character with its own relentless agenda and exacts a mythic toll for interference of any sort. Restoring the islands to an edenic paradise evokes the archetypal drama of purity, violation, separation, and the unforeseen costs of attempted recovery. Boyle lets Genesis' injunction to "have dominion. . . over every living thing" serve as the book's ironic epigraph. Neither science nor modern animal rights can escape ancient mythic forces aroused by the human need to use, control, hence upset, the natural world. Our scientific attempts to fix the natural world must account for our own imperfect natures.

69 *Cosmology in Literature*, **JOHN WILLIAM (BILL) COPELAND** (bill@copelands.org).

The literature of each era reveals the scientific understanding, the cosmology of that era. It also reveals their hopes and fears.

I will briefly summarize the science underlying literature at different ages in history, citing specific examples. In early times gods and myth ruled our understanding. How far could we go? Was there a big cliff at the edge of world?

Stories explore solutions to perceived dangers, assume, and sometimes push against the established science of the time. Consider the gray region where literature gets ahead of science. Daedalus flies. Dr. Frankenstein re-animates a dead body with electricity. Jules Verne takes us on a trip to the Moon. What did the writers wish were true? Some stories could be regarded as thought experiments not unlike Einstein's thought experiments that explored relativity theory.

A whole generation has grown up in the Star Trek universe in which men fly all over the galaxy faster than light. Relativity and the Big Bang theory put a stop to that notion. Or do they?

What is the biggest risk of science? Steering their civilization off a cliff by getting caught in a theory that becomes dogma and ignores experience and observation. The Big Bang theory and Special Relativity define limits to our universe and future options. Are they the current dogma? What if the Solar System becomes untenable, and our science tells us we can't escape? I suggest an alternative theory is suppressed that opens up our future. A theory of cosmology that is supported by observation and the tests of Occam's Razor.

70 *George G. Simpson, Concession to the Ineluctable in His Sci-fi Novel, The Dechronization of Sam Magruder*, **LEO F LAPORTE** (Emeritus, University of California Santa Cruz; current address: 430 Nimitz Ave, Redwood City, CA; laporte@ucsc.edu).

In a posthumously published work of science fiction, *The Dechronization of Sam Magruder* (St. Martin's Press, 1996), the distinguished American paleontologist George G. Simpson (1902-1984) tells the story of Sam Magruder, a "chronologist" living in 2162 AD who was experimenting on the "quantum theory of time-motion" when he suffers a "time-slip" that puts him back into Late Cretaceous time in New Mexico. Helplessly lost and with no hope of returning to the present, Magruder ekes out a primitive existence for some years until a fatal accident befalls him. Before his lingering death Magruder manages to chisel out his experience and philosophy of life on eight rock slabs that are recovered many millions of years later, and so his story becomes known and discussed by several Everyman characters.

Simpson spins a reasonably engaging tale, but its main interest (for us) is the degree to which Magruder's philosophy of life may reflect Simpson's feelings toward the end of his own life. Always more comfortable in expressing his views in writing, Simpson appears to use his work of science fiction to reveal his own, mostly melancholy, views about life's meaning and purpose, the importance of adapting to the here-and-now, and how historical contingency controls subsequent outcomes. Is Simpson speaking for himself when Magruder declares, "My real purpose in engraving these slabs is a search for comprehension ….I am exploring my own nature."

71 *The Emergence of Consciousness in Neurobiologist Terrence Deacon and Novelist James Joyce*, **JESSE J THOMAS** (36012 Corte Pavia, Murrieta, CA 92562; Department of Religious Studies, San Diego State University, 5500 Campanile Drive, San Diego, CA 92182-6064; jthomas@mail.sdsu.edu or you1@verizon.net).

Scholars have pointed out parallels between the novels of James Joyce and contemporary physics, as in Joyce's

Chaosmos and chaos theory, but little attention has been paid to life sciences. This paper compares the neurobiologist/anthropologist Terrence Deacon's ideas concerning consciousness with James Joyce's novels. Deacon never mentions Joyce, but Joyce may have helped to set the cultural table for him.

Deacon's *Incomplete Nature: How Mind Emerged from Nature* (2012) describes progressive stages of what he calls the *ententional* (inherently incomplete) development of consciousness, progressing from emergence, constraints (organization as restriction), telodynamics (endless teleology), autogenesis (self-organization), self-identity, sentience (sensory and emotional feeling), and consciousness (including subjective consciousness, which he denies is a "hard" problem if understood ententionally).

Where do such ideas originate culturally? Consider Joyce's novels and his terminology, especially in *Ulysses* (1934); *chaosmos* (potentially ordered reality), Joyce's 100 letter sound of thunder (origin of consciousness and eventually language), *anastomosis* (new connections for the old, as in puns), and "final causality of language" (meaning at endings, not beginnings), *metempsychosis* (progression from one order to another), epiphany (emotional awareness of transformation), and (the "real" meaning of) *yes*.

Consider Molly Bloom's soliloquy at the end of Joyce's *Ulysses* as a pre-figuring of both Terrence Deacon's book and perhaps even the "advancement" component of AAAS.

72 *The Tragic Commons: Population, Resources, and Freedom in Garrett Hardin and Jonathan Franzen*, **CARL A MAIDA** (Institute of the Environment and Sustainability, University of California, La Kretz Hall, Suite 300, Los Angeles, CA 90095-1496; cmaida@ucla.edu).

The "tragedy of the commons" connotes, in part, the undesirable effects of population pressure on certain shared resources, especially commons, which refer to farming and grazing land, hunting and fishing areas, and places for the disposal of wastes to which all members of a society have access. These "common pool resources," according to Garrett Hardin, were eventually abandoned, enclosed and restricted in the face of exploitation by individuals or groups attempting to maximize their own gain. In his *Science* article, citing open pasture as an example, Hardin (1968: 1244) concluded: "Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit—in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons." Writing in *Science* thirty years later, Hardin (1998: 683) reiterated his earlier message: "Individualism is cherished because it produces freedom, but the gift is conditional: The more the population exceeds the carrying capacity of the environment, the more freedoms must be given up." In the novel, *Freedom* (2010), Jonathan Franzen writes about overpopulation and its deleterious effects, including environmental degradation, energy over- consumption, eventual resource depletion, and their impact on human freedom. As the interrelationship of population, resources and freedom has a long history in American thought, this paper will end with a comparison of Hardin and Franzen's ideas to those of mid-nineteenth century *American Renaissance* writers.

Mechanisms of Tumor Progression and Cancer Therapeutics

Tuesday, 1:30 p.m. in SNAKE RIVER

73 *Breast Cancer Metastasis: A Role for the Inflammatory Cytokine Oncostatin M?* **CHERYL JORCYK** (Department of Biological Sciences, 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.

ACS RSG-09-276-01-CSM, Susan G Komen KG100513, NIH/NCRR P20RR016454 and P20GM103408, NIH/NCI R15CA137510, and NASA NNX10AN29A.

74 *A Brief History of Myeloma: How Bench Research has Transformed Treatments at the Bedside,* **PAUL MONTGOMERY** (St. Luke's Mountain States Tumor Institute, 100 E. Idaho, Boise, ID 83712; Montgomp@slhs.org).

Major genetic changes occur early in the neoplastic plasma cell. These genetic changes illuminate clinical behavior of plasma cells as they evolve from benign to malignant. Following a brief overview of the clinical manifestations of the plasmaproliferative disorders, treatments that have led to improved survival will be described. The explorations of mechanisms of treatment success and failure have been fruitful in finding new targets for control of myeloma cells. The examples of contemporary treatment with proteasome inhibitors and immunomodulatory drugs will be reviewed

as examples of treatments introduced from discoveries at the bench that led to clinical success. Conversely, lessons learned in the clinic can motivate a return to the bench with a focus for exploration of mechanisms of resistance. Recent advances in understanding of the clonal progression of these diseases will be outlined, with a focus on targets and techniques for disruption. Gene sequencing of myeloma cells has led to a variety of surprises, including identification of activating mutations in BRAF kinase in 4% of myeloma cases. Discoveries regarding how the bone marrow microenvironment contributes to selective survival advantage for myeloma cells will be highlighted, with review of the many opportunities for target discovery.

75 *Zinc Oxide Nanoparticle Toxicity Against Tumor Cells*, **JOHN RASMUSSEN** (Department of Biological Sciences, Boise State University, 1910 University Drive, Boise, ID 83725-1515; JohnRasmussen@boisestate.edu).

ZnO nanoparticles have a preferential ability to kill cancerous T cells at 20-30 times greater efficiency when compared to normal quiescent T cells of the same lineage. In an effort to improve the ZnO nanoparticle inherent toxicity in cancerous cell lines, ZnO nanoparticles were doped with increasing amounts of iron ions and subjected to toxicological experimentation. ZnO nanoparticles doped with 2.5-7.5% iron demonstrated the greatest amount of toxicity in cancerous T cells. In addition, iron doped ZnO nanoparticle toxicity was measured by generation of reactive oxygen species. Furthermore, treatment of cells with a chemical that quenches reactive oxygen species products demonstrates the central role of reactive oxygen species in nanoparticle toxicity.

76 *Stromal Signaling in the Pathogenesis of Breast Cancer*, **MINOTI HIREMATH[1]*, LAURA BOND[1], and JOHN J WYSOLMERSKI[2]** ([1]Department of Biological Sciences, Boise State University, 1910 University Drive, MS1515, Boise, ID 83725; [2]Department of Internal Medicine, Section of Endocrinology, Yale University, TAC S131, P.O. Box 208020, New Haven CT 06520; minotihiremath@boisestate.edu, lbond@boisestate.edu and john.wysolmerski@yale.edu).

Breast cancer is considered a disease of epithelial cells. However, numerous studies have demonstrated that the stromal environment of breast cancer promotes tumor formation, invasion, progression and metastasis. Wnts are secreted long-range morphogens that are known to play a role in the morphogenesis of various tissues including the mammary gland. Wnts were first discovered as oncogenes that caused breast cancer. However, there is a relative paucity of mutations of the Wnt pathway in breast cancer patients. We posit that this is because the majority of breast cancer studies focus on the epithelium and not the tumor stroma. We hypothesize that activation or overexpression of Wnt signaling components in the mammary stroma promotes breast cancer formation. We demonstrate this by mining existing microarray data that compares gene expression in breast cancer stroma to normal stroma. Parathyroid Hormone Related Protein (PTHrP) regulates Wnt signaling in the stroma of the embryonic mammary gland. We demonstrate that PTHrP-receptor is highly expressed in the breast cancer stroma along with its downstream Wnt target genes. Indeed, PTHrP-regulated embryonic stromal genes are significantly overexpressed in breast cancer stroma. Our studies demonstrate connections between embryonic and cancer stroma and suggest that reactivation of developmental pathways occurs during the tumorigenic process.

77 *The Role of Autophagy in the Development and Treatment of Colon Cancer*, **TOM DONNDELINGER* and JOELLA SKYLES** (Department of Pathology, St. Alphonsus Hospital, 1512 12th Ave Rd, Nampa, ID 83686; tdonndel@bibiomics.com).

After implementation of updates to the 120-year-old biopsy process, newly achieved tissue detail revealed a complex system of cell recycling in the intestinal crypts of the colon. This autophagic system involves the migration of cells up the side of the crypt and, rather than being shed, they enter autophagocytosis. After entering autophagocytosis, an autophagic vacuole forms in the cell after which it migrates through a pore in the basement membrane where the vacuole can then be enveloped and digested by the macrophage. A healthy colon is able to dissemble aged cells into amino acids, peptides, and other materials to be recycled for use in other cells.

When a signaling error occurs which prevents the migration of cells through the basement membrane during autophagy, the cell cannot be effectively recycled but instead remains at the top of the intestinal crypts where it then continues the autophagic system. The resumption of autophagy causes replication of a dysfunctional cell and the development of an adenomatous polyp with pre-cancerous features such as an enlarged nucleus. Ultimately, it is the disruption in the cycle of autophagy that acts as the first step in the development in colon cancer.

By understanding the role autophagy plays in early stage colon cancer, new treatment alternatives emerge that involve the manipulation of this autophagic system. Clinical trials could then focus on drugs, such as chloroquine, designed to silence the autophagic signaling in dysfunctional cells in effort to halt the persistence of select abnormal cells.

78 *Inter-omic Analysis of Breast Cancers to Uncover How Genomic Aberrants Lead to Cancer Phenotypes*, **MORGAN C GIDDINGS*, BRIAN RISK, JOHN WROBEL, and JAINAB KHATUN** (School of Arts and Sciences, Boise State University, Boise, ID 83752; morgangiddings@boisestate.edu).

For each major cancer type, there are myriad sub-types that can be classified by a growing variety of methods, including microarrays, RNAseq, protein microarrays, and

detection of genomic aberrants. Yet, despite the ability to pinpoint cancer phenotypes that correlate with disease and treatment outcomes, we are not much closer to determining how and why particular "omics" expression patterns lead to disease. Recently, significant evidence has shown that genomic aberrants such as copy number alterations, deletions, and single nucleotide variants are associated with cancers. For example, a set of deletions and gene amplifications on Chromosome 8 are associated with differentiation between the basal and luminal breast cancers. These cancer types have widely different treatment outcomes and survival prognoses, and show significantly different expression patterns at the transcriptome and proteome level. Determining the mechanisms by which these aberrations lead to cancers is a key goal for both diagnosis and improved treatment. Yet integration of knowledge across levels, from genome to transcriptome to proteome to phenotype is extraordinarily challenging.

We describe an effort to unify "omics" data sets from human in mouse breast tumor models, and from TCGA samples now being analyzed via large scale proteomic methods within the CPTAC consortium headed by the NCI. We show how data can be unified and analyzed within a genome browser view to yield new insights about the relationship between cancer genomes, proteomes, and their resultant phenotypes. We illustrate with examples of previously unknown genes that appear involved in specific cancer phenotypes.

79 *Oncostatin M Interacts with ECM Components: Implications for Chronic Inflammation and Tumor Metastasis*, **RANDALL RYAN*, BRYAN MARTIN, LILIANA MELLOR, OWEN McDOUGAL, REED JACOB, CHERYL JORCYK, and JULIA OXFORD** (Department of Biological Sciences, Department of Chemistry and Biochemistry, Biomolecular Research Center, Boise State University, Boise Idaho, 83725 USA; randyryan7@hotmail.com).

Oncostatin M (OSM) is a proinflammatory cytokine that has been reported to promote a metastatic phenotype in cancer cells via its effects on cell migration, invasion and the EMT. The ECM has been reported to regulate the properties and activities of numerous cytokines and growth factors, as well as the behavior and properties of tumor cells. In the current study, OSM was observed to bind to ECM components, in vitro, in a pH dependent fashion. OSM bound to ECM was observed to be protected from cleavage by tumor associated proteases, when compared to unbound OSM. In addition, OSM bound to ECM was demonstrated to induce OSM signaling and target proteins in breast carcinoma cells that could be inhibited with an OSM neutralizing antibody. The data suggests that OSM bound to ECM may play an important role in the acquisition of chronic inflammation and provides additional evidence for the role of inflammatory processes in cancer.

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Emerging and Re-Emerging Infectious Diseases

Wednesday, 8:00 a.m. in DOUGLAS FIR 1 & 2

80 *Toxin Production by Methicillin Resistant Strains of* Staphylococcus aureus *(MRSA): The Effect of Antibiotics*, **DENNIS L STEVENS[1,2]*, AMY E BRYANT[1,2,3], STEPHANIE HAMILTON[1,3] and YONGSHENG MA[1]** ([1]Department of Veterans Affairs Medical Center, 500 West Fort Street, Boise, Idaho 83702; [2]University of Washington School of Medicine, 1959 NE Pacific St, Seattle WA 98195; [3]University of Idaho, Department of Life Sciences, PO Box 443051, Moscow, ID 83844-305; dlsteven@mindspring.com).

The emergence of MRSA has been associated with a variety of new types of infections which have been associated with the production of potent exotoxins. Specifically, the Panton-Valentine Leukotoxins (PVL), alpha hemolysin and staphylococcal toxic shock toxin-1 (TSST-1). Early in the course of the MRSA epidemic it was noted that 50% of patients with MRSA infections were being treated with antibiotics to which the organism was resistant. This was further associated with worse outcomes, prolonged hospitalization and death. We hypothesized that inappropriate antibiotics might not only delay definitive treatment but be associated with enhanced toxin production. We first determined the susceptibility of these strains to nafcillin, vancomycin and linezolid and performed growth curves using a rising gradient of antibiotics. Further, we then measured gene expression for alpha toxin, PVL and TSST-1 at inhibitory and sub-inhibitory concentrations of antibiotics. Nafcillin induced markedly increased gene expression for PVL, TSST-1 and alpha hemolysin in MRSA despite intrinsic resistance to this agent. Further, sub-inhibitory concentrations of nafcillin marked increased gene expression of these toxins in methicillin susceptible strains of *S. aureus* (MSSA) as well. Though linezolid also enhanced toxin gene expression, toxin production at the protein level was curtailed. In summary, antibiotic choices markedly affect the virulence of *S. aureus*.

81 Yersinia pestis *Ompx Virulence Factor and Role in Host Cell Attachment, Internalization, and Immune Modulation*, **ANNA M KOLODZIEJEK[1]*, SCOTT A MINNICH[1], CAROLYN J HOVDE[1], and GREGORY A BOHACH[2]** ([1]School of Food Science, University of Idaho, 604 Rayburn Street, Moscow, Idaho 83844 -2311; [2]Division of Agriculture, Forestry and Veterinary Medicine, Box 9800, Mississippi State University, Starkville, Mississippi 39762; akolodziejek@vandals.uidaho.edu).

Yersinia pestis is the causative agent of plague. Multiple virulence determinants contribute to its highly efficient transmission and pathogenicity. Representatives of a large *Enterobacteriaceae* Ail/Lom family of outer membrane proteins (Omp) are found in the genomes of all pathogenic

Yersiniae. They promote adherence and internalization to epithelial cells, resistance to complement, and survival in macrophages. Even though well studied in enteric *Yersiniae*, their role in *Y. pestis* pathogenesis is unknown. To investigate the role of *Y. pestis* OmpX protein, an Ail homologue, we generated site-directed mutations in *ompX* and tested them for loss of any of these phenotypes. Our results demonstrated that OmpX was required for adherence and internalization to epithelial cells, and serum resistance. Infection studies revealed that loss of OmpX delayed the time-to-death in the mouse infection model of pneumonic plague. Because murine serum was not bactericidal for the *ompX* mutant, the mechanism underlying the delay in time-to-death in mice may be attributed to loss of adhesion/internalization properties, but not serum resistance. When OmpX virulence was assessed in the rat model complete attenuation of virulence was observed. This highlighted the critical role of serum resistance in primary pneumonic plague and showed its relevance for human disease. Additionally, our results showed that OmpX-mediated serum resistance, adhesiveness, and invasiveness were dependent on LPS core length, but recombinant OmpX displayed these functions in *E. coli*, independently of other *Yersinia* proteins and/or LPS. Overall, our data present an important contribution to understanding mechanisms of *Y. pestis* pathogenesis and their significance to human species.

82 *Construction and Characterization of Non-toxic Bacterial Enterotoxins as Vaccine Adjuvants*, **LAVANYA VEMPATI* and JULIETTE TINKER** (Department of Biological Sciences, Boise State University, Science/Nursing Building, Room 107, Boise, ID 82375; lavanyavempati@gmail.com).

The development of adjuvants that can promote the delivery of purified subunit vaccines by mucosal routes, such as the nose or the mouth, is recognized as a top priority for vaccine research. The bacterial enterotoxins; cholera toxin (CT) and *E.coli* heat-labile toxin (LTI), have long been recognized as powerful adjuvants with the ability to stimulate specific immune responses to co-administered antigens when delivered to mucosal surfaces. Shiga toxin 1 (ST1) and pertussis toxin (PT) are structurally homologous bacterial toxins secreted by *Escherichia coli* 0157:H7 and *Bordetella pertussis* respectively. ST1 and PT also have reported adjuvant activity. The receptor-binding affinity and protein stability of these AB5-type toxins appear to be the basis for their unique immunomodulatory properties. However, the toxicity of these molecules is a limiting factor for use as adjuvants in human vaccines. The non-toxic B subunit of CT, as well as chimeric A_2B molecules, have shown much promise as novel mucosal vaccine candidates. A_2B chimeras of CT retain the capacity to introduce antigens into host cells and modulate the immune response, and toxic domains are replaced with a vaccine antigen of interest. We have produced ST1 A_2B chimeras containing the *Yersinia pestis* bacterial antigen, LcrV and characterized antigen uptake *in vitro* by confocal microscopy. In addition, we have compared the ability of PTB, ST1B and CTB to stimulate cytokine production, dendritic cell proliferation and antigen uptake *in vitro*. These studies will contribute to the development of these toxins as novel mucosal adjuvants.

83 *Norovirus Genotype Dynamics Among Outbreak Associated Strains in Alaska, Idaho, Montana, and Wyoming 2010-2012*, **AMANDA J BRUESCH and CHRISTOPHER L BALL*** (Idaho Bureau of Laboratories, 2220 Old Penitentiary Road, Boise, ID 83712; ballc1@dhw.idaho.gov).

Noroviruses are thought to cause >90% of viral gastroenteritis outbreaks worldwide. Noroviruses are one of four genera in the *Caliciviridae.* They are categorized into five genogroups, GI – GV. Strains from genogroups GI, GII, and GIV are associated with human disease, with GII causing most outbreaks. Norovirus genogroup II is subdivided into 17 genotypes. The Idaho Bureau of Laboratories provides Norovirus genotyping for Idaho, Alaska, Montana, and Wyoming outbreaks as part of the CDC's national Norovirus subtyping network, CaliciNet USA.

In 2010, regional Norovirus diversity was low (Simpsons D=0.28; S=5) with 84% of confirmed outbreaks attributed to Norovirus GII.4_NewOrleans. In 2011, genotypic diversity increased (D=0.76; S=7) and genotype GII.1 (32%) replaced GII.4_NewOrleans (26%) as the most abundant outbreak genotype. Norovirus evolution is driven by antigenic drift associated with the development of herd immunity. This data may suggest a shift in the infectivity of norovirus GII.4_NewOrleans and the emergence of a new epidemic strain in the Pacific Northwest.

84 Campylobacter jejuni *Exploits Host Cell Processes to Enhance Disease*, **MICHAEL E KONKEL** (Washington State University, School of Molecular Biosciences, Life Sciences Bldg, Room 302c, Pullman, WA 99164-7520; konkel@vetmed.wsu.edu).

Campylobacter species are one of the most common culture-proven causes of human gastrointestinal disease worldwide, accounting for 400 – 500 million cases of diarrhea each year. Acute illness is specifically associated with *C. jejuni* invasion of intestinal epithelial cells. Accompanying *C. jejuni* invasion of the intestinal epithelium is an intense inflammatory response characterized by the secretion of interleukin-8 (IL-8) from the epithelial cells. Previous work has shown that maximal invasion of host cells by *C. jejuni* is dependent on synthesis and secretion of proteins termed the *Campylobacter* invasion antigens (Cia). We hypothesized that *C. jejuni* promotes the activation of intestinal cell signaling cascades, leading to host cell actin cytoskeletal rearrangements and the secretion of IL-8. To test this hypothesis, we infected epithelial cells with a *C. jejuni* wild-type strain

in the presence of numerous inhibitors that target host cell signaling proteins. We then measured the number of host cell-internalized bacteria and levels of IL-8 secreted into the supernatants.

We found that many of the host cell proteins required for *C. jejuni* internalization and the IL-8 inflammatory response are the same (*i.e.*, EGFR, FAK, Src, PI 3-kinase). We also identified a *C. jejuni* secreted protein, which we termed CiaD, that activates the mitogen-activated protein kinase (Erk 1/2) pathway necessary for the secretion of IL-8 from epithelial cells. These findings are consistent with the proposal that the *C. jejuni* Cia proteins promote intracellular signaling leading to bacterial uptake and the release of the pro-inflammatory cytokine IL-8.

85 *Effects of Selective and Non-selective NSAIDs on Initiation, Progression and Antibiotic Efficacy of Experimental Group A Streptococcal Myonecrosis*, **STEPHANIE HAMILTON[1,2]*, CLIFFORD R BAYER[1], DENNIS L STEVENS[1,3], and AMY E BRYANT[1,2,3]** ([1]U.S. Department of Veterans Affairs Medical Center, 500 West Fort Street, Boise, ID 83702; [2]University of Idaho, Department of Life Sciences, PO Box 443051, Moscow, ID 83844-305; [3]University of Washington School of Medicine, 1959 NE Pacific Street, Seattle WA 98195; hamilton.steph@yahoo.com).

Background: NSAIDs may worsen group A streptococcal (GAS) disease yet some advocate NSAIDs to treat bacterial infection. We examined the effects of selective and non-selective NSAIDs, alone and with antibiotics, on initiation of post-injury GAS muscle infection and on survival of mice with GAS myonecrosis. **Methods:** Wild-type or COX-$2^{-/-}$ mice underwent standardized hindlimb muscle injury. NSAIDs were given 47 hr post-injury and 1 hr prior to IV M-type 3 GAS. GAS in muscles, blood and spleen was quantitated 6 hrs later. In separate studies, mice were infected IM with LD_{100} GAS. NSAIDs and/or antibiotics (penicillin, clindamycin) were given every 8-12 h for 72 hr. Survival was followed for 14 d. **Results:** The non-selective NSAID significantly increased GAS infection of injured muscle in only wild-type mice. Pharmacologic inhibition, but not genetic deletion, of COX-2 reduced the systemic bacterial burden below the muscle infection threshold. In established myonecrosis, non-selective and COX-2-selective NSAIDs significantly accelerated the time to death and greatly reduced antibiotic efficacy. **Conclusions:** We conclude that use of certain NSAIDs, either alone or as adjuncts to traditional antibiotic therapy, for suspected or established GAS infection is not prudent and may, in fact, contribute to worse outcomes in severe GAS infection.

86 *Modeling HIV-1 Latency in Primary Central Memory Lymphocytes*, **LAURA MARTINS*, ALBERTO BOSQUE, MARYLINDA FAMIGLETTI, PETER RAMIREZ, CAMILLE NOVIS, and VICENTE PLANELLES** (Division of Microbiology and Immunology, Department of Pathology, University of Utah, 15N Medical Dr., Salt Lake City, UT, 84112; laura.martins@path.utah.edu).

Central memory CD4+ T lymphocytes (T_{CM}) harbor the majority of latent HIV-1 proviruses *in vivo*. We have developed a latency assay based on cultured T_{CM} cells to characterize biological processes important in the establishment and maintenance of HIV-1 latency. Using this model, we have characterized the effects of antigenic stimulation and homeostatic proliferation induced by cytokines on the latent reservoir. Antigenic stimulation through the TCR and the subsequent activation of the Lck/calcineurin/NFAT pathway reactivates virtually all latently infected cells, and successfully depletes the reservoir, but would result in cytokine storm if used in vivo. IL-2+IL-7 cytokine stimulation reactivates latently infected cells, albeit infefficiently, with concomitant expansion of the latent reservoir via homeostatic proliferation. Because both of these options are therapeutically untenable, we sought alternate approaches for reactivation of latent HIV-1.

We adapted our published HIV-1 latency model for high throughput screening of compounds with the ability to reactivate latent HIV-1. One such compound, denoted "C7", is capable of viral reactivation within 80% of latently infected cells, without global T cell activation. This result demonstrates the existence of alternative signaling pathways leading to activation of latent proviruses in primary cells. Key signaling elements controlling these pathways should be considered as novel therapeutic targets.

Recent Advances in Pharmacology and Toxicology

Wednesday, 8:30 a.m. in PAYETTE RIVER

87 *Inhibition of Growth of Cervical Cancer Cells by a Chymotrypsin-Like Protease Inhibitor*, **KIMBERLY J JURGENSEN*, KRISTIN A ECKERT, and GARY A CLAWSON** (Jake Gittlen Cancer Research Foundation, Pennsylvania State University College of Medicine, H059, 500 University Drive, Hershey, PA 17033; kim_jduncan@hotmail.com).

The chymotrypsin-like serine protease inhibitor, succinyl-alanine-alanine-proline-phenylalanine chloromethyl ketone ($AAPF_{CMK}$), has been shown to significantly inhibit the growth of tumorigenic human papillomavirus (HPV)-infected keratinocytes in organotypic raft cultures. We hypothesized that $AAPF_{CMK}$ treatment arrests the growth of the HPV-16 infected cervical cancer cell lines, SiHa and CaSki, by blocking the ability of the HPV-16 E6 and/or E7 oncoproteins from interacting with the tumor suppressor proteins, p53 and pRb, respectively. The effects of $AAPF_{CMK}$ treatment on cellular growth, cell cycle kinetics, DNA synthesis, and p53 and pRb expression levels were examined in

both cell lines. In SiHa cells, drug treatment induced a significant and rapid shutdown of cellular proliferation resulting from a global arrest of the cell cycle. CaSki cells also exhibited a significant decrease in cellular proliferation; however the cell population arrested at the G_1/S phase transition following treatment with $AAPF_{CMK}$. In both cell lines, the HPV-16 E7 oncoprotein and the targets, pRb and E2F1, showed no significant difference after treatment. In CaSki cells, p53 and p21 protein levels are significantly increased at 24 hours with a concomitant increase in p21 mRNA after $AAPF_{CMK}$ treatment. Although no difference in p53 and p21 protein levels was detected in SiHa cells after drug treatment, a significant increase in p21 mRNA was observed. Therefore, $AAPF_{CMK}$ treatment may potentially disrupt the ability of HPV-16 E6 to completely inhibit p53 activity. Despite the progress made by screening and vaccines, HPV infection remains a serious worldwide health problem that warrants research into additional treatment options.

88 *From Our Phones To Our Bones: Mechanisms of Cadmium-Induced Osteotoxicity*, **SARA J HEGGLAND (**Department of Biology, The College of Idaho, Caldwell, ID 83605; sheggland@collegeofidaho.edu).

Cadmium is a toxic metal that leaches into the environment, most notably through the improper disposal of electronics. Bone is a target site for cadmium toxicity. In humans, exposure to cadmium is linked to the development of osteoporosis. Our laboratory uses an osteoblast cell line model to study the direct effects of cadmium in bone-forming osteoblasts and on the extracellular matrix (ECM) these cells produce. Our research demonstrates cadmium exposure activates the ERK signaling pathway leading to osteoblast apoptosis. More recently, we expanded our osteoblast studies to clarify the impact of cadmium on the ECM. Osteoblasts secrete an ECM primarily comprised of a calcium-phosphate crystalline and a collagenous protein component. Our preliminary studies demonstrate that cadmium can be deposited in the ECM, which led us to hypothesize that cadmium exposure alters the nature of the ECM produced by osteoblasts. After inducing cells to mineralize, we assessed cadmium incorporation in the ECM and subsequent changes in calcium, phosphate, and collagen deposition. Using surface plasmon resonance and column chromatography we explored cadmium-collagen binding interactions. We found cadmium can bind collagen and with different affinity compared to calcium. We are currently studying whether cadmium alters collagen fibrillogenesis, which is the spontaneous formation of the fibrillar structure found in bone. Collectively, our work demonstrates that osteoblasts and the ECM they secrete are targets for cadmium toxicity, providing a mechanisms for how cadmium exposure may contribute to the pathogenesis of osteoporosis.

Research funded by NIH-INBRE P20RR016454 and P20 GM103408 and NIH R15ES015866 grants.

89 *Mechanism of Acrylonitrile Carcinogenesis in Rat Brain: The Potential Involvement of Oxidative Stress*, **XINZHU PU[1]*, ZEMIN WANG[2], SHAOYU ZHOU[2], LISA M KAMENDULIS[2], and JAMES E KLAUNIG[2]** ([1]Department of Biological Sciences, Boise State University, 1910 University Dr., Boise, ID 83725; [2]Department of Environmental Health, Indiana University, 1025 E. Seventh Street, Bloomington, IN 4740; shinpu@boisestate.edu).

Acrylonitrile is a heavily used chemical in the manufacturing of plastics, acrylic fibers, and synthetic rubber. Chronic exposure to acrylonitrile caused dose-related increases in brain astrocytoma in rats. The International Agency for Research on Cancer has ranked acrylonitrile as a probable human carcinogen. The mechanism of acrylonitrile carcinogenicity is not fully understood. The available data from both *in vivo* and *in vitro* genotoxicity tests, while largely negative, are mixed and inconclusive. Acrylonitrile is mainly metabolized via glutathione conjugation. Studies have demonstrated that acrylonitrile could deplete glutathione in the cell and thus may interrupt red-ox balance since glutathione is a major small-molecule antioxidant. Increased oxidative stress and oxidative damage have been linked with the induction of neoplasia by several non genotoxic chemical carcinogens. We hypothesized that acrylonitrile could cause oxidant stress and damage, which may be involved in mechanism of acrylonitrile carcinogenicity. The results of our studies showed that acrylonitrile caused persistent oxidative damage in nuclear and mitochondria DNA in rat astrocytes *in vitro*. It also caused oxidative DNA damage in the cortex of rat brain following *in vivo* exposure. In addition to stimulation of oxidative DNA damage, our studies also showed that acrylonitrile triggered the induction of the pro-inflammatory cytokines TNFα, IL-1β and CCL2, and the growth stimulatory cyclin D1 and cyclin D2 genes. In addition, antioxidant co-treatment effectively attenuated the oxidative stress induced by acrylonitrile. These results suggest the induction of oxidative stress and oxidative damage may be involved in the development of rat brain tumors induced by acrylonitrile.

90 *Modulation of Atrogin-1 and the Ubiquitin Proteasomal System by Anthracyclines in Left Ventricular Tissue in Rats*, **NICOLE FRANK[1,2]*, SUELA KUMBULLA[1], ADITI JAIN[1], JAMES C.K. LAI[1,2], RICHARD OLSON[1,2], BARRY CUSACK[1,2,3], and ALOK BHUSHAN[1,2]** ([1]Department of Biomedical and Pharmaceutical Sciences, College of Pharmacy and ISU Biomedical Institute, Idaho State University, Pocatello, ID 83209, USA; [2]Mountain States Tumor and Medical Research Institute, Boise, ID 83712, USA; [1]Research Service, Dept. Veterans Affairs Medical Center, Boise ID 83702; frannic2@pharmacy.isu.edu).

Anthracyclines are widely used to treat cancers, but may also cause a cumulative dose-related cardiotoxicity. One possible mechanism of cardiotoxicity relates to effects

on the cardiomyocyte proteasomal/ubiquitin system (UPS), the major protein recycling system in the cell. The goal of the research is to determine the impact of anthracyclines on the UPS. Fischer 344 rats were treated chronically with a clinically relevant dose of daunorubicin (DNR) or the vehicle (controls) over 4½ weeks. Another group received DNR pretreated with ICRF (dexrazoxane; a known protectant against anthracycline cardiotoxicity). The hearts were harvested one week later and analyzed. Isometric atrial preparations from rats treated with DNR showed decreased contractility compared to those pretreated with ICRF or with DNR vehicle only. Cardiac protein ubiquitination was decreased in DNR treated rats. The rate limiting step in ubiquitination is mediated by E-3 ligases. In western blot analysis of common E3 ligases in left ventricle samples from rats treated with DNR, Atrogin-1 showed a selective significant reduction ($P<0.05$) compared to animals pretreated with ICRF or DNR vehicle. This suggests that chronic anthracycline cardiotoxicity is accompanied by dysfunction of protein ubiquitination.

91 *The Role of Anti-mesothelial Cell Antibodies in Asbestos-Induced Pleural Disease*, **JEAN C PFAU* and KINTA SERVE** (Department of Biological Sciences, Idaho State University, Pocatello ID 83209; pfaujean@isu.edu).

Asbestos exposure has been linked to systemic autoimmune diseases, such as systemic lupus erythematosus, in addition to its known pathologies of fibrosis and cancer. Exposure to amphibole asbestos, such as that found as a contaminant of vermiculite mined in Libby MT for several decades, leads to a particularly aggressive and progressive form of pleural scarring. We have been studying the various autoantibodies that are induced in subjects exposed to asbestos, and have discovered a unique autoantibody that binds to mesothelial cells. These mesothelial cell autoantibodies (MesCAA) increase collagen deposition by mesothelial cells, which is inhibited by blocking a collagen-associated protein called SPARC. This discovery suggests that the rapid progression may be due to an autoimmune component and opens novel new pathways for potentially life-saving treatment.

92 *Assessment of Amphiphilic Quantum Dot Disposition in Two Human Liver Models*, **WESLEY E SMITH[1]*, JESSICA BROWNELL[3], COLLIN C WHITE[1], ZAHRA ASHFARINAJAD[1], JESSE TSAI[1], XIAOGE HU[2], STEVEN J POLYAK[3], XIAOHU GAO[2], TERRANCE J KAVANAGH[1] and DAVID L EATON[1]** (Departments of [1]Environmental and Occupational Health Sciences, [2]Bioengineering and [3]Global Health/Pathobiology, University of Washington, Seattle, WA 98195; wesmith@uw.edu).

The development of engineered nanoparticles (ENPs) for use in medical applications suggests the necessity for revisiting preclinical safety testing models. Quantum dots (Qdots) are a class of ENPs that hold promise for advancing cancer treatment. The core structure of semiconductor Qdots is composed of toxic heavy metals. Surface coatings have been employed to improve biocompatibility and mitigate toxicity. We have previously shown that CdSe Qdots coated with poly(maleic anhydride-alt-1-tetradecene), tri-n-octylphosphineoxide (PMAT-TOPO) protects against Cd-mediated toxicity, however, the disposition of these Qdots have not been fully characterized. We have tested the response in two culture systems, primary human liver cultures (PHL) and HepG2 cells utilized to represent the human liver. PHL and HepG2 cultures were treated with PMAT-TOPO Qdots over a range of doses (2.5-40nM) for 24 hrs. Gene expression changes from a number of candidate genes for cellular stress and pro-inflammatory signaling were measured in both cells lines. HepG2 cells show minimal response in gene expression changes with only MT1A (15-fold) being the only change. On the contrary, PHL cultures show a much more robust response with a 3-fold increase in HMOX, 15-fold increase in MT1A. Pro-inflammatory signaling genes also show a robust response with a 5-fold increase of CXCL8 and CCL3, and 20-fold increase in IL1B with only minimal changes in TNFα. These results illustrate that PMAT-TOPO coated Qdots elicit a pro-inflammatory response in PHL cultures but no response in HepG2 cells.

93 *Modulation of Hepatic Stellate Cell Activation by Ah Receptor Ligands*, **KRISTEN A MITCHELL (**Department of Biological Sciences, Boise State University, Boise ID 83725-1515; kristenmitchell@boisestate.edu).

The aryl hydrocarbon receptor (AhR) is a ligand-activated transcription factor and orphan receptor that regulates diverse physiological processes, including development, cell cycle progression, and immune system activation. Exposure to environmental AhR ligands, such as 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), elicits a spectrum of toxic endpoints, including carcinogenesis, immunosuppression, and hepatotoxicity, although mechanisms of toxicity remain poorly understood. We recently found that exposure to TCDD may activate hepatic stellate cells (HSCs) during liver regeneration. HSCs are non-parenchymal cells in the liver that contribute to inflammation, immune system activation, vitamin A homeostasis, and liver fibrosis. Using an immortalized human HSC line, we found that TCDD treatment enhances the production of inflammatory mediators and dysregulates vitamin A homeostasis. These findings suggest that HSC activation is directly modulated by exposure to AhR ligands such as TCDD. Given the diverse functions of HSCs, changes in this population of non-parenchymal cells may contribute to the hepatotoxicity observed in rodents exposed to TCDD and other AhR ligands.

Biophysical Insights from Experimental Approaches to Computational Simulations

Wednesday, 8:30 a.m. in WILLOWS 1 & 2

94 *Discovery of a Nanoscale Clamp for Protein and Chromatin Binding*, **RICCARDO BARON** (Department of Medicinal Chemistry, College of Pharmacy, The Henry Eyring Center for Theoretical Chemistry, University of Utah, 30 S 200 E Room 201, Salt Lake City, UT 84112; nidia.martinez@gmail.com).

LSD1 associated with its corepressor protein CoREST is an exceptionally relevant target for epigenetic drugs. Hypotheses for the role of LSD1/ CoREST as a multidocking site for chromatin and protein binding would require significant molecular flexibility, and LSD1/CoREST large-amplitude conformational dynamics is currently unknown. Our molecular dynamics simulations reveals that the LSD1/ CoREST complex in solution functions as a reversible nanoscale binding clamp. We show that the H3 histone tail binding pocket is an allosteric site for regulation of the rotation of SWIRM/ SANT2 domains around the Tower domain. Thus, targeting this site and including receptor flexibility are crucial strategies for future drug discovery.

95 *Deconstructing and Reconstructing a Protein Capsid*, **KENNETH WOYCECHOWSKY** (Department of Chemistry, Universtiy of Utah, 315 S 1400 E Room 2020, Salt Lake City, UT 84112; kwoycech@chem.utah.edu).

Icosahedral protein capsids are often used in Nature for the storage, transport, or regulation of encapsulated cargo molecules. These structures are attractive for various applications in bionanotechnology, such as drug delivery and catalysis. Towards these ends, the usefulness of protein capsids will depend upon an understanding of their supramolecular chemistry. Lumazine synthase from Aquifex aeolicus (AaLS) self-assembles into a 60-subunit dodecahedral capsid and provides an appealing scaffold for engineering novel encapsulation systems. However, an inability to control AaLS capsid assembly has presented a major obstacle for cargo loading in vitro. Here, we use structure-guided design to identify a set of three amino acids that act as important determinants of capsid assembly. Simultaneous mutagenesis of these three residues prevents capsid formation, halting self-assembly at the pentameric stage. This pentameric AaLS variant provides the basis for engineering a redox switch to build 60-subunit capsids in vitro. The capsid assembly process involves the formation of a covalent adduct between a unique cysteine in the variant (C37A/R40S/H41S/I125C-AaLS) and thiophenol. This modification adds non-polar surface area at position 125, presumably recapitulating a key feature of the isoleucine present at this position in the wild-type protein. The spontaneous, non-covalent assembly of the thiophenol-modified pentamers yields capsids that resemble those of wild-type AaLS, as assessed by size-exclusion chromatography and electron microscopy. Further, we have used this assembly switch to encapsulate the enzyme horseradish peroxidase, which remains active inside the capsid. By understanding the structural determinants for AaLS capsid assembly, we are able to deconstruct this capsid into its constituent pentamers by mutagenesis and reconstruct the capsid by chemical modification. Control of capsid assembly enables the encapsulation of enzymes and other molecules in vitro, which should prove useful in the construction of novel drug delivery and catalytic systems.

96 *Determining Realistic Structural Ensembles for Intrinsically Disordered Proteins*, **F MARTY YTREBERG** (Department of Physics, University of Idaho, Moscow, ID 83844; ytreberg@uidaho.edu).

Intrinsically disordered proteins (IDPs) are common in humans and their dysfunction is associated with many human diseases. IDPs are highly dynamic, contain varying amounts of transient secondary structure, and rarely have tertiary interactions. Given these structural features, most experimental and computational methods in structural biology are not suitable for IDPs. I will describe our new approach that combines experiment and simulation to generate structures for IDPs using the transactivation domain of tumor suppressor protein p53 as a model system; one of the most commonly mutated genes found in human tumors. Results from our study show that, while independent IDP ensembles do not appear to be structurally similar, one can calculate features that are consistent between ensembles. These findings suggest that the consistent features have biological significance, and that one should gauge the quality of the ensembles based on the ability to reproduce these features.

97 *Chromatographic Stationary Phase Development for the Analysis of Solute Interactions with Phospholipid Membranes*, **ERIC E ROSS** (Department of Chemistry and Biochemistry, Gonzaga University 502 East Boone Avenue, Spokane, WA 99258-0102; rosse@gonzaga.edu).

The retention time of a solute in chromatography is related to its partition or binding behavior between stationary and mobile phases. The specific research utility of a chromatographic system designed to probe biomembrane interactions is a factor of the replicated membrane attributes, the chromatographic efficiency of the materials, and the system's compatibility with various chromatographic formats. The most realistic membrane models used to date for chromatography, such as gel-supported liposomes, are compatible with the least efficient and most performance-limited supports, while higher performing materials based on covalently derivatized solids replicate fewer membrane attributes. This research describes the development of new materials composed of dynamic lipid bilayers supported within porous particles that are fabricated from Stöber silica colloids. Preliminary results obtained in a high performance

affinity chromatography format will be presented. These are highlighted by the predictable retention of metal ions on neutral lipid bilayers and those functionalized with ionophore receptors and the channel-forming peptide gramicidin. Apparent binding constants determined by this method are compared to those investigated with other techniques. The merit, potential applications, and likely limitations of the materials and methodology for the evaluation of low-affinity interactions at phospholipid membranes will be discussed.

98 *Biomolecular Motors and Switches: From Machines to Drugs*, **BARRY J GRANT** (Center for Computational Medicine and Bioinformatics, University of Michigan Medical School, 2055A Palmer Commons, Ann Arbor, MI 48109; bjgrant@umich.edu).

Molecular motors and switches lie at the heart of key biological processes, from the division and growth of cells to the muscular movement of organisms. Our approach to studying these fascinating nanomachines couples bioinformatics (to probe sequence-structure-function relationships); molecular dynamics (to investigate essential conformational changes); Brownian dynamics (for diffusional protein-protein encounters); and computer-aided drug design (for discovering novel therapeutics). I will describe two discoveries that exemplify the power of this approach. First, how it uncovered the importance of electrostatics in the motion of kinesin motors, and how this information enabled the rational design of mutant motors with tailored velocities. Second, how it revealed that the traditional "induced fit" view for activating conformational changes in molecular switches should be replaced by a "conformational selection" model, and how this framework led to the discovery of novel small molecule Ras inhibitors.

99 *An Unusual HMG-CoA Reductase from* Burkholderia cenocepacia*: Kinetic and Structural Characterization*, **JEFF WATSON** (Department of Chemistry and Biochemistry, Gonzaga University 502 East Boone Avenue, Spokane, WA 99258-0102; watsonj@gonzaga.edu).

Burkholderia cenocepacia is an opportunistic pathogen of the lungs with remarkable natural antibiotic resistance and a significant cause of fatality among cystic fibrosis patients, among others. A better understanding of the metabolic processes of this bacterium could provide novel avenues for combating these dangerous infections. We have recently expressed and purified 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase from *Burkholderia cenocepacia*. This enzyme is well-known as the target for statin drugs, which inhibit the biosynthesis of isoprenoids such as cholesterol via the mevalonate pathway, of which HMG-CoA reductase (HMGR) is the key regulatory step. However, a search of the *B. cenocepacia* genome indicates that this organism lacks the downstream enzymes of the mevalonate pathway, but does possess genes for the enzymes of an alternate pathway for isoprenoid biosynthesis, raising questions as to the enzyme's physiological role. Initial bioinformatic, kinetic and structural characterization of *B. cenocepacia* HMGR has uncovered several unusual aspects of oligomeric state, ligand binding and enzyme mechanism, further suggesting a potentially important role for this enzyme in the organism's life cycle.

100 *Simulation of Drug-Binding Kinetics*, **CHUNG F WONG** (Department of Chemistry and Biochemistry and Center for Nanoscience, University of Missouri-Saint Louis, 203 Center for Nanoscience, St. Louis, MO 63121; wongch@umsl.edu).

Initial efforts of drug discovery mostly emphasize the finding drug candidates that bind strongly to their intended biological targets. In other words, binding thermodynamics is the focus and binding kinetics is often ignored. However, the rate of association and dissociation between a drug candidate and its biological target could also have profound influence on the effectiveness of the drug, especially because, in practice, a drug functions in a non-equilibrium rather than an equilibrium system. This talk offers some insights from simulation of the application of drugs to the Epidermal Growth Factor Receptor (EGFR) signaling pathways, and presents some ways of using molecular simulation to understand drug-binding kinetics at the molecular level, with the hope of obtaining hints on developing better drugs by fine-tuning binding kinetics.

101 *Computational Studies of Ras Dynamics, Membrane Binding and Assembly*, **ALEMAYEHU (ALEX) GORFE** (Integrative Biology and Pharmacology, University of Texas Medical School – Houston, 6431 Fannin Street, Houston, TX 77030; Alemayehu.G.Abebe@uth.tmc.edu).

Understanding how structural fluctuations, membrane binding and clustering of lipid- modified proteins modulate cell-signaling events is of major interest in contemporary biophysics and biomedical research. Physics-based simulations coupled with the concept of conformational selection have begun to play an important role for the development of dynamics-guided drug design strategies to selectively inhibit the abnormal function of this class of proteins. I will use lipidated Ras proteins as model systems to highlight the roles of dynamics, membrane binding and domain-specific nanoclustering for the function of lipid-modified bio-switches.

102 *Observing Intermolecular Unbinding Mechanisms Through Forced Unbinding Studies Using AFM*, **JONATHAN WALSH** (Department of Physics, Boise State University, 1910 University Drive, Boise, ID 83725).

As biomolecules interact within biological systems they undergo delicate conformational changes, specifically as a result of enzyme/ligand interactions. These changes in structure occur relative to various intermediate states and

energy barriers throughout the reaction process, and have a great effect on the function of the ligand after the reaction process. Since the precise mechanism of interaction between an enzyme and its ligand(s) is highly disputed, providing additional insight into this phenomenon is of great importance. Forced unbinding studies using atomic force microscopy (AFM) have contributed valuable information about the interactions between biomolecules. The strength of intermolecular interactions can be observed by attaching the enzyme and ligand molecules to the AFM tip and sample surfaces through tethering molecules, and measuring the unbinding force required to pull the molecules apart. By applying a previously modified, freely jointed chain model, along with additional mathematical analyses, we were able to determine the unbinding mechanism in a model enzyme/inhibitor system consisting of 5'-Methylthioadenosine/S-adenosylhomocysteine nucleosidase and its transition state analog, Homocysteinyl Immucillin A. Our data suggest that in this system the unbinding mechanism follows a process of elastic deformation. This type of observational method has the potential to greatly improve our understanding of enzymatic interactions as well as the production of powerful inhibitory drugs.

103 *Ab initio QM/MM Molecular Dynamics with AMBER and TeraChem: Exploring Environmental Effects on the Absorption Spectrum of Photoactive Yellow Protein*, **ANDREAS W GOETZ** (San Diego Supercomputer Center 10100 Hopkins Drive, La Jolla, CA 92093; agoetz@sdsc.edu).

We have recently extended the mixed quantum mechanical / molecular mechanical (QM/MM) capabilities of the AMBER molecular dynamics (MD) software package to include ab initio and density functional theory (DFT) methods via an interface to external QM software packages. Of particular interest is our support of the electronic structure code TeraChem that exploits the massive parallelism of GPU accelerators to speed up ground and excited state calculations. We describe the interface between AMBER and TeraChem and present results for absorption spectra of photoactive yellow protein (PYP) obtained from time-dependent DFT calculations within the QM/MM framework along MD trajectories. The effects of long-range electrostatics are explored by computing the spectra for various QM regions and MM cutoff values. Comparisons are made to spectra calculated for the PYP chromophore in vacuum and aqueous solution.

104 *Characterizing the Conformations and Dynamics of PEGylated Human Interferon ß-1a via Molecular Dynamics Simulation*, **NIKOLAI SMOLIN** (Department of Chemistry and Biochemistry, Boise State University, 1910 University Drive, Boise, ID 83725; nikolaismolin@boisestate.edu).

PEGylation, the covalent attachment of a polyethylene glycol polymer to a molecule or protein, is known to increase the efficacy of a protein with minimal changes to immunogenic properties. The protein of interest in this study is human interferon ß-1a (IFN), used in the treatment of multiple sclerosis, cancer, and viral infection. The effect of PEGylation is still poorly understood at the molecular level. In this work, we present comparative molecular dynamics simulations of free mPEG's, Apo IFN, and mPEG-IFN conjugates in order to describe and characterize the conformational differences induced by PEGylation. The simulations allow deeper insight into the dynamics and energetics of the mPEG-IFN interactions not observable by conventional bench top experiments. A major concern of pharmaceutic development is assessing the stability of the system. We anticipate the findings of this study will have broad implications for protein pharmaceutical enhancement and development with a unique approach to the study of protein drug stability from a computational perspective.

CONTRIBUTED ORAL PRESENTATIONS

HEALTH SCIENCES SECTION

Monday, starting at 8:20 a.m. in WILLOWS 1

105 *Psychoanalysis and Conflict Between the Mutual Nurturance Drive and Social Survival*, **RODERIC GORNEY** (Department of Psychiatry, Semel Institute, UCLA, 760 Westwood Plaza, Los Angeles, CA 90095, [please send a copy of correspondence to Dr. Gorney's private office at 635 Walther Way, Los Angeles, CA 90049]; preadapt@ucla.edu).

Mutual nurturance begins at birth with breast suckling that simultaneously nourishes the baby and, via reflex stimulation of oxytocin in mother, halts her bleeding. We grow up identifying with the care-giver and wanting to be mutual nurturers too.

What I call the "mutual nurturance drive" developed across three million years of human evolution in small nomadic bands as our fundamental strategy for surviving scarcity. Because they were each other's only social security, these early people mainly took care of each other by sharing.

Modern civilization began 12,000 years ago with invention of agriculture/herding, which generated surpluses and allowed settling in fixed villages. For the first time, people could safely hoard for themselves rather than share with neighbors whose resultant poverty converted them into the most valuable resource of all: cheap labor.

Twelve millennia later, all our "advanced" societies, whether "left" or "right," continue to concentrate wealth and power, so that now we instead increasingly take advantage of each other, surviving not on good will, but on goods, as

well as suffering unconscious guilt for betraying our legacy of mutual nurturance.

Psychoanalysis sought to relieve patients' unconscious libidinal conflicts, leaving them with Freud's "ordinary misery of life," thought to be insusceptible to analysis. My recent experience, and that of others, indicates that much such suffering originates in conflict between the mutual nurturance drive and imperatives for survival in modern society, and that by directing analysis onto this social conflict, psychological suffering can further be reduced.

106 *Delta Dental of Idaho School-Based Dental Sealant Program: An Evaluation of Sealant Retention and Dental Caries Prevention*, **ERIC S DONAHUE* and LEE HANNAH** (College of Health Science, Boise State University, 1910 University Drive, Boise ID 83725; ericdonahue@u.boisestate.edu).

Dental caries are one of the most common preventable diseases of childhood and dental sealants have been shown to significantly decrease the prevalence of dental caries in adolescents. Nationally only 30% of children between ages of 6 and 11 have dental sealants on their permanent molars. School-based dental sealant programs focus on populations that are at the greatest risk of experiencing dental disease. Delta Dental of Idaho's community outreach staff travels throughout the state providing free dental sealant clinics in elementary and middle schools. The program focuses on schools with 55% or more of the student population qualifying for free or reduced lunch. This study examined the efficacy of the program in dental caries prevention and sealant retention in sealed 6-year molars. The baseline examination was conducted with 144 second and third grade students throughout the state of Idaho and evaluated a total of 576 molar surfaces. Overall, 52% of children had shown signs of suspected decay in at least one molar at the baseline examination. Decay experience in sealed molars was only 24%, with 94 of 388 sealed molars either having been filled or with suspected decay at follow-up. Only 7% of the total sealed and unsealed molars had signs of decay at follow-up. Sealant retention was above average, with 59% of molars sealed at baseline being retained at the four year follow-up. The results demonstrated that dental sealants are imperative to pediatric preventative health services and reveal the necessity of school-based health programs in rural and under-served regions.

107 *Metformin Pharmacology and Pharmacogenomics of Organic Cation Transporter 3 (OCT3), SLC22A3*, **LIGONG CHEN*, LU XU, EUGENE CHEN and KETHLEEN GIACOMINI** (Department of Bioengineering and Therapeutic Sciences, University of California San Francisco, 1550 4th Street, Mission Bay, RH 584, MC2911, San Francisco, CA 94158; ligong.chen@ucsf.edu).

OCT3 has been increasingly recognized as an important anti-diabetes and cancer drug transporter. Genome-wide association studies have suggested that OCT3 is susceptible to prostate cancer in which it is dramatically down-regulated. The current presentation mainly discusses: 1, the role of OCT3 in the pharmacologic action of metformin. Quantitative PCR and immunostaining showed that OCT3 was highly expressed on the plasma membrane of skeletal muscle and liver, target tissues for metformin action. We evaluated metformin-induced activation of AMPK, the molecular target of metformin in primary skeletal muscle cell. Both OCT3 inhibitor and OCT3-specific shRNA significantly reduced the activating effect of metformin on AMPK. Oct3-/- mice showed altered metformin pharmacokinetics and pharmacodynamics. 2, identification and characterization of genetic and epigenetic factors regulating the expression and function of OCT3. Six novel nonsynonymous variants in coding region were identified among 4 ethnic groups. In functional assays, using various monoamines and metformin, 3 of the variants exhibited a similar transport function to the reference OCT3, whereas the other 3 variants showed altered substrate specificity. 5 genetic variants and 7 haplotypes were identified in the basal promoter region. Genetic polymorphisms in the proximal promoter region of OCT3 change the transcription rate of the gene and may be associated with the altered expression levels of OCT3 in clinical human liver samples. Aberrant methylation in promoter region of OCT3 contributes to the reduced expression of OCT3 in prostate cancer and is associated with the prostate tumorigenesis.

ORAL BIOLOGY and DENTAL MEDICINE

Monday, starting at 9:20 a.m. in WILLOWS 1

108 *Pilot Study of Oncogenic HPVs in Oral Lavage Samples from HIV Positive Senegal Women*, **JULIET DANG[1]*, NANCY KIVIAT[2], QINGHUA FENG[3] and STEPHEN HAWES[4]** ([1]Department of Oral Biology, University of Washington, B-224, 1959 NE Pacific St., Seattle, WA 98195; [2]Department of Pathology, University of Washington, 325 Ninth Ave, Box 359791, Seattle, WA 98104; [3]Department of Pathology, Room 232, 815 Mercer St. Seattle, WA 98109; [4]Department of Epidemiology, University of Washington, 908 Jefferson, Suite 1190, Seattle, WA 98110; jhtdang@uw.edu).

Although HPV infection plays an etiological role in a subset of oral cancer, little is known about transmission and the natural history of oral HPV infection in individuals without cancer, nor the optimal methods to detect oncogenic HPVs. We determined whether HPV 16 and 18 could be detected in 19 oral lavage samples collected from 15 HIV positive women in Senegal using a real-time PCR based assay.

All patients attended an outpatient infectious disease clinic in Dakar and were part of a longitudinal study assessing HPV, HIV and the development of high-grade cervical lesions. Of these 15 women, 11 (73%) were positive for HIV-1, 4 (27%) were positive for HIV-2. Of matched cervical

swab samples, eight were positive for HPV 16, one was positive for HPV 18, and ten were negative for both HPV 16 and 18. Of the 15 women there were 4 patients that contributed 2 samples each. The presence of HPV 16 and 18 in oral lavage samples was determined using quantitative Taqman real-time PCR assays. All samples were sufficient for HPV detection. We found that none of 19 oral lavage samples was positive for HPV 16 and only one oral lavage sample was positive for HPV 18. The corresponding cervical swab sample from the same patient was positive for HPV, though it was not positive for HPV 16 or 18.

We concluded that oncogenic HPVs can be detected among cancer-free individuals using quantitative Taqman assays, though the frequency is low even among HIV positive individuals.

CHEMISTRY and BIOCHEMISTRY
Monday, starting at 10:00 am. in WILLOWS 1

109 *Molecular Docking, Synthesis of Novel Quinazolin Analogues as Inhibitors of Transcription Factors NF-κB Activation and their Anti-cancer Activities*, **LU XU* and WADE A RUSSU** (Department of Pharmaceutics and Medicinal Chemistry, Thomas J. Long School of Pharmacy and Health Sciences, University of the Pacific, Stockton, CA 95211, USA; l_xu@u.pacific.edu).

NF-kB is a transcription factor protein complex that can be found in almost all animal cell types and is a key player in some cancers and inflammatory responses. It can enhance the proliferation rate, reduce apoptosis, as well as creating more blood flow to ensure the survival of cancer, thus blocking the NF-kB pathway has potential therapeutical effect. Our research is now focusing on developing a compound that inhibits the binding of NF-kB to its DNA recognition sequence and thus block NF-kB signaling. We designed a series of compounds based on quazoline scaffold pharmacophore model which may have high binding affinity with P50 subunit of NF-kB. The compounds with phenol substitution at 2 position of quinazoline has been proved to be more effective in inhibiting NF-kB function both theoretically and experimentally. These series of compounds also reduce the proliferation rate especially on leukemia cell lines and the mean GI50 for the compound 2a is calculated to be 2.88uM on NCI 60 cell lines. At the same time, compound 2a can induce great amount of apoptosis in EKVX cell line at the concentration of 1 μM.

110 *Separation and Characterization of Multiple Component Detergent Systems Used in Industrial Sanitation Processes*, **ASHLEY A FISHER*, EMILY DRUSSEL, PETR MALEK, and OWEN M MCDOUGAL** (Department of Chemistry and Biochemistry, Boise State University, 1910 University Dr, Boise, ID 83725; ashleyfisher2@boisestate.edu).

Nonlyphenol ethoxylate (NPE)-containing detergents have recently been found to accumulate in the environment, negatively impacting water sources, causing toxicity in wildlife, and adversely affecting humans. They have been shown to disrupt endocrine function by mimicking steroid hormones and interacting with the estrogen receptor. As a result, there is a need to develop new industrial detergents that replace NPE components with eco-friendly polymers, green chelatants, and ethoxylated alcohols. Reverse engineering of existing market products allows for identification and characterization of components found in these commercially available detergents. Compilation of these components into a library of raw materials (surfactants, polymers, chelators, etc.) will allow for reformulation of novel green detergents available for manufacturing and distribution. The separation and characterization of the existing detergents have proven to be challenging based on the overwhelming complexity of these systems. Consequently, multiple approaches to analysis and identification have been implemented. Component separation was performed using high performance liquid chromatography (HPLC) with evaporative light scattering detection (ELSD). The individual surfactants and polymers within the detergents were isolated and collected, and subsequent component identification was conducted using a combination of techniques, including infrared spectroscopy (IR), mass spectrometry (MS), and nuclear magnetic resonance spectroscopy (NMR).

111 *Oxalate Metabolism by* Sclerotinia sclerotiorum*, a Fungal Pathogen in Soybeans*, **ANNE MBIRI[1,2]*, ERUSTUS GATEBE[1], MARY NDUNG'U[1], DANIEL KARIUKI[1], and ERUSTUS MWANGI[1]** ([1]Department of Chemistry, Jomo Kenyatta University of Agriculture Technology, P.O.BOX 62000-00200, Nairobi, Kenya; [2]Department of Pure and Applied Sciences, The Mombasa Polytechnic University College, P.O.Box 90420-80100, Mombasa; wanjiraanne33@gmail.com).

Pathogenesis of *Sclerotinia sclerotiorum* majorly depends on production of oxalate (Lib.) de Bary, but the mechanism by which the oxalate is produced is not well understood. Control of Sclerotinia stem rot (SSR) in soybean which is caused by this ubiquitous phytopathogenic fungus requires the knowledge of oxalate synthesis by *S. sclerotiorum*. Nine isolates from infected soybeans and soils were obtained and used to study the various organic acids and enzymes involved in oxalate metabolism. The study showed that *S. sclerorotiorum* produces malate, succinate, oxaloacetate and acetate during the synthesis of oxalate. The activities of Oxaloacetate hydrolyase (OAH), malate dehydrogenase (MDH), glyoxylate dehydrogenase (GDH) were detected in all the isolates but activities of Oxalate decarboxylase (ODH), and formate dehydrogenase (FDH) were not detected. The high specific activity of MDH suggests an important role that this enzyme could be playing in oxalate

biosynthesis. Absence of FDH and ODH could be the reason why the oxalate concentration was found to be high in the filtrates. This study reports the significance of GDH and OAH in pathogenesis of *S. sclerotiorum*. Overall, these results suggest metabolism of oxalate by *S. sclerotiorum* through a tricarboxylic cycle. This study is the first report on oxalate metabolism by *Sclerotinia sclerotorium* in soybeans in Kenya and the information can be used in coming up with methods of controlling Sclerotinia stem rot in soybeans.

PHYSICS and MATERIALS SCIENCE
Monday, starting at 11:00 a.m. in WILLOWS 1

112 *Growth and Magnetic Properties of Co-deposition Ni-Mn-Ga via Radio Frequency and Direct Current Physical Vapor Deposition*, **KIMO WILSON*, PETER MÜLLNER, and WILLIAM KNOWLTON** (Department of Materials Science and Engineering, Boise State University, 1910 University Dr. Boise, Idaho 83725-2100; kimowilson@gmail.com, petermullner@boisestate.edu, BKnowlton@boisestate.edu).

Sputtering by physical vapor deposition has become a primary technique for the fabrication of thin films. Co-sputtering deposition (sputtering with multiple targets simultaneously) allows for a wide variety of film compositions and increased deposition rates. Films produced via physical vapor deposition have good adhesion to substrates and film uniformity. A major difficulty in sputter deposition of Ni-Mn-Ga films is that structural, thermal, magnetic, and mechanical properties of Ni-Mn-Ga depend heavily on composition. Accurate control of the composition is essential to achieve appropriate structural and magnetic transition temperatures and is difficult to control when sputtering from a single alloy target. A robust procedure with three targets (Ni, NiGa, and Mn) is desirable and essential for the deposition of controlled Ni-Mn-Ga films with defined structural and magnetic properties. We co-sputtered films from three targets for which the sputter power could be controlled independently. By systematically varying sputter power of all three targets, the film composition, measured with Energy-Dispersive X-ray Spectroscopy was varied over a wide range including $Ni_{50}Mn_{30}Ga_{20}$ (at.%) for which we aimed. By adjusting sputter powers, we made a film with composition $Ni_{50.5}Mn_{29.2}Ga_{20.3}$ matching the nominal composition within ± 0.25 at. %.

113 *The Effect of Natural Aging and Grain Size on the Mechanical Properties of AA6111 Aluminum for Auto Panel Application*, **GEORGE K QUAINOO* and DALLIN BAKER** (Department of Physics, Materials Science and Engineering, Southern Oregon University, Ashland, OR 97520; quainoog@sou.edu).

In the continuing drive for weight reduction in new automobile designs, to meet the Corporate Average Efficiency (C.A.F.E) standards, the 6000 series aluminum alloys have emerged as the most promising age-hardening body sheet material. Currently, one of the body sheet alloys used for its combination of strength and formability in natural aging and artificial aging tempers, is AA6111, an Al-Mg-Si-Cu alloy. Some advantages of this alloy for this application include light weight compared to steels, high dent resistant, corrosion resistant, and improved mechanical strength in the production process corroborated by studies in the open literature. However, the link between the effect of natural aging and the grain size morphology has not been established. The goal of this investigation therefore was to determine the effect of natural aging (aging at room temperature) before artificial aging of AA6111, by studying the hardness and grain size of the microstructure of the alloy throughout the aging process, using samples that had been subjected to varying lengths of natural aging prior to artificial aging. The results establish that the length of natural aging before precipitation heat treatment of AA6111 had a deleterious effect on the subsequent artificial aging strength of the alloy. To maximize the strength of auto panels made from AA6111, the parts should be solution heat treated and immediately artificially aged for no more than 6 hours. Allowing the alloy to sit at room temperature before artificial aging for even 24 hours severely reduces its strength.

114 *An Upside-Down Reality: The Matter-Time Universe*, **STEPHEN F AGNEW** (Principal Scientist, Columbia Energy and Environmental Services, Inc., 1806 Terminal Drive, Richland, WA, 99354; sfagnew@charter.net).

Space time physics has been very successful in explaining many observations of physical reality and yet despite its many successes, gravity and electromagnetism persist as separate unrelated forces. In addition, observations continue to accumulate that are inconsistent with space-time physics, spanning from the mass of quarks in protons and neutrons to the boundaries of black holes and the structure of galaxies in the universe. Both dark matter and dark energy are now commonly assumed by many scientists even though there is no unifying theory for those assumptions.

An alternative interpretation of physical reality, matter time, is very different from space time and yet is both consistent with current observations and uncertainties and yet appears to resolve many of the conundrums of space time. In particular, matter time shows electromagnetic and gravitational forces are due to the same fundamental time-dependent matter decay flux applied at very different scale. The matter decay flux is very small, 283 ppt/yr, and well within current uncertainties and atomic time slowly increases at one leap second every 127 years.

Along with the Schrödinger equation and the coordinates of matter, time, and phase, apparently just three constants determine all properties and actions of the matter-time universe: a charge velocity, c/α; a fundamental matter-time particle mass (m_∞); and a matter-time matter decay rate, mdot.

ECOLOGY, ORGANISMAL BIOLOGY, and ENVIRONMENTAL SCIENCES

Monday, starting at 9:00 a.m. in WILLOWS 2

114a *Flowering Patterns following Tephra Disturbance of Understory Herbs in Old-growth Subalpine Forest*, **DONALD ZOBEL[1] and JOSEPH ANTOS[2]** ([1]Botany and Plant Pathology, Oregon State University, Cordley Hall 2082, Corvallis OR 97331; [2]Biology, University of Victoria, PO Box 3020 STN CSC, Victoria, BC, Canada V8W 3N5; zobeld@science.oregonstate.edu).

During succession, flowering allows plants to increase in density and to spread farther than via vegetative reproduction. Within a community, species range from those for which frequent flowering is essential for spread to those that rarely flower. However, few studies consider the full variation in flowering within a community. Here we analyze flowering of understory herbs, using permanent plots in forests affected by 1980 tephra from Mount St. Helens. Incidence of flowering in 1980-83, 2000, 2005, and 2010 was related to environment and species properties using logistic regression.

Flowering varied widely among species, with some never flowering. Overall, incidence of flowering was greater in herb-rich sites than in sites with few species, but there was no overall difference between sites with 4.5 versus 15 cm tephra. Plants with a graminoid or a deciduous, non-clonal growth form had the highest incidence of flowering; clonal deciduous and clonal evergreen plants were intermediate; non-clonal evergreen plants seldom flowered. Species limited to forest flowered more consistently than those that also grow in meadows or in early seral conditions. With time, incidence of flowering increased for deep tephra, herb-poor sites, species that also grow in early-seral sites, and those restricted to forests. Species differed widely in their patterns of flowering among years and with environment. Incidence varied among common species from 0% (Xerophyllum tenax) of the situations in which a species was present to 85% (Tiarella unifoliata). Where flowering occurred, 4 to 19% of shoots flowered.

115 *Testing Monophyly and Phylogenetic Relationships of* Smittium *(Harpellales) using a Five-Gene Molecular Phylogenetic Analysis*, **YAN WANG[1]*, ERIC D TRETTER[1], ERIC M JOHNSON[1], PRASANNA KANDEL[1], ROBERT W LICHTWARDT[2], and MERLIN M WHITE[1]** ([1]Department of Biological Sciences, Boise State University, 1910 University Drive, Boise, ID 83725; [2]Department of Ecology & Evolutionary Biology, University of Kansas, 1200 Sunnyside Avenue, Haworth Hall, Lawrence, KS 66045; Yanwang@u.boisestate.edu).

Smittium is a ubiquitous group of fungi, best known as endosymbionts of various Arthropods, thus commonly referred to as the gut fungi. During the 75 years since the first species, *Smittium arvernense*, was described, *Smittium* has grown to include 81 species. The symbiotic relationships within this genus range from commensalism, mutualism, to parasitism. This genus has also helped to advance our understanding of the gut fungi, by serving as a "model" for laboratory studies of the fungal trichomycetes. Many isolates of *Smittium* have been used for host feeding, isozyme, physiological, serological, ultrastructural, and now ongoing molecular systematic studies. Previous and recent molecular studies have shown that *Smittium* is polyphyletic but with consistent separation of *Smittium culisetae*, one of the most common and widespread species, from the remainder of *Smittium* species. Here we used morphological (sexual and asexual spores shape), molecular (18S and 28S rRNA genes), immunological, and isozyme evidence to suggest a new genus, *Zancudomyces*, to accommodate *Smittium culisetae*. A multi-gene dataset, consisting of 18S and 28S rRNA genes, as well as RPB1, RPB2, and MCM7 translated protein sequences for *Smittium* and related Harpellales (*Austrosmittium, Coleopteromyces, Furculomyces, Pseudoharpella, Stachylina* and *Trichozygospora*), was used for phylogenetic analyses to test the monophyly of *Smittium*. A consensus tree was generated with strong support at multiple levels. The clades and branches of the tree were assessed relative to morphological traits for the taxa of interest, including holdfast shape, thallus branching type, trichospore (asexual spore) and zygospores (sexual spore) characters as an aid to inform the taxonomy and eventual systematic revisions and reclassification. A narrower genus definition of *Smittium* was supported by molecular data, and approved by morphological reexamination.

116 *Investigating the Presence and Impacts of Wolbachia, a Bacterial Symbiont, on a Threatened Butterfly*, **AMY TRUITT* and CATHERINE De RIVERA** (Department of Environmental Science and Management, Portland State University, 1825 SW Broadway, Portland, OR 97201; amtruitt@pdx.edu).

The endosymbiotic bacteria, *Wolbachia,* likely affect population dynamics of the imperiled Oregon silverspot butterfly, (*Speyeria zerene hippolyta*, OSB) and may have been a contributor in the decline of its many extirpated populations. Some strains of *Wolbachia* induce cytoplasmic incompatibility between its host insects and uninfected conspecifics, including for many Lepidoptera. The goals of this study were to determine: if this species is infected with *Wolbachia*, whether infection affects population growth of this butterfly. We conducted a screen for *Wolbachia* infection by collecting samples from archived female butterflies (from 1999 and 2001-2011, n=234), extracting DNA from the samples, and employing polymerase chain reaction protocols using *Wolbachia*-specific primers. Reproduction data, eggs laid and eggs hatched, for infected versus uninfected individuals were analyzed. Proportion of infected individuals per year was compared to population indices.

Our results revealed a *Wolbachia* infection in OSBs that changed over time. Infected individuals, on average, laid more eggs than uninfected individuals; however, the difference was not statistically significant (p=0.0285). Infected individuals successfully hatched more eggs than uninfected individuals did (p<0.001). The event of an individual laying zero eggs was more prevalent in uninfected than infected samples (0.05). In addition, preliminary results suggest that infection rates of OSBs have increased over time and were intermediate during many of the years of population decline. Our data shows evidence of *Wolbachia* being a potential contributor to population declines likely due to incompatibility between infected and uninfected mating pairs. Further investigations into the potential of multiple infections and speciation of OSB are underway.

117 *Enlisting Citizen Scientists in a Search for Zombie Bees*, **JOHN E HAFERNIK[1,3]*, ASIM UTKU ZIHNIOGLU[2,3], JONATHAN IVERS[1,3], CHRISTOPHER D QUOCK[1,3], ROBERT MCKIMMIE[1,3], ANDREW G ZINK[1,3], and DRAGUTIN PETKOVIC[2,3]** ([1]Department of Biology, San Francisco State University, 1600 Holloway Ave, San Francisco, CA 94132; [2]Department of Computer Science, San Francisco State University, 1600 Holloway Ave, San Francisco, CA 94132; [3]Center for Computing for Life Sciences, San Francisco State University, 1600 Holloway Ave, San Francisco, CA 94132; hafernik@sfsu.edu).

In the U.S., Colony Collapse Disorder (CCD), a phenomenon characterized by hive abandonment by worker bees, has dramatically increased losses of honey bee colonies. The main suspects for CCD are parasitic mites, fungal parasites, viral diseases, pesticides and interactions amongst them. Recently, a new suspect, the phorid fly *Apocephalus borealis* (AKA the zombie fly*)* has been added to the mix. This widely distributed native fly, previously known to parasitize native bumble bees and paper wasps, has expanded its host range to infect the non-native honey bee. Parasitized honey bees show "zombie-like" behavior leaving their hives at night. These bees are attracted to nearby lights where they become disoriented and die.

So far, the fly has only been found parasitizing honey bees in California and South Dakota. The worldwide web provides a powerful means to enlist citizen scientists to determine the current geographic extent of fly parasitism in honey bees and to follow changes in its geographic extent and intensity over time. To do this, we have designed a WWW site (zombeewatch.org) to support our investigation. It allows participation and data collection by "Bee keeper Scientists" and "Citizen Scientists" who contribute their observations (e.g. comments, images, counts of infected bees) to the site. Our WWW site then displays multiple geographical representations of the collected data. The WWW site was designed and implemented using the latest user interface design and software engineering methods and is hosted in the cloud by Amazon Web Services.

118 *Determinants of Territory Quality and Male Reproductive Success in Southern Sea Otters (*Enhydra lutris nereis*)*, **LILY MAXINE TARJAN** (Department of Ecology and Evolutionary Biology, University of California Santa Cruz, 100 Shaffer Road, Santa Cruz, CA 95060; ltarjan@ucsc.edu).

Vertebrates exhibit a wide range of mating systems, which are largely determined by resource availability and distribution. The sea otter mating system differs from those of seals and sea lions because females are asynchronous breeders and parturition/pup rearing is aquatic, precluding the potential to monopolize female breeding aggregations. Knowledge of the sea otter mating system remains inferred and descriptive and the degree to which the features of male territories and/or attributes of males themselves contribute to reproductive success remains unknown. To measure biotic and abiotic territory features that may influence male reproductive success, territories of radio-tagged males in Monterey Peninsula, CA were defined using adaptive Local Convex Hull analysis. Preliminary results based on a GIS "surface" of foraging success suggest that the likelihood of encountering a given female within a territory is related to that female's diet specialization. Up to a 17-fold difference in kelp density across territories also suggests that males have the opportunity to increase their reproductive success by monopolizing patches of kelp with resting females. Microsatellite analysis of existing tissue samples from radio-tagged territorial males and female pups will allow quantification of male reproductive skew and reproductive success. Territory features will be included with measures of reproductive success in structural equation models to identify which variables contribute to male reproductive success.

EARTH SCIENCES

Monday, starting at 10:40 in WILLOWS 2

119 *The Occurrence of the Ancestral Santa Lucia Fir (Abies SECTION Bracteatae) of California in the Mid-Cenozoic of Colorado*, **ESTELLA B LEOPOLD and STEPHANIE ZABORAC-REED*** (Department of Biology, University of Washington, Box 351800, Seattle, WA 98195, eleopold@u.washington.edu and susitna@gmail.com).

The Santa Lucia Fir, *Abies bracteata,* is the sole extant member of the most primitive section (Bracteatae) of the genus *Abies*. Not only is the morphology of its cones unique with their long bracts, but its pollen is unusual and generally diagnostic within the genus. *Abies bracteata* is currently restricted to the Santa Lucia Mountains near Los Angeles, California. It occurs in a mixed conifer forest community mainly between 3200 and 5500 feet in elevation, where the mean annual temperature (MAT) is 11°C and a winter-wet/summer-dry precipitation pattern prevails. Megafossils and pollen from Section Bracteatae are recorded in the mixed

conifer forest of the Creede Formation (26 Ma Oligocene) of southern Colorado. Seeds and pollen of Section Bracteatae are found in the older Florissant formation (34 Ma Eocene) of Central Colorado, in a warm temperate mixed hardwood forest characterized by a summer moist climate. Bracteatae-type pollen also appears in the Antero Formation (33 Ma) near the Florissant site, while Bracteatae-type needles, bracts, seeds and scales occur at Miocene sites in Nevada and Oregon. The abundant remains of *Pinus crossii* (cf. bristlecone pine) associated with Bracteatae-type remains at Creede suggest that after the warm Florissant, the climate was cooling and drying. The shift from MAT of 11-18°C to less than 2°C (Wolfe and Schorn) suggests that this cooling in the Rocky Mountains coincided with the global cooling of the early Oligocene. *Abies bracteata* is the sole representative of Section Bracteatae, whose forebears were once adapted to a summer moist climate.

120 *Evaluating the Ti-in-Quartz Deformation Temperatures in the Scandinavian Caledonides*, **ANDREA M WOLFOWICZ*, MATTHEW J KOHN, and CJ NORTHRUP** (Department of Geosciences, Boise State University, 1910 University Dr., Boise, ID 83725; andreawolfowicz@u.boisestate.edu).

The Titanium-in-quartz (TitaniQ) thermometer was evaluated in ductilely sheared rocks (mylonites) from the Scandinavian Caledonides in comparison with several other thermometric methods, including (1) TitaniQ thermometry in cross-cutting quartz veins (minimum temperature), (2) garnet-biotite Fe-Mg exchange thermometry, (3) metamorphic phase equilibria, and (4) quartz microstructures as calibrated experimentally and empirically. In all instances, quartz vein temperatures mimic TitaniQ temperatures of the host rocks. Similarly, TitaniQ temperatures, ranging from ~325°C to ~550°C, agree well with temperatures expected from metamorphic phase equilibria. In the two samples analyzed for garnet-biotite Fe-Mg exchange thermometry, one is consistent with TitaniQ temperatures; a larger sample size is necessary for accurate comparisons. Lastly, TitaniQ temperatures are mostly consistent with temperatures expected from quartz microstructures. However, TitaniQ temperatures reveal Grain Boundary Migration recrystallization (GBM) occurring at temperatures as low as 375°C, which is much lower than previously published temperatures for GBM (Hirth and Tullis 1992; Stipp et al 2002).

Two competing models for the evolution of orogens exist: The critical wedge model and the channel flow-extrusion model. Due to the unusual and consistent exposure of thrust surfaces for ~140 km across the Scandinavian Caledonides, we were able to resolve a consistent lateral thermal gradient along the thrust of 1.43°C/km. This low thermal gradient supports the critical wedge model for the evolution of orogens.

AGRICULTURE and HORTICULTURAL SCIENCES

Monday, starting at 11:20 in WILLOWS 2

121 *Towards a Yield-Scale Assessment of Greenhouse Gas Emissions in Agriculture*, **CHRIS VAN KESSEL[1]*, JAN WILLEM VAN GROENIGEN[2], and BRUCE LINQUIST[1]** ([1]Department of Plant Sciences, University of California, Davis, One Shield Avenue, Davis, CA, 95616; [2]Wageningen University, Department of Soil Quality, Wageningen, The Netherlands; cvankessel@ucdavis.edu).

With the world population projected to reach 9 billion in 2050, there will be an increasing demand (about 1.3% annually) for cereals to feed the world. This increased production needs to occur in such a way that it will reduce the environmental burden. For example, agriculture already accounts for 10 to 12% of the total global anthropogenic emissions of greenhouse gases. Commonly, N_2O emissions are expressed as a function of N application rate. Here we argue that crop yield should be included when assessing N_2O emissions and propose reductions. We hypothesized that if N surplus (N applied minus N uptake) is equal to or smaller than zero, yield-scaled N_2O emissions will remain stable and relatively low but will increase under surplus N. A meta-analysis of peer-reviewed, published data confirmed this hypothesis.

Whereas the concept of a yield-scale assessment was based on N_2O emissions, the concept needs to be expanded to include CO_2 and CH_4 and obtain yield-scaled Global Warming Potential (GWP) values. Recently, other studies using field research, meta-analysis, or life-cycle analyses have evaluated this concept and arrived at similar conclusions: GWP needs to be assessed as a function of crop yield.

We postulate that, in a world with growing demand for food, fuel and fiber, expressing GWP emissions as a function of land area or N_2O emissions as a function of N-fertilizer application rate is not helpful and may even be counter-productive and promote lower yields or expansion of agriculture into marginal lands.

122 *Effect of Weather Patterns on Beef Production in the Northern Great Plains*, **MICHAEL D MacNEIL* and LANCE T VERMEIRE (**USDA Agricultural Research Service, 243 Fort Keogh Rd., Miles City, MT 59301; macneil.deltag@gmail.com).

Predictions of climate change effects on livestock production are inconsistent and long-term data relating weather to animal performance are rare. Beef production records collected over 76-year from Hereford cattle, and concurrent weather records were used to assess effects of weather patterns on the growth of calves from birth to weaning on rangeland. Data were simultaneously adjusted for trends in the calf production data arising from selection and inbreeding, and for effects of age of dam and sex of calf to produce clean estimates of the year effects. Daily maximum and minimum

temperatures were summarized to identify the first and last days of a 1500 growing-degree-day growing season. Precipitation was accumulated from the end of the growing season the previous year through 31 December, 1 January through the beginning of the current year growing season, and during the current growing season. These weather records were then subjected to principal components analysis. The eight years characterizing extremes in each of the five principal components were identified. Extreme year effects on calf growth were contrasted for each principal component. Irrespective of the pattern of precipitation before the growing season and with near or above average precipitation during the growing season, calves reared in years characterized by longer, cooler growing seasons gained more weight from birth to weaning than those reared in opposing years. This retrospective analysis indicates a general increase in temperature in the Northern Great Plains is expected to reduce the growth of calves from birth to weaning.

MATHEMATICS

Monday, starting at 10:30 a.m. in PONDEROSA PINES 1 & 2

123 *Perfect Stripes from a General Turing Model in Different Geometries*, **JEAN SCHNEIDER** (Department of Mathematics, Boise State University, 1910 University Drive, Boise, ID 83725; jeanschneider@u.boisestate.edu).

We explore a striped pattern generated by a general Turing model in three different geometries. We look at the square, disk, and hemisphere and make connections between the stripes in each spatial direction. In particular, we gain a greater understanding of when perfect stripes can be generated and what causes defects in their patterns. In this investigation we look at the difference between the solutions due to the different domain shapes. In the end we lay out a reason why stripes from a reaction-diffusion system can be perfect on a square or hemisphere, but can never be perfect on a disk.

124 *Markov Chains on the Symmetric Groups Converging to Non-uniform Measures*, **YUNJIANG JIANG** (Department of Mathematics, Stanford University, building 380, Stanford, California 94305; yunjiangster@gmail.com).

The study of random walks on finite groups, and in particular symmetric groups, viewed as card-shuffling models, has seen tremendous activities in recent decades. An extremely challenging set of problems concerns the mixing time in total variation as well as other distances on the space of probability measures. These problems have many practical consequences ranging from the effectiveness of Monte-Carlo simulation to number of times one needs to shuffle a deck of cards to mix it properly. Here we introduce several other important measures on the symmetric groups other than the uniform, construct natural Markov chains converging to them, and analyze their mixing times in sharp form via results from symmetric function theory. We also introduce more general families of measures given by class functions, and analyze the associated Metropolis chains using the so-called path method. In particular we give a small degree polynomial bound for the uniform sampling chain on derangements, based on the random transposition walk. We will also mention a few open problems towards the end.

125 *Nondefective Secant Varieties of Split Varieties*, **DOUGLAS A TORRANCE** (Department of Mathematics, University of Idaho, 300 Brink Hall, Moscow, ID 83844; torrance@vandals.uidaho.edu).

Suppose R is the polynomial ring in n+1 variables with coefficients in an algebraically closed field of characteristic zero k. The set of all homogeneous polynomials in R of degree d can be considered as a vector space over k. By considering two nonzero polynomials to be equivalent if they are scalar multiples of each other, we can define a projective space. The split variety, or variety of completely decomposable forms, consists of all points in this projective space which correspond to polynomials that are the product of d linear factors.

For every s distinct points lying on this variety, there is an (s-1)-plane containing them. We define the closure of the union of all these (s-1)-planes as the secant variety. We expect that the secant variety of a split variety will either fill up the projective space or have dimension $s(dn+1)$. In this case, the secant variety is said to be nondefective. Otherwise, it is said to be defective.

It is conjectured that the secant variety to a split variety will be defective if and only if $d = 2$ and $2 \leq s \leq n/2$. It remains to show that the remaining cases are nondefective. In this talk, we discuss new results in this area.

Mathematics oral presentations continue on Tuesday. Please refer to page 90 in these *Proceedings*.

CELL and MOLECULAR BIOLOGY

Tuesday, starting at 8:40 a.m. in WILLOWS 2

126 *A Role for Inflammatory Cytokines in Breast Cancer Cell EMT*, **HUNTER COVERT*, NICOLE ANKENBRANDT, RANDY RYAN, and CHERYL JORCYK** (Department of Biological Sciences, Boise State University, 1910 University Drive, Boise, ID 83725; Huntercovert@u.boisestate.edu).

Inflammatory cytokines are expressed in high levels during breast tumor development. Tumor cells, as well as monocytes, macrophages, and neutrophils, secrete these cytokines. Our preliminary results have shown certain inflammatory cytokines cause an increase in cell detachment as well as a change in morphology. The change in cell morphology can be studied by looking at cellular markers which are expressed when a cell displays an epithelial or mesenchymal

phenotype. Important epithelial markers include E-cadherin and α-catenin, which are both cell-cell adhesion proteins that are down regulated in the presence of inflammatory cytokines. Mesenchymal markers such as vimentin, fibronectin, and N-cadherin, which are important for cellular flexibility, are upregulated in the presence of inflammatory cytokines. Downregulation of epithelial markers and an upregulation of mesenchymal markers in conjunction with a change in cellular morphology is a hallmark for epithelial-mesenchymal transition (EMT). Once a cell transitions to a mesenchymal phenotype it is able to metastasize to different locations in the body. After extravasation, cells arrive at their secondary location where they will undergo mesenchymal-epithelial transition (MET), which is a reverse EMT to establish a secondary tumor. This metastatic process presents major challenges for the treatment of breast cancer. Targeting inflammatory cytokines that promote EMT would be beneficial in preventing metastasis.

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127 *The Role of Autophagy in the Development and Treatment of Colon Cancer*, **TOM DONNDELINGER* and JOELLA SKYLES** (Department of Pathology, St. Alphonsus Hospital, 1512 12th Ave Rd, Nampa, ID 83686; tdonndel@bi-biomics.com).

After implementation of updates to the 120-year-old biopsy process, newly achieved tissue detail revealed a complex system of cell recycling in the intestinal crypts of the colon. This autophagic system involves the migration of cells up the side of the crypt and, rather than being shed, they enter autophagocytosis. After entering autophagocytosis, an autophagic vacuole forms in the cell after which it migrates through a pore in the basement membrane where the vacuole can then be enveloped and digested by the macrophage. A healthy colon is able to dissemble aged cells into amino acids, peptides, and other materials to be recycled for use in other cells.

When a signaling error occurs which prevents the migration of cells through the basement membrane during autophagy, the cell cannot be effectively recycled but instead remains at the top of the intestinal crypts where it then continues the autophagic system. The resumption of autophagy causes replication of a dysfunctional cell and the development of an adenomatus polyp with pre-cancerous features such as an enlarged nucleus. Ultimately, it is the disruption in the cycle of autophagy that acts as the first step in the development in colon cancer.

By understanding the role autophagy plays in early stage colon cancer, new treatment alternatives emerge that involve the manipulation of this autophagic system. Clinical trials could then focus on drugs, such as chloroquine, designed to silence the autophagic signaling in dysfunctional cells in effort to halt the persistence of select abnormal cells.

128 *Quantitative Evaluation of the Inductive Effects of OSM-Signaling on Breast Cancer Metastasis to Bone*, **JIM MOSELHY[1]*, KEN TAWARA[1], JEFF REDSHAW[1], CELESTE BOLIN[1], ROBIN ANDERSON[2], and CHERYL L JORCYK[1]** ([1]Department of Biological Sciences, Boise State University, Boise, ID 83725; [2]Peter MacCallum Cancer Centre, Melbourne, Victoria, Australia, 8006; jimmoselhy@boisestate.edu).

In humans, bone is the most frequent site of metastasis of breast cancer affecting approximately 75% of patients with the disease. To better understand the underlying pathological mechanisms driving breast cancer progression and metastasis to bone, we have sought to shed light on the role of signaling via the IL-6 family pro-inflammatory cytokine, oncostatin M (OSM) and its receptor (OSMRb). We have developed a mouse model of bone-metastasizing breast cancer using the bone-homing murine breast cancer cell line 4T1.2. Stably transfected 4T1.2 cell lines with knockdown expression of OSM (4T1.2-OSM) and the respective vector-transfected control 4T1.2-lacZ were injected into the 4th mammary fat pad of Balb/c mice. Spines were harvested from sacrificed animals and genomic DNA extracts prepared. Real-time quantitative polymerase chain-reaction (qPCR) was performed on the extracts using primers specific for neomycin (Neo) as the reporter gene and vimentin (Vim) as the housekeeping gene. Bone metastasis was assessed by the relative tumor burden using the comparative (DDCt) method referenced against genomic DNA derived from the parental cell lines. To further examine the effects of OSM-signaling on breast cancer metastasis to bone, a tetracycline-inducible lentivirus vector was prepared incorporating mouse OSM (mOSM) gene in order to test the effects of temporal modulation of OSM levels on bone metastasis. Results from our experiments will help to establish the impact of tumor-derived OSM on breast cancer metastasis to bone.

Funding for this project is gratefully acknowledged under the following grants: American Cancer Society: ACS RSG-09-276-01-CSM; Susan G. Komen for the Cure: KG100513; National Institute for Health Sciences: NIH/NCRR P20RR016454.

129 *A Molecular Mechanism for Metastatic Breast Cancer-Mediated Bone Destruction*, **KEN TAWARA* and CHERYL JORCYK** (Department of biological sciences, Boise State University, 1910 University Drive, Boise, ID 83725; kentawara@boisestate.edu, cjorcyk@boisestate.edu).

One of the end-stage clinical manifestations of metastatic breast cancer is osteolytic bone metastases that leads to pathologic fractures, spinal cord compression, intense pain, reduced mobility, and complications associated with hypercalcemia. In normal bone there is a balance of activity between the cells that make bone, osteoblasts; and the cells that degrade bone, osteoclasts. However, metastases to bone disrupt this balance, which result in uncontrolled osteoclast activity and bone destruction. Palliative therapies such as bisphosphonates slow down bone degradation by inhibiting

osteoclast activity but do not prevent bone metastases from forming. Immune related cytokines such as oncostatin M (OSM) and transforming growth factor beta, have been shown to inhibit proliferation of breast cancer cells while promoting characteristics related to invasion and metastasis. These factors have also been demonstrated to increase osteoclast differentiation in normal bone and increase osteolysis. Osteoclasts can be differentiated from the hematopoietic stem cells in the bone marrow (BM) or from the peripheral blood mononuclear cells (PBMC). Recent studies propose that in bone metastases, PBMC-derived osteoclasts may play a bigger role in bone destruction compared to BM-derived osteoclasts. To investigate the ability of bone metastatic breast cancer cells to differentiate preosteoclasts, BM cells and PBMCs have been cocultured with various mammary tumor cell lines and treated with OSM, and results will be discussed. This research could lead to the development of OSM suppression therapies in breast cancer patients, which could reduce the incidence and severity of bone metastases and reduce patient morbidity.

Funding provided by NASA NNX10AN29A; INBRE (NIH/NCRR) NIH/NCRR P20RR016454 & P20GM103408; Komen KG100513; ACS RSG-09-276-01-CSM.

130 *Inflammatory Monocyte Populations During Liver Regeneration*, **STEPHANIE WYLER* and KRISTEN MITCHELL** (Department of Biological Sciences, Boise State University, 1910 University Drive, Boise, ID 83725; stephaniewyler@u.boisestate.edu).

The liver is one of the few organs capable of complete regeneration. The best-studied experimental model for liver regeneration is 70% partial hepatectomy (PH), in which two-thirds of the liver is removed. After PH, remaining hepatocytes proliferate until the original organ mass is restored. Although the processes governing liver regeneration are not completely understood, it is well established that hepatocytes respond to soluble factors produced by nonparenchymal cells, such as Kupffer cells, which are resident macrophages in the liver. Recent studies indicate that at least two populations of macrophages can exist in the liver: F4/80+CD68+ "phagocytic" macrophages and F4/80+CD11b+ "inflammatory" macrophages. The purpose of this project was to characterize the types of macrophages in the regenerating liver, with the long-term goal of understanding the relative contributions of infiltrating monocytes and resident macrophages to regulation of liver regeneration. To this end, mice were subjected to PH, and monocytes and macrophages were isolated from the regenerating liver. Results indicate that the percentage of cells expressing CD11b increased more than two-fold 24 hr after PH, with a concomitant decrease in CD68 expression observed 24 and 36 hr post-PH. Moreover, the number of F4/80+CD11b+ cells in the regenerating liver steadily increased after PH, while the number of F4/80+CD68+ cells decreased. These results suggest that liver regeneration may depend on the recruitment of inflammatory macrophages. Future studies will investigate recruitment of inflammatory monocytes and determine if they are responsible for the production of soluble factors necessary for optimal hepatocyte proliferation during liver regeneration.

131 *Asymmetry in Chromatin Patterns in All Cancer Daughter Cells*, **TOM DONNDELINGER, JOELLA SKYLES, and KAILEY TRAUTMANN*** (Department of Pathology, St. Alphonsus Hospital, 1512 12th Ave Rd, Nampa, ID 83686; tdonndel@bi-biomics.com).

By using a reengineered tissue processing methodology to achieve higher levels of histological detail, the pattern of chromatin packaging was then analyzed at 1000-1600x. Phylogenetic and histological observances indicated a predominant binary feature of chromatin in daughter cells. Once identified, these differences were then interrogated with antibodies against modified histone tails. Anti-phophorylated histone H1 clearly demonstrates a distinction between chromosome sets beginning in prophase through to metaphase and telophase. Conversely, H4 acetylated at K16 exhibit dissimilarity only in the interphase chromatin. Within these interphase cells, the nuclei of the slightly smaller daughter cells reveal more coarsely clumped chromatin both on the nuclear membrane and inside the nucleus.

The cytoplasm of daughter cells displays unique differences in reference to the degree of granulation as well as with protein expression. This process is strictly conserved and always present in malignancies, where the more undifferentiated tumors display greater levels of dissimilarity. With the advent of time-lapse fluorescence real-time microscopy, it becomes apparent that these variations between daughter cells are actually indicative of pairing.

By altering the fundamental understanding of cancer cell biology, approaches to cancer research and treatment can then be appropriately modified. The knowledge that cancer cell division is asymmetric and daughter cells are non-identical in terms of their chromatin and gene expression affects the understanding of cancer cell behavior. Cell cancer lines are poor equivalents for cancer research because cancer is dimorphic and heterogeneous in the tissue slides and future advances in cancer treatments must take into consideration both daughter phenotypes.

132 *Characterization of Lung Metastasis in an Inflammatory Cytokine Model of Breast Cancer*, **CELESTE BOLIN[1]*, JOEL GARBOW[2], KEN TAWARA[1], JEFF REDSHAW[1], ROBIN ANDERSON[3], and CHERYL JORCYK[1]** ([1]Department of Biological Sciences, Boise State University, 1910 University Dr., Boise, ID, 83725; [2]Washington University School of Medicine, 660 S. Euclid Ave., St. Louis, MO, 63110; [3]The Sir Peter MacCallum Department of Oncology, The University of Melbourne, Melbourne, St. Andrews Place, East Melbourne, VIC, Australia, 8006; celestebolin@boiosestate.edu).

Metastatic breast cancer is the most aggressive type of breast cancer with a high risk of painful and potentially fatal consequences when vital organs such as the lungs become host to metastatic lesions. It is estimated that 60 to 70% of patients with advanced disease develop metastasis to lung. The propensity of a primary breast cancer cell to colonize in the lung is suggested to be partially explained by the high inflammatory conditions that exist in the lung microenvironment. However, it is poorly understood how inflammatory mediators, such as inflammatory cytokines, expressed by the primary breast cancer cells might also affect this metastasis. In order to investigate this, we used a syngeneic mouse model of breast cancer. Mouse mammary tumor cells were implanted into the fourth mammary fat pad and metastasis to the lung was monitored *in vivo* with magnetic resonance imaging (MRI) and verified *ex vivo* by histology. The volume as well as number of lung metastases identified by MRI were quantified in mice with tumors expressing reduced levels of an inflammatory cytokine and found to be significantly lower than controls. Our preliminary lung histology results suggest that there is a high expression of tumor-associated macrophages (TAMs) at the leading edge of the lung metastases that could be influenced by the level of inflammatory cytokines expressed by these lung metastases. This study provides evidence of a novel, cyokine-mediated promotion of primary breast cancer metastasis to the lung with implications for pharmaceutical intervention.

Funding provided by INBRE NIH/NCRR P20RR016454 & P20GM103408, Susan G Komen Foundation KG100513, and the American Cancer Society (ACS) RSG-09-276-01-CSM.

133 *Modeling HIV-1 Latency in Primary Central Memory Lymphocytes*, **LAURA MARTINS*, ALBERTO BOSQUE, MARYLINDA FAMIGLETTI, PETER RAMIREZ, CAMILLE NOVIS, and VICENTE PLANELLES** (Division of Microbiology and Immunology, Department of Pathology, University of Utah, 15N Medical Dr., Salt Lake City, UT, 84112; laura.martins@path.utah.edu).

Central memory, CD4+ T lymphocytes (T_{CM}) harbor the majority of latent HIV-1 proviruses *in vivo*. We have developed a latency assay based on cultured T_{CM} cells to characterize biological processes important in the establishment and maintenance of HIV-1 latency. Using this model, we have characterized the effects of antigenic stimulation and homeostatic proliferation induced by cytokines on the latent reservoir. Antigenic stimulation through the TCR and the subsequent activation of the Lck/calcineurin/NFAT pathway reactivates virtually all latently infected cells, and successfully depletes the reservoir, but would result in cytokine storm if used in vivo. IL-2+IL-7 cytokine stimulation reactivates latently infected cells, albeit infefficiently, with concomitant expansion of the latent reservoir via homeostatic proliferation. Because both of these options are therapeutically untenable, we sought alternate approaches for reactivation of latent HIV-1.

We adapted our published HIV-1 latency model for high throughput screening of compounds with the ability to reactivate latent HIV-1. One such compound, denoted "C7", is capable of viral reactivation within 80% of latently infected cells, without global T cell activation. This result demonstrates the existence of alternative signaling pathways leading to activation of latent proviruses in primary cells. Key signaling elements controlling these pathways should be considered as novel therapeutic targets.

134 *Digging Deeper: The Immunotoxicology of Erionite*, **NASH ZEBEDEO* and JEAN C PFAU** (Department of Biological Sciences, Idaho State University, Pocatello, ID 83209; pfaujean@isu.edu).

Erionite is a fibrous zeolite with a similar morphology to amphibole asbestos fibers. Although is does have different physical and chemical properties from asbestos, it can cause malignant mesothelioma and other diseases similar to what is seen in individuals who have been exposed to asbestos. There is very little known about how erionite affects the immune system or whether it is associated with systemic autoimmune diseases. The hypothesis of this study is that erionite will activate macrophages and lymphocytes, which will lead to a production of autoantibodies similar to what has been seen in asbestos. Macrophages and lymphocyte phenotypes will be investigated using C57BL/6 mice. They will be exposed to erionite, or amphibole asbestos through intraperitoneal instillations, and the macrophage and lymphocyte populations will be counted using flow cytometry. These results will be compared between the two treatment groups along with an untreated control. Data has shown that macrophages exposed to erionite have decreased viability and increased production of TNFα. Results collected so far have shown that macrophages exposed to erionite behave in much the same way as macrophages exposed to asbestos. As more natural deposits of erionite are being discovered in both Turkey and in the US, it is important to understand the effects of erionite. Having a better understanding will help determine if any precautionary measures need to be taken prevent further exposure to erionite.

ANTHROPOLOGY and ARCHAEOLOGY

Tuesday, starting at 9:00 a.m. in WILLOWS 1

135 *Modeling Clovis Adaptive Systems: Decision-Making on the Late Pleistocene Landscape c. 13,000 ya*, **E S LOHSE** (Department of Anthropology, Idaho State University, Box 8096, Pocatello, ID 83209; lohseme@isu.edu).

Like many dimensions of human behavior during the early phases of New World occupation, interpretations of Clovis period subsistence on the Late Pleistocene landscape are highly contentious. Different researchers examining the same archaeological record have hotly debated what these

Early Paleoindians were hunting, collecting, and eating. Some argue that Clovis were quintessentially **"**large game specialists;" while others model a pattern of "generalized foraging." This debate has to be placed in an interdisciplinary research context using expertise from a wide range of natural history disciplines. Resolution also requires that we construct explicit models referencing readily accessible large heritage databases. My colleagues and I, on and off the Idaho State University campus, propose building a game simulation atop a GIS database to first test experts' propositions and then examine these against the archaeological data record. My upper division class this Fall "Paleoindian Research Issues" will be taught online, with archaeological experts helping students in a highly interactive wiki environment to build the foundation for the simulation that will then be vetted through knowledge elicitation experiments to build the necessary knowledge model conducted in the Spring. That knowledge model will be verified by archaeological experts and then used to build a simulation to direct future archaeological research aimed at exploring human use of the Late Pleistocene landscape, Camas Prairie, south-central Idaho. This ambitious project requires expertise in Paleoindian archaeology, database development, game theory, GIS, geoscience, and ecology, to adequately construct the Late Pleistocene environment.

136 *Pastoral and Foraging Economy of the Evenki: Understanding the Role of Movement in a Taiga Environment*, **KARL MERTENS* and JOHN ZIKER** (Department of Anthropology, Boise State University, 1910 University Dr, HWSC, Room 55, Boise, ID 83725-1950; karl.mertens@u.boisestate.edu, jziker@boisestate.edu).

The Evenki of Siberia, known in Alexander Pushkin's 1836 poem Exegi Monumentum as the 'wild Tungus,' were classified as a 'wandering' tribe in the Speransky administrative reforms of 1822. While mobility is a critical element of pastoral and foraging lifeways in Siberia, this research shows that, far from aimless, Evenki mobility patterns illustrate a keen sense of the environment in a series of trade-offs and a number of scales. Documenting why, when, and how people move is important for understanding perception of environment. This research addresses questions about the role of mobility in the lifeways of the Evenki of Eastern Siberia. The Evenki are integrated into market and government systems through exchange of forest products for industrially produced goods, and many Evenki are living in villages constructed during the Soviet period. A smaller number of Evenki families and individuals live in the taiga where they pursue traditional practices centering on big-game hunting, trapping fur-bearers, and gathering, with mobility facilitated by domestic reindeer, and in some cases combustion-powered vehicles. This research addresses questions about the ecological and social significance of mobility that can be applied to understanding diverse issues of indigenous rights, sustainable resource use, and cooperation. The main trade offs between reindeer herding, big-game hunting, and trapping require different kinds of mobility and trade patterns.

137 *Are Other Hominins Alive today? – The Relict Hominoid Inquiry*, **JEFF MELDRUM** (Department of Biological Sciences, Idaho State University, 921 S. 8th Ave., Stop 8007, Pocatello, ID 83209-8007; meldd@isu.edu).

The editors of *New Scientist* recently compiled their list of the ten biggest questions in human evolution. One of these puzzles is "Are other hominins alive today?" This move acknowledges a growing recognition of the ever-increasing bushiness of the hominin phylogenetic tree, and the rising number of examples of recent persistency of many hominin lineages. A half century ago, interpretations of the hominin fossil record were markedly different. Deriving from the influential evolutionary concept of competitive exclusion, it was deemed that only one species could occupy the hominin niche at any one time. From this emerged the Single Species Hypothesis. However, the hypothesis was overturned when it was recognized that African *Homo erectus* (now *H. ergaster*), a large-brained human ancestor, had coexisted with *Australopithecus* (*Paranthropus*) *boisei*, a parallel lineage of small-brained facially-robust hominins. Now numerous contemporary hominin species are known to have coexisted over the past seven million years. In addition, there are revelations of the ever more recent persistence of a number of the branches or lineages within the tree. One of the most surprising discoveries was the enigmatic "Hobbit" or *Homo floresiensis*, which survived until as recent as 18 ka. The Denisova hominins add another recent branch to the bush. The Denisova genome established this species as distinct from modern humans and Neanderthals. Might such relict hominoids lie at the root of wildman traditions, such as the Russian *almas* or the Indonesian *ebu gogo*? Is it premature to conclude that *Homo sapiens* is the last hominin species standing?

138 *Footprint Evidence of the Nguoi Rung – the Vietnamese Forest People*, **JEFF MELDRUM** (Department of Biological Sciences, Idaho State University, 921 S. 8th Ave., Stop 8007, Pocatello, ID 83209-8007; meldd@isu.edu).

The discovery of the very recent persistence of a hominin species in Indonesia (*Homo floresiensis*), and reports of ever younger dates of latest occurrence of other fossil hominins, raise interest in the potential existence of relict hominids in various corners of the globe. One region that possibly harbors an unrecognized hominid has also recently yielded several novel species of fauna – the central highlands of Vietnam. In 1982, while participating in a biological survey, Professor Tran Hong Viet, of the University of Hanoi, discovered a human-like footprint on the slopes of Chu Mo Ray, in the province of Kontum. The print measured 27.9 cm in length, 9.9 cm across the ball, and 7.1 cm across the heel.

It was photographed and cast, but only recently have quality images of these been released in the West for examination. In 2011, a documentary film crew discovered a series of three somewhat larger footprints with a step length of approximately 75 cm. These were also photographed and the clearest impression was cast. It measures 34.3 cm in length, 12.7 cm across the ball, and 8.4 cm across the heel. Breadth-to-length ratios are very similar to the footprint discovered by Dr. Viet, and atypical of human footprints. It is notably flat, but with a somewhat raised medial border at midfoot, with indication of midfoot flexibility. The toes are long and the fifth toe exhibits considerable splay. The three possible source explanations for these footprints – indigenous human, bear, or unrecognized hominid – are considered.

SOCIAL, ECONOMIC, and POLITICAL SCIENCES

Tuesday, starting at 10:40 a.m. in WILLOWS 1

139 *Fragmented Ties and the Colombian Diaspora: Considering Historical Trauma as a Factor for Mistrust, and Fragmented Solidarity*, **CAROLINA VALDERRAMA ECHAVARRIA** (Department of History, Boise State University, 1910 University Dr. , Boise, ID 83725; carolinavalderrama@u.boisestate.edu)**.**

For most immigrants, social networks at places of destination play a critical role in the adaptation, adjustment and at times the success of immigrant groups abroad. However, despite the importance that social network plays with immigrant groups in the United States, Colombian immigrant social networks fragment. Peculiarly enough, the phenomenon manifests not just in the United States but Canada and Great Britain as well. Why has fragmentation occurred, but more importantly, what has occurred in the history of this group to cause it to fragment? While scholars have begun to pay attention to the social fragmentation of Colombian immigrants and have begun the discussion as to "how" the fragmentation occurs within this group, scholars have yet to look at the "why." Thus, this interdisciplinary paper seeks to extend the argument of a socially fragmented Colombian diaspora to suggest that historical trauma further explains their fragmentation. Historical trauma a psychological term used to explain the emotional and psychological wounding over time, usually affects a large group, if unresolved the trauma manifests in depression, distancing and distrust of one another, and can lead to damaging networks, affecting families, and the community as a whole. The Colombian diaspora demonstrates symptoms of historical trauma suffering fragmentation, weak social networks, distrust of each other, and in Europe it has even manifested with families deporting one another. This paper will intertwine three different disciplinary field's history, sociology, and psychology to suggest that historical trauma may be a contributing factor to the fragmentation of Colombian social networks.

140 *Forest-Sector "Development," Flooding, and Socio-Economic Impact in Pakistan*, **JEFFREY GRITZNER** (Department of Geography, The University of Montana, 32 Campus Drive, Missoula, Montana 59812-0648; jeffrey.gritzner@umontana.edu).

This paper examines the causes and consequences of the 2010 floods in Pakistan. While monsoon patterns and unusually heavy precipitation obviously contributed to the flooding, its intensity can be attributed to massive deforestation. Owing to the unconstrained activity of the so-called "timber mafia," more than seventy per cent of Pakistan's forests were illegally harvested between 2007 and 2009—leaving only 5.2 per cent of the country with forest cover. Flood hazard increased in response to devegetation. Agriculture employs roughly forty-seven per cent of the population in Pakistan, and approximately sixty percent of the country's foreign exchange earnings are derived from the agricultural sector. Crop loss was extensive. Owing to mismanagement and the feudal character of the agricultural sector, peasants with no alternative livelihood suffered the greatest loss. In total, more than two thousand people died in the floods; twenty million were severely affected; and it is estimated that the rebuilding effort will cost some fifteen billion dollars.

141 *The Political Economy of International Aid, Industrialization and the 'Arsenic Crisis' in Bangladesh*, **CLAUDIA J CARR** (Environmental Science, Policy and Management Department, University of California, Berkeley, CA 94720; claudiacarr@berkeley.edu).

International aid institutions, and notably the World Bank, have termed the major poisoning crisis in Bangladesh a naturally occurring "arsenic crisis". Based on this assumption, hundreds of millions of dollars for research concerning such poisoning and its possible mitigation have been issued by the Bank and other agencies. Based on the similarity between arsenic and other heavy metals, along with the central role of heavy metal-polluting industries in the Bangladeshi economy, an analysis of the international aid funding for these industries strongly suggests that widespread poisoning of the Bangladeshi population is more likely related to the creation of a 'toxic soup' of heavy metals than to naturally occurring arsenic. Results of this study are industry specific and include recommendations for a resolution of the actual source and thus appropriate solutions to the crisis.

142 *Accounting Systems and High-Growth Startup Companies*, **MICHAEL LEE and SPENCER COBIA*** ([1]Department of Accountancy, College of Business and Economics, Boise State University, 1910 University Drive, Boise, ID 83725; spencercobia@u.boisestate.edu).

Accounting systems must keep with a growing company. This case study examines how a start-up company was able to support its strategic changes, expansion in size and evolution in structure with accounting systems. We evaluate the

past changes in the accounting system and propose a design to meet the future requirements of the company. To support rapid growth, the accounting system has had to evolve beyond its reporting and taxation needs to meet its future planning, monitoring and decision making requirements. We worked with the company to design a forward-looking accounting system to include a working model of a profit plan. To monitor and motivate performance, we develop a set of customer and operational measures with targets that directly linked to profitability. Finally, we demonstrate our design by showing management how it monitors the key measures, visualizes the impact on the profit plan, and assists decision making to keep company performance on track. Our case study reveals that accounting systems can and needs to change continually to support the evolution of strategy and structure in a start-up company.

MATHEMATICS

Continuing from Monday (refer to page 84 in these *Proceedings*).
Tuesday, starting at 2:30 p.m. in PONDEROSA PINES 1 & 2

143 *Cantor's Original Proof that the Reals are Uncountable*, **JASON SMITH** (College of Western Idaho, P.O. Box 3010, Nampa, ID 83653; jasonsmith@cwidaho.cc).

George Cantor's diagonalization argument for the uncountability of the Reals is well known amongst students of mathematics. We will present Cantor's first proof using pre-topological techniques.

Mathematics oral presentations continue on Wednesday. Please refer to page 92 in these *Proceedings*.

EDUCATION

Wednesday, starting at 10:00 a.m. in MERLINS

144 *Technologies of the Future: An Exploration- and Design-Based Survey Course on Modern Topics in Bioinspired Design and Nanoscale Engineering for Non-Science Majors*, **KELLAR AUTUMN[1], ANNE K BENTLEY[2], JULIO DePAULA[2], and JONATHAN B PUTHOFF[1]*** ([1]Department of Biology, Lewis and Clark College, Portland OR USA; [2]Department of Chemistry, Lewis & Clark College, Portland OR USA; jbputhoff@gmail.com).

Technologies of the Future is a novel course for non-science majors in which students participate in team-based laboratory and design projects with modern materials systems. Through lectures and assigned readings, students learn about the parallel processes of scientific innovation and product development. After learning about a phenomenon or physical principle in class, students are given the opportunity to explore it in lab and are tasked with the design of a novel device that incorporates it. During the exploration phase, instructors guide experiments on artificial muscles, superhydrophobic surfaces, dye-sensitized solar cells, or the fabrication of nanostructures. In the design phase, instructors act as "consultants", lending their expertise to students unfamiliar with engineering analysis or ancillary physical concepts. The students present and discuss their innovations in projects including a promotional video, a simulated trade show presentation, or as a provisional patent application. These open-ended summative activities are designed to leverage the diverse talents of the interdisciplinary teams of students. Modern techniques for tracking student outcomes, such as the use of classroom response systems, are utilized through out the course.

This course was made possible by grants from the Howard Hughes Medical Institute, the Keck Foundation, and the National Science Foundation.

145 *Independent Science and Engineering Research Program for High School Students*, **BEVIN C DAGLEN*, ROBERT L ORR*, KRISTEN M S MYERS*, and WILLIAM G LAMB**, (Science Department, Oregon Episcopal School, 6300 SW Nicol Road, Portland, OR 97223; daglenb@oes.edu, orrr@oes.edu, myersk@oes.edu).

Performing independent science research allows students to develop key tools for investigating complex systems and solving problems in an area of study that is relevant to their interests and life experiences. This is a core idea expressed in the Next Generation National Science Education Standards and it is an idea that is shared and supported at Oregon Episcopal School (OES). OES has been integrating science research into the curriculum since 1982 and it has developed into a middle and high school program that is fully established in the core science classes. The OES high school research season begins in September when students generate testable questions and experimental designs, then finishes in late February where students formally present their findings via poster format to judges at the OES Aardvark Science Expo (an International Science and Engineer Fair affiliated fair of 200+ projects). This presentation will briefly cover the growth of the research program, detail the current status and curricular components, and highlight the benefits we witness in our student.

HISTORY and PHILOSOPHY of SCIENCE

Wednesday, starting at 10:40 a.m. in MERLINS

146 *Histories of Conservation and Science: Comparing National Parks in Patagonian and Amazonian South America*, **EMILY WAKILD** (Department of History, Wake Forest University, P.O. Box 7806, Winston-Salem, NC 27109, wakildel@wfu.edu [Until June 30, 2012] Department of History, Boise State University, 1910 University Dr., Boise, ID 83725-1925; emilywakild@boisestate.edu [Starting July 17, 2012]).

In 1903, Argentina created South America's first national park and in the next century nearly twenty-five percent of the

continent was designated a protected natural area. Parks—and the land ethics and conservation agendas they represent—infuse the frozen Andean borders of Argentina and Chile making up the region of Patagonia and they permeate the boundary between Peru and Brazil that share, along with several other countries, the region of Amazonia. The parks form contiguous transnational swaths of nature but they exist in a historical vacuum; little is known about their comparative declaration, evolution, and meaning despite a collective consciousness at home and abroad about the extensive wilderness areas they protect. This paper provides an overview of the similarities and contrasts between nature protection in tropical and temperate South America with attention to the global trends in national parks. It argues that the role of individual scientists, state agencies, international organizations, and local stakeholders shaped conservation agendas and actions in distinct ways that serve to temper global debates about conservation refugees and exclusion. The paper gives special attention to the role of scientific research in defining—and being defined by—transnational natural areas, the significance of these areas in the constitution of national identities through frontier settlement, and the ways global exchanges shaped the categorization of landscapes and their growth as inter-connecting webs of land use.

147 *Millennial Biology: The National Science Foundation and the Life Sciences, 1975-2005*, **DONALD J McGRAW** ("Dr. Donald J. McGraw, Independent Scholar/Contractor," P.O.Box 515, Ephraim, UT, 84627; donaldmcgraw@mac.com).

At the past several meetings of the AAAS/Pacific Division, Dr. McGraw has presented several talks in a series of interim reports on the status of his book being written under contract to the National Science Foundation. In his earlier reports, the author described the contract and the research period efforts and discussions of completed draft chapters. The present report is the final in the series. It will describe work accomplished on all sections of the ten-chapter book of some 650 pages and its present status.

148 *A Novel Explanation of Creationism's Frustrating Persistence*, **LAWRENCE H WOOD** (Physicist, Retired, 8433 Camano Loop NE, Lacey, WA 98516; marylar@comcast.net).

Despite significant Scientific advances over the past 2500 years, polls continually reveal that a majority of Americans prefer Creationism, which avers that "There is no reason not to believe that God [an undetectable, supernatural "magician"] created our universe, earth, plants, animals, and people just as described in the book of Genesis (www.bestbiblescience.org/mainpts.htm)." The tenaciousness of this belief can be shown to result from a variation on the bold Jesuit claim "give me a child until he is seven and I will give you the man."

Thus "Creationism indoctrination" given young children explains Creationism's persistence; viz., the Creationism concept is relatively simple, thus, a young child can easily understand it, but hasn't enough knowledge to realize that it is preposterous. The Creationism indoctrination continues until the child reaches High School and encounters Evolution for the first time, but by then has been "brain washed" against it. This paper presents a clear explanation of Creationism's origin including its bizarre belief in a supernatural magician, something I haven't seen articulated but which aids in understanding Creationism's persistence. In addition, the futility of anti-Creationism efforts presenting "mountains of evidence" supporting science, which are unfortunately easily "cherry picked" by creationists are analyzed. Finally a clear explanation of how the Process of Evolution works which might be understandable by a young child is presented. This paper should be of interest to any Scientist interested in understanding Creationism's origin, why it is so persistent and possible techniques for changing Creationists beliefs.

149 *From 1953 Genetics: Molecular Biology to the Wider Pictures of Both Science and its Religious Basis*, **DANIELLE MIHRAM[1]* and G ARTHUR MIHRAM[2]** ([1]USC Libraries and Department of French and Italian, University of Southern California, 650 W 35th Street, Los Angeles, CA 90089-2571; [2]P.O. Box 1188, Princeton, NJ 08542-1188; dmihram@usc.edu).

The history of modern biology has been enhanced since the 1953 discovery of the double helix [James Watson, Francis Crick (plus Maurice Wilkins, Rosalind Franklin)], the physical context by which the transmission of characteristics (between successive generations) can qualify quite explicitly as the explanation for biological evolution.

We relate three post-1953 historical developments. First, the quickly ensuing (new) discipline of *molecular biology* quite naturally appeared; yet, this itself has only served as a further confirmation of Darwin's *On the Origin of Species by Means of Natural Selection*. One can now note the ensuing fascination with 'chromosomal abnormalities' present in cancers, leading to the promise of medical cures.

Second, an examination of the founding basis of the very human activity (extracorporeal model-building) has led not only to neurologist JZ Young's recognition [*Model of the Brain*] of this as the biological characteristic uniquely defining Mankind among the species but also to our consequent conclusion [*Teorema* 28(2): 35-44 (2009)] that Science is conducted, as properly implemented natural philosophy, in a six-stage model-building process (*Scientific Method*). This very process, first conducted without cognition by the 'gene pools' of each plant and animal species, has been followed by the 'higher' species of animals, those having the neural capability of memory-and-recall, to construct mental models enhancing survival.

Third, the biological/social explanation [*SIGMA XI FORUM*, *2011*] for *why the Scientific Method developed quite exclusively in the Western/Christian world* is due to its founding principle for day-to-day behaviour: Christ's Golden Rule [*MATTHEW* 7:12; *LUKE* 6:31].

MATHEMATICS

Continuing from Tuesday (refer to page 90 of these *Proceedings*). Wednesday, starting at 10:00 a.m. in PONDEROSA PINES 1 & 2

150 *Non-Hodgkin-Huxley Model of Cardiac Function*, **DAVID BLACKMAN** (Retired University of California, Berkeley and Honorary Professor, Albert Schweitzer International University; current address: 307 W 2nd St., Phoenix, OR. 97535-7733; gribear@mac.com).

There are four theorems derived from first principles, which are descriptive of cardiac function. Each theorem has real-world consequences explaining: the connection between polarization and contraction, leakage current and T wave alternans, polarization by active transport, and the origins of the ECG signal. Each of these theorems has real-world consequences. Theorems 2 and 3 elucidate the origins of arrhythmia and a treatment for arrhythmia. Since Rosenbaum's work, T-wave alternans are both a predictor of arrhythmia and the signposts to understanding arrhythmia. The most important consideration is the independence of active and passive transport of potassium ions. By exploiting this independence it is possible to get to the root of arrhythmia. This is an alternative theory to the Hodgkin-Huxley model for cellular transport. This model exploits the obvious in concert transport of all the passive channels and leads to a new mathematical construct called the Hamiltonian dynamic as an alternate explanation for cessation of passive transport.

151 *Experimentation at the Frontiers of Reality in Schubert Calculus*, **ZACH TEITLER** (Department of Mathematics, Boise State University, 1910 University Drive, Boise, ID 83725; zteitler@boisestate.edu).

How many lines meet four given lines? This is a question in Algebraic Geometry. It can be worked out by computers using Computational Algebra, including techniques such as Grobner bases. But in fact the answer was already known in the 19th century as one of the first examples of Schubert calculus. We can show (with pictures!) that the answer is two. Along the way we'll get a brief overview of these fields of mathematics.

But how many of those solutions are real, as opposed to complex? This is the subject of the Shapiro conjecture, which says that in some conditions all the solutions are real. The conjecture has been proved in some settings; it remains open in other settings, and various generalizations are also open. An intergenerational team of faculty, postdocs, and graduate students has tested (and continues to test!) the conjecture using a supercomputing network of moonlighting computers. We have computed billions of examples using over a terahertz-year of computing power, giving overwhelming evidence for the conjecture and discovering new phenomena beyond the conjecture.

152 *Driving Hazards in 2-Spheres*, **JENS HARLANDER (**Department of Mathematics, Boise State University, 1910 University Drive, Boise, ID 83725; jensharlander@boisestate.edu).

The the early 1990's Anton Klyachko discovered what he termed a "funny property of the sphere". If cars drive around the boundary of the regions in a tiling of the 2-sphere, clockwise, continuously and without stopping, then somewhere a total collision will occur. He used this observation to settle a major case of the Kervaire conjecture, stated in 1963. Klyachko's observation, which he thought of as suitable for a high school competition, turned out to be the tool needed for making considerable advances in the _field of combinatorial topology and group theory. In my talk I will explain Anton Klyachko's funny property of the sphere.

CONTRIBUTED POSTERS

PHYSICS and MATERIALS SCIENCE

153 *Pushing the Neutral Atom Microscope Past Conventional Optical Resolution*, **PHILIP WITHAM* and ERIK SÁNCHEZ** (Department of Physics, Portland State University, P.O. Box 751, Portland, OR, 97207-0751; pjw@pdx.edu, esanchez@pdx.edu).

Recent advances have made microscopy using a beam of neutrally charged gas particles a practical reality. This technique is also called Atomic DeBroglie Microscopy and Scanning Helium Microscopy. The particle energy used is under 0.07 eV, roughly 10^5 times lower energy than a typical SEM or Helium Ion microscope, resulting in a probe beam that scatters from the first atomic layer of samples, and with little chance of beam damage. Others working with molecular beam experiments have shown the potential for new science using neutral atom scattering. For these reasons, this form of microscopy has been pursued for twenty years by a number of researchers, with the first success published in 2008 by Koch, Rehbein, Schmahl, Reisinger, Bracco, Ernst, and Holst.

At our lab we developed a Neutral Atom Microscope (NAM) which produced the first images ever obtained in reflection mode from gas scattering. This has been improved to the possibly record resolution of 0.35 μm. It has allowed one

to begin exploring the unique imaging contrast mechanisms seen by gas scattering. This microscope makes no attempt to focus the beam but relies on locating the sample very close to a beam forming aperture, and mechanically scanning the sample. Continued improvement of the "pinhole" NAM has followed directions indicated by simple optimization math. Progress over the last year has validated that math and gives confidence that, if funded, the resolution can pass below 100 nm, with relatively little effort.

154 *Can Light be Used as a Sensor to Detect and Monitor the Corrosion of Metals?* **RUKMINI A RAVI[1]*, VILUPANUR A RAVI[2], and THUAN K NGUYEN[2]** ([1]Claremont High School, 1601 N. Indian Hill Blvd., Claremont, CA 91711; [2]Department of Chemical and Materials Engineering, 3801 W. Temple Ave., Pomona, CA 91768; garuda01@att.net).

Corrosion is a major engineering and economic issue confronting the world today. Worldwide losses due to corrosion cost $2.2 trillion – 3% of the world's GDP. Corrosion affects us in a number of ways, e.g., corrosion in civil structures like bridges and pipelines can cause loss of life and property, corrosion problems in the petrochemical industry can interrupt the supply of oil to the public, etc. Therefore, understanding, predicting, and preventing corrosion are very important to our society. For this project, we decided to investigate a simple method to detect corrosion using a flashlight, Light Emitting Diodes (LEDs) and a laser pointer as light sources, a solar panel as a detector and a multimeter to measure current. The current is proportional to the intensity of light coming out of the solution. I investigated metal samples corroding in salt water and in bleach solutions. We found that the flashlight was most effective in monitoring corrosion. As corrosion progressed, the light intensity dropped. This method has the potential to be implemented in industrial applications and allow for early detection of corrosion in critical components.

CHEMISTRY and BIOCHEMISTRY

155 *DockoMatic: An Education Resource for Molecular Docking and Peptide Interactions*, **KEN WEEKES*, REED B JACOB, and OWEN M McDOUGAL** (Department of Chemistry and Biochemistry, Boise State University, 1910 University dr, Boise, ID 83725; kenweekes@boisestate.edu).

DockoMatic is a software program designed to simplify the process of computational molecular docking studies. The program consists of a graphical user interface (GUI) and a suite of capabilities that can be used, in part, to facilitate job submission to AutoDock, a docking engine that calculates the Gibbs free energy of the ligand/receptor complex. Here we present a laboratory experiment that exemplifies the use of DockoMatic in the undergraduate curriculum. This exercise challenges students to analyze the crystal structure of the 16 amino acid peptide conotoxin TxIA (i.e., the ligand) bound to the pentameric AcetylCholine Binding Protein from *Aplysia californica* (*Ac*-AChBP). Students propose amino acid side chain substitutions of TxIA that will enhance binding to the receptor, create the peptide analog using DockoMatic, and perform the molecular docking calculation to compare their result to the rest of the class. Analysis of the molecular docking results will determine intermolecular forces, binding energy, and geometric orientation of the newly prepared analog with the *Ac*-AChBP compared to the original TxIA/*Ac*-AChBP crystal structure. This exercise is designed for a two hour laboratory period and can be accomplished with access to an internet connected PC.

156 *Inverse Virtual Screening using DockoMatic*, **THOMAS PEAVEY*, REED B JACOB, GREG HAMPIKIAN, and OWEN M McDOUGAL** (Departments of Biological Sciences and Chemistry and Biochemistry, Boise State University, 1910 University Drive, Boise, ID 83725; thomaspeavey@u.boisestate.edu).

Proteomics is the characterization of protein structure and function within a system. Through methods such as high performance liquid chromatography and mass spectrometry (shotgun proteomics), large numbers of proteins can be rapidly identified. The end result makes up the proteome of an organism which has many applications ranging from disease biomarker identification and disease progression to pharmaceutical treatment/research. By combining proteomics studies with high performance computational software, many combinations of protein ligand/receptor interactions and binding energies can be studied in a short period of time. DockoMatic is a user friendly suite of programs developed to perform either inverse or high throughput virtual screening (IVS or HTVS) to model ligand/receptor interactions using AutoDock as the docking engine. In addition, DockoMatic can be used to create homology models of ligands or receptors to test hypothetical interactions. Results can be quickly analyzed and aid in directing experimental research design.

157 *Utilization of Blender in Figure Generation for Biochemical Processes*, **NICHOLAS L BAKER** (Department of Chemistry and Biochemistry, Boise State University, 1910 university Drive, Boise, ID 83725; nicholasbaker1@u.boisestate.edu, owenmcdougal@boisestate.edu).

Blender is a 3D model and animations software program that has been used for its inexhaustible ability to create, modify, and display. The process of fibrillogenesis is complex and difficult to depict schematically. Blender has been used to create models depicting the process of fibril formation using pdb files of collagen I, V, XI and BMP-1 proteases. This work represents advances in modeling and visualization software to represent a complex biological process. The compatibility of blender allows it to import .wrl

files that have been converted in pymol from pdb's attained from www.pdb.org and allows the user to scale, adjust, and modify to what their intended image needs to look like. With the co-utilization of pymol I am also able to generate electron densities that can be imported and overlapped with their corresponding structure in blender. Blender performs well in expressing an idea of how molecules interact with one another not only with still images but with animation as well. Blender could be used to show nutrient/waste transfer of molecules in the cardiovascular system, or a time lapse of cancerous cell proliferation in a tissue. Once an image is generated, parts of the structures can be moved and saved in frames. If I wanted to show the creation of a collagen dimer through NPP interaction, I can save an image, move 30 frames ahead and save again. Blender then fills in the other 28 frames to allow for a smooth animation.

158 *Simple Detection of Alkaloids from* Veratrum californicum, **MAYRA ESTRADA*, CHRIS CHANDLER, JESSICA BROOKHOUSE, ASHLEY FISHER, and OWEN McDOUGAL** (Department of Chemistry and Biochemistry, Boise State University, Boise, ID 83725; mayraestrada@u.boisestate.edu).

Veratrum californicum is a plant native to the mountainous regions of the Pacific Northwest. Throughout the growth cycle of the plant, steroidal alkaloids are produced, interconverted, and ultimately degraded. Our efforts focus on evaluating the composition of steroidal alkaloids present in different parts of the plant (root, stem, or leaf) during the growth season. This effort is motivated by the recent emergence of drug studies based on synthetic derivatives of cyclopamine and veratramine, two steroidal alkaloids produced by *V. californicum*. Cyclopamine inhibits the hedgehog-signaling pathway and has been shown to diminish the growth of cancer cell lines *in vitro*. Here we describe our efforts to isolate steroidal alkaloids from the roots of *V. californicum* using ultrasonic treatment and solvent extraction. Simple separation of the steroidal alkaloids was accomplished by thin layer chromatography and the results matched to standards of known steroidal alkaloids in *V. californicum.*

ENGINEERING, TECHNOLOGY and APPLIED SCIENCES

159 *Sound-Field Mapping in Liquid-Filled Containers*, **AARON DIAZ[1]*, KAYTE DENSLOW[1], MONDELL deWAYNE WELLS[2]*, and ANTHONY CINSON[1]** ([1]Pacific Northwest National Laboratory, P.O. Box 999 Richland, WA 99352, aaron.diaz@pnnl.gov; [2]Department of Mechanical Engineering, Maseeh College of Engineering and Computer Science, Portland State University, Post Office Box 751 Portland, Oregon 97207-0751, mondell@cecs.pdx.edu).

The purpose of this study was to map the sound field produced by externally applied transducers in liquid-filled containers. Trials were conducted using a 500-kHz transducer, to better understand sound-field propagation in various containers. Sound-field maps were generated by introducing the sound field of an ultrasonic pulse through both steel and high-density-polyethylene (HDPE) 55-gallon drums containing water. The sound fields were captured in both horizontal and vertical drum orientations. First, the necessary amount of pressure required when forming a dry coupling between the transducers and the drum was quantified. This was accomplished by comparing the amplitude of the original signal to the correlating pressures. For the pressure tests a single-element, contact, 750 kHz ultrasonic transducer was used. Then, the water-filled drums were scanned using a computer-controlled track scanner to receive the ultrasonic pules at the opposite end of the sound field. These scans produced a visual cross-section of the sound-energy distribution.

160 *Current Transmission Hysteresis in Electron Hop Funnels*, **MARCUS PEARLMAN*, TYLER ROWE*, and JIM BROWNING** (Department of Electrical and Computer Engineering, Boise State University, 1910 University Drive, Boise, ID, 83725; tylerrowe@u.boisestate.edu, marcuspearlman@u.boisestate.edu).

Electron hop funnels have been constructed out of Low Temperature Co-fired Ceramic. Electron hop funnels are dielectric materials formed into a funnel shape. Electrons are emitted into the wide end of the funnel, current is sustained along the funnel wall by secondary electron emission, and electrons "hop" along the wall towards the exit. Hop funnels can be used to improve the performance of field emitter arrays (FEAs) by enhancing uniformity and spatial distribution of the transmitted electron beam. Hop funnels can also allow for the use of FEAs in microwave electron devices, and are a promising new method to measure secondary electron yield.

An integral part of the funnel is an electrode (hop electrode) placed around the exit of the funnel. The electrode provides the electric field necessary to extract electrons from the funnel. A comparison of the potential on the hop electrode versus the current transmitted through the hop funnel (I-V characteristic) is an important measurement of hop funnels. This I-V characteristic has been simulated and measured experimentally.

These funnels have been modeled using the particle trajectory code Lorentz 2E which has been modified to describe the electron hopping transport mechanism. Initial simulations of these hop funnels did not appropriately model a hysteresis seen in experimental measurements of the I-V characteristics. The method used to simulate the funnels has been modified to properly model the observed hysteresis and help explain the source of hysteresis. The method and results of these simulations will be presented and compared to experimental results.

161 *The Impact of Traffic and Heavy Vehicles on Air quality: A Case Study in Portland, Oregon*, **ADILENE AMARO-ZURITA** (Department of Civil Engineering, Portland State University, Engineering Building Suite 200, 1930 SW 4th Ave. Portland, OR 97201; ceedept@cecs.pdx.edu).

Air quality in traffic corridors are affected by traffic volumes and the types of vehicles used. Persons that use these corridors as public transit users, pedestrians, and cyclists are exposed to air pollutants that can adversely affect human health such as particulate matter, carbon monoxide, and carbon dioxide. This case study is looking at the impacts of congestion, traffic volumes and weather variables on the levels of $PM_{2.5}$, PM_{1}, PM_{10}, and Ultrafine particles. Particulate matter is fine particles that can be found in the air and smoke. Because of its microscopic size, it can pass through the nose, throat, and deep into the lungs and across the lungs into cardiovascular system and aggravate heart and lung diseases. The objective of this research is to try explain changes in level of $PM_{2.5}$, PM_{1}, PM_{10}, and Ultrafine particles as a function of traffic and weather variables. Some of the equipment used for data collection was:

- The Wavetronix sensor, which is a radar unit, were used to measure traffic volumes of cars and heavy vehicles at the intersection.
- Dustrak Aerosol monitors were used to measure particulate matter levels.
- A Young Ultrasonic Anemometer Model 81000 was used to measure the wind speed and direction.

The data indicate that $PM_{2.5}$ levels can be highest during peak traffic periods (e.g. 9/15/2011 data) fairly steady in other days (e.g. 9/29/11). There seems to be a correlation between $PM_{2.5,}$ PM_{1}, and PM_{10} levels, heavy vehicle traffic and wind speed.

CELL and MOLECULAR BIOLOGY

162 *Tetracycline-Inducible Overexpression of Human Oncostatin M in Breast Cancer*, **DOLLIE LaJOIE* and CHERYL L JORCYK** (Department of Biological Sciences, Boise State University, 1910 University Drive, Boise, ID 83725; dollielajoie@boisestate.edu, cjorcyk@boisestate.edu).

Oncostatin M (OSM) is a signaling factor that binds to its receptors to induce various changes in breast cancer cell growth and metastasis. We are creating stable human breast cancer cell lines that will inducibly overexpress human OSM by lentiviral transduction. Confirmation of tetracycline-inducible OSM overexpression will be determined by ELISA. The cell lines will be further characterized *in vitro*. *In vivo*, these cells will allow us to evaluate the effects of OSM on breast cancer metastasis.

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163 *In Vitro Investigation of Cytokine-Induced Osteoclastogenesis by Mammary Tumor Cells*, **ERIK STOLL*, CELESTE BOLIN, and CHERYL JORCYK** (Department of Biological Sciences, Boise State University, 1910 University Drive, Boise, ID 83725).

Breast cancer metastasis to bone often results in a pathological condition that can cause bone degradation and pain. These metastases disrupt normal bone homeostasis, which is regulated by bone forming osteoblasts and bone resorbing osteoclasts. In particular, breast cancer metastases promote the differentiation of preosteoclasts to mature osteoclasts during the process of osteoclastogenesis.

Previous results from our lab have shown that an IL-6 family cytokine member can promote osteoclastogenesis in *in vitro* models of breast cancer metastasis to bone. Specifically, we have shown that the mechanism of this cytokine-induced increased osteoclastogensis is through an increase in growth factor secretion by mammary tumor cells. These in vitro studies were performed with mouse mammary tumor cells in co-culture with mouse preosteoclast cells. To investigate the importance of tumor cell-secreted factors versus membrane bound factors on the promotion of osteoclastogenesis, we performed a transwell experiment in which mouse mammary cells were separated from mouse preosteoclast cells by a 0.4 μm porous membrane. The mouse mammary cells were pre-treated with a neutralizing antibody for growth factors of interest, and osteoclastogenesis was measured by tartrate-resistant acid phosphatase (TRAP) staining, a marker for mature osteoclasts. Results from this study further our investigation on the importance of direct cell-to-cell contact in cytokine-induced osteoclastogenesis.

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164 *The Effect of JMJD Inhibitors on Head and Neck Cancer Cell Proliferation*, **MARIA VIDAL*[1], NAILAH WADE*[1], DAVID BAE[2], ERIC TANG[2], CUN-YU WANG[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program; [2]UCLA School of Dentistry, 10833 Le Conte Avenue, 63-007 CHS, Los Angeles, CA 90095; mariavidal95@yahoo.com, nsolufemi@hotmail.com).

Jumonji domain (JMJD) proteins can demethylate lysine or arginine residues on histones and have been found to play an important role in development and cancer.**Objective:** To examine how two JMJD2 inhibitors, A70 and SD70, affect proliferation of two established squamous cell carcinoma (SCC) cell lines SCC1 and SCC23. **Methods:** To determine effects on proliferation, proliferation assay was performed whereby SCC cell lines were grown on 6 well dishes with or without inhibitors and cell number was counted daily using a hemacytometer for four days. To analyze protein expression, western blot analysis was performed on cells from day four. To identify the progression of cell cycle upon treatment, we performed cell cycle analysis of SCC cell lines on day four. **Results:** Proliferation assay revealed that both JMJD2 inhibitors A70 and SD70 drastically

inhibited cell proliferation of both SCC1 and SCC23 cells. Cell cycle analysis showed that the inhibitors affected cell cycle progression of both SCC1 and SCC23 similarly in that the percentage of cells in S and G2 phase increased at the expense of those in G1. **Conclusion:** Based on our data, JMJD2 inhibitors A70 and SD70 can effectively inhibit SCC proliferation and can possibly be a target for the treatment of head and neck cancers.

165 *Role of IL-6 Family Cytokines in Breast Tumor Cell Expression of VEGF*, **MADHURI NANDAKUMAR*, DANIELLE HEDEEN and CHERYL JORCYK** (Department of Biological Sciences, Boise State University, 1910 University Drive, Boise, ID-8372; madhurinandakumar@u.boisestate.edu).

OSM is a multifunctional IL-6 family cytokine produced by many cells including human T-Lymphocytes, neutrophils, macrophages and monocytes. Studies from our lab and others provide evidence that OSM plays an important role in tumor progression through stimulation of detachment, invasion *in-vitro* and induction of the pro-angiogenic factor, vascular endothelial growth factor (VEGF). Our current studies were designed to determine differential secretion of VEGF in breast cancer cells induced by IL-6 family cytokines. Our results indicate an increased secretion of OSM-induced VEGF. Effect of these inflammatory cytokines on endothelial tube formation and neo-vascularisation, *in vivo,* were also measured. Our results also provide insight into the effects of inflammatory cytokines on inducing important transcription factors. These results may provide important insight into understanding signaling pathways involved in cytokine-mediated VEGF induction.

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166 *Parathyroid Hormone Related Protein (PTHrP) Regulates Expression Of Estrogen Receptor In Bone And Breast*, **KELSEY BRUCH, HANNAH DYAR* and MINOTI HIREMATH** (Department of Biological Sciences, Boise State University, 1910 University Drive, MS1515, Boise, ID 83725; Hannah.dyar@gmail.com, kelseybruch@u.boisestate.edu and minotihiremath@boisestate.edu).

Parathyroid Hormone Related Protein Protein (PTHrP) acts as a local cell-signaling factor to regulate mammary development in the embryo. PTHrP is required for formation of the mammary mesenchyme, which is a collection of stromal cells that condensed around the invading epithelial component of the mammary gland. Mammary mesenchymal cells express specific proteins including estrogen receptor (ER). ER expression is abolished in *PTHrP*$^{-/-}$ mice and is expanded to the ventral dermis by overexpression of PTHrP. To determine if PTHrP regulates ER expression in other systems, we harvested RNA from PTHrP-treated and untreated osteoblasts. ER expression was analyzed by semi-quantitative PCR. Our preliminary results show that PTHrP treatment results in a 2-fold increase in ER levels. To determine if PTHrP affects ER protein, we treated T47D and MCF7 breast cancer cells with PTHrP for 24 hours. Immunofluorescence and Western blotting indicated that PTHrP increases ER protein expression in these cells. Taken together, out studies suggest that PTHrP regulates ER expression in bone and breast. Declining levels of estrogen are implicated in the etiology of postmenopausal osteoporosis. Our data suggests that exogenous PTHrP is a novel potential treatment to sensitize osteoporotic bone to declining estrogen levels by increasing the expression of ER. Moreover, we predict that PTHrP treatment could also be used as an adjuvant therapy to sensitize breast cancers to Tamoxifen, an anti-estrogen currently widely used as a treatment for breast cancer.

167 *Does Oncostatin M Induce Morphological Changes in Human Breast Cancer Cells?* **NICOLE ANKENBRANDT*, HUNTER COVERT, and CHERYL JORCYK** (Department of Biology, Boise State University, 1910 University Dr., Boise, ID 83725; nicoleankenbrandt@u.boisestate.edu).

Currently in the United States, 1 in 8 women are at risk of acquiring breast cancer in their lifetime. The interleukin-6 (IL-6) family cytokine oncostatin M (OSM) was originally believed to reduce breast tumor cell proliferation, but recent data suggests that OSM may promote tumor metastasis by breaking cell-cell adhesion. Therefore, it is the research goal of this lab to determine the mechanisms behind the disease and to examine the effects of OSM on the morphological changes of the human breast cancer cell lines, MCF-7 and MCF-7 luc. One of the proposed mechanisms for tumor metastasis utilizes the process of tumor cell detachment and change in morphology. We hypothesize that OSM promotes cell detachment by reducing cell-cell adhesion proteins such as E-cadherin and α-catenin. This hypothesis will be tested by observing morphological changes with and without OSM and immunocytochemistry (ICC) of E-cadherin and α-catenin along with phalloidin staining for actin. Actin filaments provide mechanical support for cells, as well as determine their shape, and allow for division and migration. These studies will allow us to understand the mechanism by which OSM leads to inhibited breast tumor cell proliferation and yet increased metastatic potential.

168 *The Effects of Chemotherapy Drugs, Paclitaxel and Cisplatin, Combined with NAC on Pancreatic Cancer Stem Cells*, **CARLOS ANAYA[1]*, KATELYNN BARKLEY[1]*, HAN-CHING HELEN TSENG[2], GABRIELLA ORONA[2], and ANAHID JEWETT[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program at UCLA; [2]The Weintraub Center for Reconstructive Biotechnology; UCLA School of Dentistry, 10833 Le Conte

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Cisplatin (Cis) and Paclitaxel (Pac) are chemotherapy drugs used to stop cancer cell proliferation and N-Acetyl-Cysteine (NAC) is a supplemental drug used to supply nutrients to the body. Objective: To observe the synergistic effects of Cis and Pac combined with NAC, to treat pancreatic cancer stem cells (BXPC3s). Methods: BXPC3s were treated with four different concentrations (10, 20, 30, and 40 µg) of Cis, Pac, Cis+NAC (20µg), Pac+NAC (20µg). Cell death assay using flow cytometry were employed to examine the BXPC3s after a 24 hour treatment. Propidium Iodide (PI) was used because it can integrate within the cells that have a porous membrane, an indication of cell death, and allow quantification of dead tumor cells. Results: More PI was found in Cis treated BXPC3 than Pac treated BXPC3. The amount of PI decreased by 20% in Cis+NAC treated BXPC3 when compared to Cis-only treated BXPC3 and increased by 40% in Pac+NAC treated BXPC3 when compared to Pac-only treated BXPC3. Conclusion: Cis is more effective at treating BXPC3s than Pac; however, the addition of NAC inhibited the killing effects of Cis while synergistically increasing the killing effects of Pac on BXPC3s. Discussion: Since Cis and Pac have negative side effects when used to treat patients, the addition of a supplement drug NAC might help to control such negative side effects without lowering the efficiency of the chemotherapy drugs. However, further research in vivo is needed.

169 *Do Human Multiple Myeloma Cells Express IL-6 Family Inflammatory Cytokines?* **DANIELLE HEDEEN*, DOLLIE LaJOIE, and CHERYL JORCYK** (Department of Biological Sciences, Boise State University, 1910 University Drive, Boise, ID 83725; daniellehedeen@u.boisestate.edu).

Multiple myeloma (MM) is a cancer of the plasma cells, found in the bone marrow, which leads to the formation of multiple tumors in bone. Plasma cells arise from B lymphocytes, and produce immunoglobulins that help rid the body of infection. It is known that the inflammatory cytokine, Interleukin (IL)-6, is an important growth factor for human MM, and human MM cells are known to express IL-6. We hypothesize that other cytokines in the IL-6 family may also be expressed in human MM. For the model system, we are using three human MM cell lines (RPMI-8226, MM1.S, and MM1.R) grown in RPMI-1640 media with 10% FBS and penicillin-streptomycin. The secretion of IL-6-family cytokines by these three cell lines will be investigated by enzyme-linked immunosorbent assay (ELISA), reverse transcriptase polymerase chain reaction (RT-PCR), and Western blot analysis. Family member receptor expression will also be investigated by RT-PCR. Furthermore, we will investigate the effect of IL-6 family cytokines on proliferation in these MM cell lines, and vascular endothelial growth factor (VEGF) secretion by ELISA. Investigating the effects of IL-6 family inflammatory cytokines and their signaling in these cell lines will lead to a better understanding of MM biology and potentially identify novel therapeutic targets.

170 *Overexpression of SOX4 Leads to Down Regulation of UBC9*, **JOHANNA LEWIS*[1], RUBY ENRIQUEZ*[1], MIN ZHANG[2], and SHEN HU[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program; [2]UCLA School of Dentistry, Division of Oral Biology and Medicine, 10833 Le Conte Avenue, Room 63-070 CHS, Los Angeles, CA 90095; jjlewis46@gmail.com, rubyenriquez@live.com).

Sex Determining Region-Y4 (SOX4) is a transcription factor, which plays an important role in embryonic development. It is composed of three regions, High Mobility Group box (HMG), Glycine Rich Region (GRR) and Serine Rich Region (SSR). SOX4 expression was found to be deregulated in many types of cancer. However, the underlying mechanism is still not clear. ***Objective:*** To study the effects of the overexpression of SOX4 in oral cancer. ***Methods:*** Sox4-FLAG plasmid was transformed into *E. coli* cells. Plasmid DNA was purified by Maxi plasmid DNA purification kit (Qiagen). The concentration of DNA is determined by nanodrop spectrometer and the size of plasmid is confirmed by agarose gel electrophoresis. The oral cancer cell line UM1 was used to overexpress SOX4. The overexpression of SOX4 is confirmed by Western blot analysis with anti-FLAG mouse monoclonal antibody and anti SOX4 mouse monoclonal antibody, respectively. The expression of Ubiquitin Conjugating Enzyme-9(UBC9), which plays an important role in metastasis, was detected with anti UBC9 rabbit polyclonal antibody. ***Results:*** SOX4 is overexpressed in UM1 cells by introduction of SOX4-FLAG plasmid into the cells**;** the overexpression of SOX4 in cell line UM1 resulted in the down regulation of UBC9. ***Discussion:*** Further research on SOX4 for a more precise outcome of its effects may result in a possible cure for oral cancer. ***Conclusion:*** Overexpression of SOX4 might limit metastasis via down-regulation of the expression of target proteins, such as UBC9, which have a role in metastasis.

171 *TCDD Treatment Suppresses Vitamin A Storage and Activates LX-2 Human Hepatic Stellate Cells*, **WENDY A HARVEY*, JALISA J ROBINSON, REILLY J CLARK, CALEB D HUANG, and KRISTEN A MITCHELL** (Department of Biology, Boise State University, 1910 University Drive, Boise ID 83725; wendyharvey@u.boisestate.edu).

2,3,7,8-Tetrachlorodibenzo-*p*-dioxin (TCDD) is an environmental pollutant in the family of halogenated aromatic hydrocarbons. Exposure of rodents to TCDD has been shown to modulate retinol metabolism by decreasing hepatic retinyl esters, yet the mechanism by which this occurs has not been identified. In the present study, we used the

LX-2 human hepatic stellate cell line to test the hypothesis that TCDD directly affects retinol storage in hepatic stellate cells, which store the majority of vitamin A in the human body. LX-2 cells were treated with 5 mM retinol and 100 mM palmitic acid in the presence or absence of TCDD (10 nM). Intracellular lipid droplets were visualized 48 hr later by staining cells with oil red O. Results indicate that TCDD treatment abolished lipid storage in LX-2 cells. Additional studies revealed that exposure to TCDD enhanced LX-2 cell proliferation and increased markers of activation, such as expression of alpha-smooth muscle actin and production of the pro-inflammatory chemokine, monocyte chemoattractant protein (MCP)-1. However, other activation endpoints, such as production of collagen 1 and TGF-b1, were not altered by TCDD treatment. Collectively, these results indicate that TCDD treatment may directly activate hepatic stellate cells, leading to the loss of retinol storage and the acquisition of a pro-inflammatory phenotype. Enhanced activation of hepatic stellate cells might explain the dysregulation of retinol homeostasis observed in TCDD-treated rodents.

172 *Stress Enhanced Fear Learning Conditioning's Effect on Gamma-Aminobutyric Acid Type A Receptors in the Cortex*, **RAUDEL HERNANDEZ*[1], EDWARD MEYER[2], ALEXAUNDREA SMITH[2], and IGOR SPIGELMAN[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program; [2]UCLA School of Dentistry, 10833 Le Conte Avenue, 63-007 CHS, Los Angeles, CA 90095; leduar7@yahoo.com).

Gamma-aminobutyric acid type A receptors ($GABA_A$Rs), ion channels that control the flow of ions in the brain, are important drug targets that are potentially altered in response to stress. ***Objective:*** To study changes in $GABA_A$R subunits (alpha1, alpha2, gamma1, gamma2 and delta) in the cortical tissue of an animal model of stress-enhanced fear learning (SEFL). This animal model mimics human post-traumatic stress disorder (PTSD). ***Methods:*** SEFL rats (n=4) were conditioned with 15 inescapable foot-shocks (1 mA, 1 second), over a period of 90 minutes. Control rats (n=4) were not shocked, but spent the same duration of time in the conditioning chamber. After behavioral measurements were complete, the cortex was removed, microdissected, homogenized and assayed for protein concentration. The cortical tissue homogenate was then run through a polyacrylmide gel, and transferred to a polyvinyl difluoride (PVDF) membrane. The membranes were probed with primary and secondary antibodies, placed into an enhanced chemilumescent (ECL) substrate, exposed, and developed as Western blots. This process was repeated for each specific primary antibody for each $GABA_A$R subunit. ***Results:*** SEFL rats tended to have slightly more $GABA_A$Rs subunits in the cortex compared to control rats, however the difference were not significant. ***Discussion:*** Researching the effects of stress and anxiety on $GABA_A$Rs will help medical science understand and potentially treat anxiety disorders like PTSD. ***Conclusion:*** $GABA_A$Rs are affected by stress and anxiety, the functional changes in the brain need to be further studied to identify the mechanisms of how stress induces changes to $GABA_A$Rs subunits in the cortex.

173 *Stimulation of Adenosine A_1 Receptors in the Nucleus Accumbens Reduces Dopamine D_1 Receptor-induced Reinstatement by Antagonizing D_1-mediated Enhancements in Glutamate Transmission*, **BENJAMIN D HOBSON*, CASEY E O'NEILL, and RYAN K BACHTELL** (Department of Psychology and Neuroscience and Center for Neuroscience, University of Colorado Boulder, UCB 345, Boulder CO 80309-0345; Benjamin.hobson@colorado.edu).

Cocaine is a psychostimulant that can lead to dependence following continuous use, resulting in an addiction that negatively affects the individual's physical, mental, and social health. The continuous potential for relapse in addicts makes treatment of cocaine addiction especially difficult. These studies seek to understand the neurobiological factors contributing to relapse using a rodent model of addiction. Stimulation of either AMPA glutamate or dopamine D_1 receptors in the nucleus accumbens (NAc) is sufficient to induce reinstatement of cocaine seeking. Identifying strategies to reduce the activity of these systems may provide insight into effective treatments. Adenosine A_1 receptors co-localize with D_1 receptors on post-synaptic terminals of medium spiny (NAc) neurons where they counteract D_1 receptor activity through opposing intracellular signaling.

Here, we investigate the interaction between dopamine and glutamate receptors and explore how A_1 receptor stimulation in the NAc may reduce D_1-induced facilitation of AMPA receptors and cocaine seeking. Specifically, we investigate the role of AMPA receptors in D_1-induced reinstatement using viral-mediated gene transfer to bi-directionally modulate AMPA receptor activity in the NAc. We also determined whether stimulating A_1 receptors in the NAc would inhibit D_1-induced reinstatement and $GluA1^{S845}$ phosphorylation using a synaptoneurosome prep and subsequent western blot analysis. Our results demonstrate that stimulation of A_1 receptors decreases D_1-induced cocaine seeking as well as $GluR1^{S845}$ phosphorylation. These findings suggest that A_1 receptor stimulation reduces the activity dependent AMPA receptor trafficking that drives D_1 receptor-mediated reinstatement.

174 *Investigating the Interaction of Osteogenic Cell Sheets with Osteoblast Cells*, **EDWIN SALVATIERRA[1]*, RAJITA KODALI KANURU[2], and OGAWA TAKAHIRO[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program, UCLA School of Dentistry, 10833 Le Conte Avenue, 63-007 CHS, Los Angeles, CA 90095; [2]The Weintraub Center for Reconstructive Biotechnology, UCLA School of Dentistry, 10833 Le Conte Avenue 63-014 CHS,

Los Angeles, CA 90095; salvatierra.edwin@gmail.com).

This research's overall purpose is to improve the cohesion of titanium implants to any bone around them by using cell sheets to shorten the time needed for the cohesion to occur. ***Objective***: To examine if the presence of osteogenic cell sheets would cause a greater proliferation and differentiation in osteoblast cells when directly in contact. ***Hypothesis***: There will be an increase in proliferation and differentiation due to the greater amount of osteogenic cells and signaling between them. ***Methods***: Bone marrow cells where extracted from the femur bones of male rats and then passaged to petri dishes, where the BMC were seeded to temperature responsive culture dishes. The T.RC dishes were each split, individually, into two groups; the cell sheet alone and the cell sheet with direct contact with BMC. The assays used were WST-1, water-soluble tetrazolium salt, measuring cell proliferation and cell metabolic activity, Von Kossa staining, Alkaline Phosphatase staining and calcium quantification, measuring cell differentiation. ***Results***: WST-1 results for the 3, 24 and 48 hours showed an estimated gain from 7% to 29% in cellular metabolic activity when the cell sheet was added with the BMC. Likewise the Calcium Quantification assay also demonstrated a greater calcium deposition at day 10 when cell sheets were combined with BMC. Both the Von Kossa and Alkaline Phosphatase showed a greater staining when the cell sheet and BMC were together. ***Conclusion***: There is a greater synergistic effect after co-culturing the cell sheets and BMC together over just the osteogenic cell sheet alone.

175 *The Effects of Bmi-1 in Pulp Cells*, **LAUREN WILLIAMS*[1], KATHERINE CATALAN*[1], ZI XIAO LIU[2], JU EUN OH[2], SHEBLI MEHRAZARIN[2], and MO KANG[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program, UCLA School of Dentistry, 10833 Le Conte Avenue, Los Angeles, CA 90095; [2]UCLA School of Dentistry, 10833 Le Conte Avenue, Room 43-009 CHS, Los Angeles, CA 90095; lauren04377@yahoo.com, catalan_katherine@yahoo.com).

Bmi-1 is important for the self-renewal of stem cells. The Bmi-1 gene was inserted into a viral vector pBabe and the entire construct was used to infect Dental Pulp Stem Cells (DPSCs) and to generate the Bmi-1 cell line. The empty pBabe vector (B0) was utilized to generate the control cell line. The effects from the two DPSC cell lines were observed as they were treated with ionizing radiation and lipopolysaccharide (LPS). ***Objective:*** To determine whether Bmi-1 can repress cytokine production in DPSCs. ***Methods:*** Two cell lines were used: an experimental DPSC cell line expressing Bmi-1 and a control line transfected with B0. For both cell lines, the effects of ionizing radiation were compared to treatment with LPS. PCR analyses were conducted upon both cell lines for IL-6, IL-8, EZH2, p16, and JMJD3 post-transcriptional expressions in order to evaluate experimental effects of ionizing radiation as compared to treatment with LPS. Western blots were performed to evaluate the amount of different protein markers present in the cells. ***Results***: Bmi-1 over expression increased IL-6 and IL-8 expression in irradiated, non-treated, and LPS treated DPSCs. Despite having increases in these cytokines, the Bmi-1 over expression decreased p16 expression in the LPS and irradiated DPSCs. ***Conclusion:*** The over expression of Bmi-1 did not affect the rate of DPSC growth, but aided in preventing senescence, and helped to block the effects of irradiation. This indicates that Bmi-1 has the potential to prevent cytokines from developing and to protect cells from the effects of radiation.

EARTH SCIENCES

176 *Characterization of the Geothermal System near Paisley, Oregon*. **KYLE A MAKOVSKY (**Department of Geosciences, Boise State University, 1910 University Drive, Boise, ID 83725; kylemakovsky@u.boisesstate.edu).

The abundance of geothermal resources in the western United States is a direct product of Tertiary tectonics. Much emphasis has been placed on the characterization of geothermal systems of the central Basin and Range in Nevada. The goal of this project is to identify the type of geothermal resource in Paisley and place it into the larger tectonic framework.

Three main rock types exist in the Paisley area: Intermediate volcanic rocks associated with subduction and basalts and rhyolites associated with rifting processes. The intermediate rocks consist mostly of porphyritic andesites, lahars and other volcaniclastic rocks, tuffs, and dacite lava domes. All rocks in this area exhibit varying degrees of hydrothermal alteration.

Several northeast-southwest striking normal faults exist in this region. Geologic mapping here has revealed that these faults trend N30E and dip NW. Faults are important to geothermal systems because they act as conduits or pathways for fluid flow. A major normal fault controlling fluid flow in the Paisley geothermal system has been identified by a small scale gravity survey along with geologic mapping.

Aqueous geochemistry has been determined for the thermal waters of the Paisley geothermal system. The thermal waters here are abundant in SO_4^{2-}, $NaHCO_3$, Cl^-, suggesting they have both a magmatic and a meteoric signature. Basin and Range systems are typically high in $NaHCO_3$ whereas magmatic systems are typically high in SO_4^{2-}, suggesting that the geothermal system near Paisley could be a mix of these two types of systems. Geothermometers indicate possible reservoir temperatures of 160°C.

177 *Petrologic and Geochemical Evolution of Lower Oligocene to Lower Miocene Volcanic Rocks of the Western Cascades Volcanic Series, Southwest Oregon*, **JAD A D'ALLURA** (Department of Chemistry, Physics, Materials, and Engineering, Southern Oregon University, 1250 Siskiyou Boulevard, Ashland, OR 97520; rockit@dishmail.net).

Western Cascade volcanism in Southwest Oregon exhibits distinct trends from oldest (early Oligocene; ~33Ma) to youngest (early Miocene; ~23Ma) lavas and related volcaniclastic rocks. Petrologic and geochemical trends support complex histories yet are typical of eruptions through continental crust associated with subduction. Long residence time within magma chambers is reflected in the abundance of phenocrysts (normally 20-35%), complex zoning of minerals, and reaction rims. These features commonly are coupled with textures indicating periods of rapid growth and local devolitization during ascent. Assimilation fabrics and strikingly different generations of plagioclase are evident in many rocks.

Geochemical relations are consistent with evolving calc-alkaline trends dominated by fractional crystallization. Increasing silica and alkali content as well as increasing Rb, Cs, Ba, Pb and Th and decreasing Ti, Zr, Nb, Ta, Cr, Ni, and Sc are consistent with maturation of succeeding magmas. Trends, from tholeiitic to calc-alkaline rocks, follow decreasingly curved paths on AFM diagrams rather than the typical straight-line "Cascade" trend suggesting eruption through thickening and evolving crust. In general, the geochemistry of clasts in breccias units mirror trends in the lavas. Older tuffaceous rocks are dacitic while younger tuffs are rhyolitic showing variable but increasing alkali content. Atypical variations in trace elements that defy a simple fractionation model are due to assimilation of crustal material or complexities within magma chambers. Lower Miocene rocks contain a higher Mg, Cr, and Ni content and slightly fewer phenocrysts, suggesting crustal thinning, opening of conduits caused by faulting, or rapid rise of magma.

ECOLOGY, ORGANISMAL BIOLOGY, and ENVIRONMENTAL SCIENCES

178 *Characterizing a Local Model System for Studies of Ecological Stoichiometry of Trophic Interactions*, **CAROLYN F WEBER, JEFFREY P HILL, and AMOEBA** (Department of Biological Sciences, Idaho State University, 921 South 8th Avenue, Stop 8007, Pocatello, ID 83209-8007; webecaro@isu.edu).

The elemental stoichiometry of biomass and available resources play an important role in controlling how organisms interact with each other and their habitats, but the relationship between these two stoichiometries is poorly understood in terrestrial ecosystems. A first step in understanding this relationship is studying the physiological homeostasis of organisms in isolation and in mixed communities across a range of environmentally relevant resource stoichiometries. Mesocosm studies conducted in a controlled laboratory setting can potentially provide such insights, but require well-characterized and small-scale model systems. We are currently using mesocosms to characterize feeding-behaviors of organisms associated with soil mosses that are abundant in local sagebrush steppe. Physical separation and antibiotic applications have isolated a soil nematode species, and several bacterial species that can serve as their food source. Based on DNA sequencing of ribosomal RNA genes, the nematode and bacteria isolated thus far are most closely related to *Panagrolaimus detritophagus* and four undescribed members of the genus *Pseudomonas,* respectively. Efforts to obtain axenic cultures from two species of moss protonema have revealed the presence of a persistent fungal associate; coarse manipulations of light and organic carbon availability influenced the balance of moss-fungus relationships indicating that varied ecological stoichiometries exert significant control over the type of interactions (e.g. mutualistic, parasitic) between these two organisms. Identifying the nutritional requirements and elemental stoichiometries of individual organisms will provide the foundation for understanding of how nutrient availability and trophic flux of key elements contribute to species composition in local soil moss communities.

179 *Defining Microalgae Growth Conditions That Eliminate Competitive Exclusion and Maximize Lipid Production for the Purpose of Biofuel Production*, **HERBERT A POLLARD IV*, WILLIAM HEWITT*, and LUKE SUGDEN*** (Department of Biology, Boise State University, 1910 University Drive, Boise, ID 83725; bioinfo@boisestate.edu).

It has been long recognized by population ecologists that greater species diversity allows for greater biomass productions. Currently, DOE projections of algal based biofuels rest on calculation of only single species culture. Our work investigates the use of mixed species microalgae cultures to enhance potential for biomass production vs. single species cultures. We assessed microbial conditions that permit two microalgae species to grow without competitive exclusion taking place. Our approach is unique in that we will use uniculture growth constants on a limiting growth substrate gradient to determine the concentrations in which mixed-culture growth can be maintained. Our work utilizes Monod's model of growth rate on a single growth controlling substrate to define the conditions of mixed culture growth, but also investigate whether the stage of high lipid production between two microalgae can be induced at the same range of nitrogen limitation. If this condition is met, it will allow for the comparison of net lipid yields of stable mixed cultures vs. single

species cultures. Our experiments utilize the microalgae *Scenedesmus obliquus*, *Ankistrodesmus falcatus*, *Chlorella vulgaris*, and *Chlorella zofingiensis*, which have been studied at length for their high lipid yields. Growth assays were performed on our individual cultures to determine their Monod's growth constants across a NO_3^- gradient. Initial mixed cultures demonstrated that competitive exclusion took place at 2.93 mM NO_3^-. Finally, we used our generated growth constants to pair our microalgae at a specific substrate concentration to demonstrate that mixed culture growth can occur without competitive exclusion taking place.

180 *A Reconnaissance Study of Microbiota as Environmental Monitors*, **DEIRDRE McATEER*, JESSE ZANEVELD, and BECKY VEGA THURBER** (Oregon State University, Department of Microbiology, 220 Nash, Corvallis, OR 97331; mcateerdk@gmail.com).

The use of microbial and viral communities to show the risk of pathogen transmission to wildlife and humans can be conducted using marker genes that detect the presence (and, in some cases, abundance) of these microorganisms. Such comprehensive sequencing efforts are needed to more fully understand the impact microbiota have on ecosystems and regional human health. However, relatively few studies of beach microorganisms have characterized the entire bacterial and archaeal community diversity. Studying the baseline microbial populations of beaches is a key step in understanding how human impacts and climate change are affecting the communities and visa versa.

This study analyzed microbial populations from 54 samples collected from 6 sampling sites along the southern Oregon Coast. Sampling sites varied by: pH, approximate sand grain size, water content, temperature, and surrounding anthropogenic inputs. The beach microbiota was determined using DNA extraction, amplification of the small subunit (SSU) 16S ribosomal RNA gene using universal bacterial primers, high-throughput 454 pyrosequencing, and bioinformatics analysis. A total of 86,925 sequences were characterized with an average number of 3,248 reads per sample. In addition to identifying general familial branches and the dominant microorganisms present, alpha and beta diversity tests were run to identify diversity at a particular site and among the sites as a whole.

Overall, sites with similar parameters (as mentioned above) had similar communities. Additional future investigations should identify specific groups of microbes, such as fecal contaminants or other well-known sentinel species, to continue monitoring beach health.

181 *Remodeling a Model System for Studies of Ecological Stoichiometry in Plants*, **JEFFREY P HILL*, CAROLYN F WEBER, and AMOEBA** (Department of Biological Sciences, Idaho State University, 921 South 8th Avenue, Stop 8007, Pocatello, ID 83209-8007; hilljeff@isu.edu).

Ecological stoichiometry seeks to understand how interactions between organisms and their environment are shaped by the balance of chemical elements available in natural habitats relative to the elemental stoichiometry that different organisms need for life. Although pioneering research in this field began in aquatic ecosystems, the applicability of similar principles is increasingly recognized for organisms in terrestrial settings. The haploid phase of terrestrial non-seed plants is a life stage that is expected to be particularly sensitive to environmental nutrient chemistry. One of our long term study objectives is focused on using the model fern *Ceratopteris richardii* to discover how manipulations of resource stoichiometry affect elemental and physiological homeostasis in free-living fern gametophytes. Understanding how gametophytes will respond to changing nutrient levels on the planet (e.g., increasing nitrogen deposition and rising CO_2 levels) first requires a reevaluation of standard culture methods, so that plant growth and development can be characterized under more germane environmental conditions. Dilutions up to 1/1000 of the basal salt medium recommended for *Ceratopteris* culture coupled with adjustments to the nitrogen:phosphorus stoichiometry, osmotic potential (using polyethylene glycol) and ionic strength (using potassium chloride) suggest new protocols can be successfully developed to support gametophyte survival, growth and reproduction. Modifications of laboratory growth media with a balance and concentration of elements that better emulate conditions in Nature are expected to have broad relevance for linking laboratory and field studies of ecological stoichiometry.

MATHEMATICS

182 *A Radial Basis Function Partition of Unity Method for Transport on the Sphere*, **GRADY WRIGHT and KEVIN AITON*** (Department of Mathematics, Boise State University, 1910 University Dr. Boise, ID 83725-1555; wright@math.boisestate.edu, kevinaiton@u.boisestate.edu).

The transport process dominates geophysical fluid motions on all scales making the numerical solution of the transport problem fundamentally important for the overall accuracy of any flow solver. We present a new high-order, computationally efficient method for this problem that uses radial basis functions in a partition of unity framework. Results of the method are presented for several well-known test cases that probe the suitability of numerical methods for modeling transport in spherical geometries.

EDUCATION

183 *Who is Teaching with Electronic Books and Why? A Survey of Oregon State University Faculty*, **LAUREL KRISTICK* and MARGARET MELLINGER** (Oregon State University, 121 The Valley Library, Corvallis, OR, 97311; laurel.kristick@oregonstate.edu).

Oregon State University (OSU) Libraries owns over 29,000 electronic books (e-books) ranging from handbooks and encyclopedias to scholarly monographs. Several years ago, the Libraries chose to convert most journals to electronic format, and there is now a similar movement for books. To better understand the choices involved, information about how faculty currently use e-books in teaching and research was needed. The authors recently surveyed a sample of OSU faculty to determine their awareness of the Libraries' collections, their use of the collections for teaching and research, and their reasons for using or not using electronic books.

The authors will present findings from the survey related to faculty use of electronic books in teaching. The presentation will include how faculty responses varied by college and by length of time teaching at the institution, as well as the reasons given for using or not using e-books in teaching.

184 *AMOEBA: Authentic Mentoring of Engaged Biologists Alliance at Idaho State University*, **JEFFREY P HILL*, BRUCE P FINNEY, and CAROLYN F WEBER** (Department of Biological Sciences, Idaho State University, 921 South 8th Avenue, Stop 8007, Pocatello, ID 83209-8007; hilljeff@isu.edu).

This pilot project fuses teaching and research activities within a newly established mentored learning community (AMOEBA) with levels of expertise that span from undergraduate freshmen to life science PhDs. Incoming students are first invited to become "scientific learners" (i.e., to adopt the best learning practices based on data-driven evidence available in the science education literature). AMOEBA embraces a central National Science Foundation tenet that biology is a discovery science by providing students at the threshold of their higher education direct experiences in research. Student-centered learning accomplished through research-focused activities is expected to yield genuine primary data for professional dissemination in contexts where early career students can legitimately realize creative and intellectual ownership of their work. A goal for the project is to attract research-active biology faculty members, graduate students and advanced undergraduates as experienced mentors in an alliance that includes lower division biology students. Research modules link faculty expertise and interests directly with experiential learning opportunities to enhance students' understanding of core concepts and competencies that ultimately contribute to the development of lifelong biological literacy.

HISTORY and PHILOSOPHY of SCIENCE

185 *Rediscovering Emilie du Chatelet: A Scientist and Pholosophe of the French Enlightenment*, **NICHOLE SNYDER** (Department of History, Boise State University, 1910 University Drive – MS 1925, Boise, ID 83725; nicholesnyder@u.boisestate.edu).

Known primarily throughout history as the lover of Voltaire, scholars over the last decade have rediscovered the significance of Emilie du Chatelet as a contributor to scientific development in the French Enlightenment. As one of the earliest female scientists, her life illustrates that although it was difficult, it was possible for a woman to be defined by the complexity and the success of her own scientific accomplishments such as her impressive translation of Newton's *Principia* that is still in use today. Historically significant female scientists are little known prior to the twentieth century, but through comparing the way scholars have treated Emilie du Chatelet in the past and the work of historians today of the significance of her life, it is clear her image is changing. Emilie du Chatelet deserves recognition not only for her role as a philosophe in the French Enlightenment but a scientist in her own right.

ANTHROPOLOGY and ARCHAEOLOGY

186 *Investigation of Histomorphometric Values in an East Arctic Foraging Group, the Sadlermiut*, **JOSEPH PURCELL[1]*, MARGARET STREETER[1], EMILINE RAGUIN[2], BRIDGET DENNY[1], MICHELLE DRAPEAU[2], and RICHARD LAZENBY[3]** ([1]Department of Anthropology, Boise State University, 1910 University Drive, HWSC Room 115, Boise, ID 83725; [2]Departement d' anthropologie, Universite de Montreal, PO Box 6128, Station Centre-Ville, Montreal Canada, H3C 3J7, m.drapeau@umontreal.ca; [3]Department of Anthropology, University of Northern British Columbia, 3333 University Way, Prince George BC, Canada V2N 4Z9; Lazenby@unbc.ca).

A sample of second metacarpals (n=78) obtained from the Sadlermiut, Inuit (1285-1903 A.D.), a genetically isolated East Arctic foraging group, was analyzed in this study. The Sadlermiut subsisted nearly exclusively on small marine mammals and fowl. Based on known adaptations to a cold environment, a high level of physical activity and a diet high in protein, it was predicted that Inuit bones would show elevated levels of cellular activity. The size and density of secondary osteons in the Sadlermiut are used in this study to compare their bone metabolic processes with known data from a sample of Euro-Canadian metacarpals (n=63) from an historic cemetery in Ontario, Canada. Exact ages were known for the Euro-Canadian group, while the individuals in the Inuit sample are only known as young, middle and old. Student's t-tests were used to investigate variation

in histological values based on age, sex and handedness. Additionally, cross-sectional measures were compared between three groups (Sadlermiut, St. Thomas, and modern Baltimore). Differences in osteon density between the three age categories of the Inuit were found to be significant at the .05 level. Variation between right and left hands and based on sex were not significant. The Sadlermiut were found to have smaller cross-sections of bone an increased medullary area and smaller osteon density, comparatively. The decreased cellular activity in the Sadlermiut suggests that even though they had smaller cortices, they were adapted to the strain levels in their hands.

187 *Analysis of Human Remains from the Siriki Shell Mound, Northwestern Guyana*, **BEKI JUMONVILLE*, JOSEPH PURCELL, MARGARET STREETER, MARK PLEW, and CHRISTOPHER WILLSON** (Department of Anthropology, Boise State University, 1910 University Drive, HWSC room 115, Boise, ID 83725; bekijumonville@u.Boisestate.edu).

Unique in the prehistory of northeastern South America and the Guiana Shield are the shell mound sites of Guyana. Located within the northwestern part of the country, the mounds which consist of accumulations of shell refuse were utilized as living platforms and as locations for human burials. Recent excavations at the site of Siriki, the largest of the Guyana shell mounds, document multiple occupations spanning a period of 4140-270 RCYBP. The cultural material assemblage consists of 70 artifacts of the so-called Alaka Phase—a Middle to Late Holocene pattern emphasizing the use of shellfish. Excavations recovered the remains of nine individuals from different locations within the mound and spanning the temporal use of the location. Analysis indicates the presence of adults and sub-adults, at least one male individual, evidence of both antemortem and postmortem damage, and pathologies that include osteophytic lipping in vertebrae. As human remains rarely preserve in the northern Amazon this analysis will provide important baseline data relevant to a more complete understanding of the skeletal biology of regional Holocene populations.

HEALTH SCIENCES

188 *Development of a New Approach to Kill Non-Small Cell Lung Cancer with Resistance to Standard Chemotherapy*, **NICHOLAS M ANDERSON[1]*, DIANA C MÁRQUEZ-GARBÁN[1], GANG DENG[2], MICHAEL E JUNG[2], and RICHARD J PIETRAS[1]** ([1]University of California at Los Angeles, Department of Medicine, Division of Hematology/Oncology, 11-934 Factor Building; [2]Department of Chemistry and Biochemistry, 3505A Molecular Sciences, Los Angeles, CA 90095; nmanderson@ucla.edu).

Lung cancer is the leading cause of cancer-related death in both men and women. The poor prognosis of advanced non-small cell lung cancer (NSCLC) is due, in part, to the emergence of subpopulations of cells with resistance to chemotherapy. Recent data indicate that cancer stem cells (CSC) are a major component of these subsets of tumor cells responsible for drug resistance and tumor maintenance. We find these cell subsets form tumor spheres and maintain self-renewal capacity in vitro while exhibiting greater tumorigenic capability in vivo. Without eradication of these cells, most cancer therapies will ultimately fail. Use of parthenolide (PTL), a naturally-occurring sesquiterpene lactone, is able to reverse NSCLC cell resistance to cisplatin, a drug commonly used to treat cancer in the clinic. PTL treatment results in increased apoptosis and inhibition of proliferation of both isolated CSC and bulk NSCLC cells with known cisplatin resistance. These antitumor properties appear to be driven by PTL-induced inhibition of nuclear factor-κB (NF-κB), a regulator of genes involved in proliferation, DNA damage response, antiapoptosis and angiogenesis. NF-κB activation is markedly upregulated by chemotherapy and contributes to CSC survival. However, use of PTL sensitizes NSCLC cells to low concentrations of cisplatin, thus helping to reverse drug resistance. To improve targeting of CSC, we have now developed novel analogs of PTL and confirm that these new compounds have increased bioavailability and antitumor potency. We hope that these PTL analogues may prove useful in the future to treat patients afflicted with advanced NSCLC.

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189 *A Novel Method of Estimating Adhesivity of Airway Mucus Enable Investigating Its Role on Mucus Displacement during Cough Inside a Model Trachea Accurately*, **ANPALAKI J RAGAVAN[1]*, CAHIT A EVRENSEL[1,2], and PETER KRUMPE[1,3]** ([1]Graduate Program of Biomedical Engineering, University of Nevada, Reno, NV 89557; [2]Department of Mechanical Engineering, University of Nevada, Reno, NV 89557; VA Sierra Nevada Health Care Systems, 975 Kirman Avenue, Reno, NV 89502; ragavan@unr.edu).

Pathogens adhere to airway mucus before adherence to other structures in airways. Thus adhesivity of airway mucus (adhesivity) plays important role in pathogenesis and infection of respiratory tract. Adhesivity has been reported to be mediated by a multitude of factors such as storage modulus (G'), viscosity (η') and surface tension (σ_m) of mucus, surface tension of airway epithelium (σ_S), contact time (T) and contact geometry (contact area [A], contact depth [t]). Interaction among these factors that serves to demonstrate how these factors act together to enable adherence to occur has never been investigated. In this study the combined effect of multiple factors (G',η', σ_m, σ_S, T, A, t) on adhesivity to low energy surfaces was investigated using

simulated mucus(mucus) prepared similar to airway mucus of healthy individuals and patients with a wide range of airway diseases such as cystic fibrosis (CF), chronic obstructive pulmonary disease (COPD) and asthma,. Developed method was tested against adhesivity measured by a previously described method for viscoelastic materials (Majumder *et al*., *Science* 318, 258 (2007)). Effect of adhesivity on mucus displacement inside a model adult trachea during coughs of 300ms at low velocity (12±0.5ms^{-1}), generated using a computer controlled solenoid valve was investigated. Adhesivity decreased significantly with surface energy of solid and viscosity ($p<0.0001$, was independent of A or T and increased with displacement ($p<0.0001$). An optimum G' at which adhesivity may be considerably enhanced was observed. Multiple parameters influencing adhesivity were reduced to an equation of two non dimensional groups collapsing a large amount (n=667) of data into a straight line(R^2=0.996). Measured and calculated (from equation developed) adhesivity agreed adequately (R^2=0.96).

190 *New Mucomodulator Therapy for Improved Clearance of Airway Mucus during Cough Inside a Model Trachea*, **ANPALAKI J RAGAVAN** (Graduate Program of Biomedical Engineering, University of Nevada, Reno, NV 89557; ragavan@unr.edu).

Using osmolytes is simpler, effective and faster way with fewer side effects to enhance mucus clearance through hydration. The effect of combined use of osmolytes in promoting clearance of mucus during cough has not been investigated. In this study the effect on displacement of simulated airway mucus(mucus) treated with a combination solution of two osmolytes (isotonic saline solution [ISS, 3%] combined with dextrose solution [S,2%]) was compared to that treated with ISS (3%) or S (2%) alone inside a tracheal model during coughs. Mucus was prepared by cross-linking 0.01molar (M) locust bean gum solution (Sigma, St Louis, MO) with 12 ml solution of sodium tetra-borate (0.02M). The resulting mucus had rheological properties similar to respiratory secretions typical of Chronic Obstructive Pulmonary Disease (COPD) patients. Mucus thus prepared was treated with ISS (3%) or S (2%) or a combination of the two osmolytes (ISS [3%]+S [2%]). Displacement of 0.3 ml aliquots of the three types of mucus placed inside an inverted "D" shaped, horizontally oriented, Plexiglas model adult trachea (cross-sectional area of 2.44cm^2) were measured during coughs of 300 ms at iso-velocity of 12±0.5 m/s (representative of the low cough velocity of a typical adult COPD patient) generated using a computer controlled solenoid valve. Dextrose solution decreased the storage modulus (G', a measure of elasticity) of the mucus significantly ($p<0.0001$, GLMM) while ISS increased G' significantly ($p<0.05$) compared to control (untreated). Both osmolytes did not alter the viscosity of the mucus significantly. Combination of the two osmolytes resulted in an optimum G' of mucus thereby improved displacement significantly ($p<0.0001$) compared to mucus treated with either osmolyte alone or control.

191 *Tooth Micro-hardness Changes After Applying Bioactive Glass-containing, Anti-microbial Sealants*, **VALERIA URSU[1]*, JOHN C MITCHELL[2], MIKE MELANSON[3], SARA HAYS[4], SATIN SALEHI[5], JOHN ENGLE[2], WHITNEY ANHORN[6], WILL MARRA[6], CATHRINE MARTELL[6], MANSEN WANG[7], and JACK L FERRACANE[2]** ([1]Oregon State University, Biochemistry and Biophysics, 1103 West Complex, Corvallis, OR 97331-1801, valerita88@gmail.com; [2]Oregon Health & Science University, Department of Restorative Dentistry, Division of Biomaterials and Biomechanics, 611 S.W. Campus Drive Portland, Oregon 97239-3098, mitchelj@ohsu.edu, englej@ohsu.edu, ferracan@ohsu.edu; [3]Oregon Health & Science University**,** Department of Pediatric Dentistry, 611 S.W. Campus Drive Portland, Oregon 97239-3098, melanson@ohsu.edu, sara.hays12@gmail.com; [4]Sunset High School; [5]Oregon Health & Science University**,** Department of Restorative Dentistry, Division of Biomaterials and Biomechanics, 611 S.W. Campus Drive Portland, Oregon 97239-3098, salehi@ohsu.edu; [6]Oregon Health & Science University, 611 S.W. Campus Drive Portland, Oregon 97239-3098, anhorn@ohsu.edu, marraw@ohsu.edu, martell@ohsu.edu; [7]Biostatistical Analyst, Banfield Applied Research and Knowledge, Banfield Pet Hospital, 8000 NE Tillamook, Portland, OR 97213, mansenwang@yahoo.com).

The AAPD recommends placement of dental pit and fissure sealants on surfaces that are at risk or exhibiting carious lesions. These sealants may be enhanced by the addition of ion-releasing, anti-microbial filler particles of bioactive glass (BAG). We prepared novel dental pit and fissure sealant materials containing BAG fillers and tested their ability to prevent tooth demineralization in bacterial broth. We synthesized two types of BAG: BAG1 (61wt% silica - 31wt% calcia - 4wt% phosphate - 4wt% fluoride) and BAG2 (81wt% silica - 11wt% calcia - 4wt% phosphate - 4wt% fluoride). Ultraseal XT (USXT) resin without filler was supplied by the manufacturer (Ultradent Products, Inc. South Jordan, UT). BAGs were individually incorporated into the resin (25wt%) and provided handling properties similar to USXT. Caries-free teeth (n=5 each) were randomly assigned to three groups (BAG1-sealant, BAG2-sealant, or USXT) with sealants placed by the same practitioner. Teeth were half-covered by acid-resistant nail polish and immersed in a bacterial culture system of sucrose-rich brain-heart infusion (BHI) media containing *Streptococcus mutans* strain #25175, an acid-producing microbe, and incubated at 37˚C, 5%CO_2; media was changed every other day. Bacterial growth was confirmed throughout the test period. At two weeks, teeth were sectioned sagitally and microhardness testing compared changes in hardness as a function of

location on the tooth. Overall, the BAG2-sealant samples strengthened and became significantly harder than the other sample groups. (ANOVA/Tukey's; α=0.05). The inclusion of BAG as a filler component results in a harder tooth that may be better able to resist demineralization.

192 *Met and Unmet Need for Dental Services in a National Sample of Children with Varying Disabilities*, **VANESSA LAM*, JACLYN AVILA*, RICHARD MORRIS*, YAN WANG, HONGHU LIU, and MARVIN MARCUS** (UCLA School of Dentistry Post-Baccalaureate Program, Division of Public Health and Community Dentistry, 10833 Le Conte Avenue, Los Angeles, CA 90095; vanessalam.18@gmail.com, jaclynann44@gmail.com, rich.morris06@gmail.com).

Children with special health care needs (CSHCN) have unique issues when it comes to unmet need for dental care. There are over 8 million American children who are CSHCN; however, there are gaps in our understanding of the factors that are associated with unmet need. The purpose is to study the perceived met and unmet need for preventive and other dental care of children based on their caregivers' perception of their need for assistance in performing daily functions. Data were analyzed from the 2005-2006 National Survey of Children with Special Health Care Needs (NS-CSHCN), based upon interviews with 40,840 caregivers. Univariate, bivariate, and multivariate analyses using SAS were performed. The dependent variable is the need for met and unmet preventive and other dental care for CSHCN; the independent variable is the caregiver's perception of the need for assistance performing daily activities; controlling for demographics and family characteristics. About 23% of CSHCN having more debilitating conditions were more likely to have unmet need for preventive and other dental care, compared to CSHCN with less debilitating conditions. Latinos and blacks are more likely to have unmet need for both preventive and other care. Compared to children living in two-parent families, children in foster care and children in single-mother families are also more likely to have unmet dental needs. Disparities in unmet needs are found with CSHCN based on need for assistance, ethnicity, and family structure.

193 *Active Dental Caries and Adults' Use of Antidepressants in a National Probability Sample*, **OGORCHUKWU OLELE*, ADRIANNA JAUREGUI*, YAN WANG, HONGHU LUI, and MARVIN MARCUS** (UCLA School of Dentistry Post-Baccalaureate Program, Division of Public Health and Community Dentistry, 10833 Le Conte Avenue, Los Angeles, CA 90095; olele@usc.edu, adrianaj12@yahoo.com).

The National Health and Nutrition Examination Survey (NHANES) estimates that 39 million adults in the United States have untreated active dental caries. One cause of dental caries in adults is dry mouth, also known as xerostomia. Antidepressants are known to produce dry mouth. The objective of this study is to identify and examine the relationship between active dental caries and the use of antidepressants controlling for socio-demographic and behavioral characteristics. The 2007- 2008 NHANES data set used for this analysis represents 196 million adults in the United States. The dependent variable is active dental caries. The independent variable is the use of antidepressants, other medications, and no medication use. We conducted univariate, bivariate, and multivariate analysis. Although we hypothesized that antidepressants would be associated with active dental caries, it did not occur. However, taking other medications reduced the likelihood of having active dental caries by 41% in comparison to those who do not take any medications. We observed a linear relationship between active dental caries and education, controlling for age, ethnicity, smoking, and general health. Furthermore, the results corresponding to ethnicity indicated that the Latino and black populations are highly impacted by active dental caries. Those taking other medications are less likely to have active dental caries. This effect occurred even though we controlled for age, gender, perceived general health, and smoking. This opens up an area for fruitful research to determine the types of medications that are responsible for this relationship.

GENERAL and INTERDISCIPLINARY

194 *Psychostimulant Use Among College Students During Periods of High and Low Stress: An Interdisciplinary Approach Utilizing Both Self-Report and Unobtrusive Chemical Sample Data*, **RAMSEY LARSON[1]*, MIKAEL FERM[1], DAVID MOORE[1], and DAN BURGARD[2]** ([1]Department of Psychology, University of Puget Sound, 1500 N. Warner, Tacoma, WA 98416; [2]Department of Chemistry, University of Puget Sound, 1500 N. Warner, Tacoma, WA 98416; rlarson@pugetsound.edu).

The present study used both self-report measures and chemical data derived from campus wastewater samples to investigate psychostimulant use among undergraduate students at periods of high and low stress over the course of a semester. Web-based surveys were administered at three time periods: during the first week of school (Time 1; $N = 676$), midterms (Time 2; $N = 468$), and shortly before final exams (Time 3; $N = 400$). Wastewater samples were collected on campus at similar times, and the metabolites of Adderall and Ritalin were quantified through solid phase extraction and liquid chromatography-tandem mass spectrometry.

Survey results indicated that non-prescriptive use of Adderall was roughly three times higher at Time 2 than at Time 1. Although reported non-prescriptive Adderall use was also higher at Time 3 compared to Time 1, this difference was not statistically significant. Chemical sample results

roughly corresponded with these patterns indicating a 300% increase in Adderall metabolites between Time 1 and Time 2 and a nonsignificant increase between Time 1 and Time 3. Survey findings revealed no significant increase from Time 1 in non-prescriptive Ritalin use, whereas chemical analyses showed a gradual increase in Ritalin metabolites throughout the semester.

These findings shed further light on psychostimulant use patterns among college students, particularly as a function of stress, and they highlight the benefit of utilizing an interdisciplinary approach that uses both subjective and objective empirical data. The results also have implications for prevention/intervention programs on college campuses designed to reduce stress and facilitate healthier coping.

ORAL BIOLOGY and DENTAL MEDICINE

195 *The Status of Cancer Stem Cells in Multistep Oral Carcinogenesis*, **DON MACFOY*[1], CHRISTOPHER PRIDE*[1], VIKKI LEE[2], and KI-HYUK SHIN[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program, [2]UCLA School of Dentistry, 10833 Le Conte Avenue, 43-033 CHS, Los Angeles, CA 90095).

Many studies have demonstrated that only a small fraction of cancer cells is able to initiate and maintain tumor growth. These cells have been termed cancer stem cells (CSCs) due to their stem cell-like qualities such as the ability to self-renew and differentiate. For our study, we utilized the *in-vitro* multi step oral carcinogenesis model, including normal human oral kerotinocytes (NHOKs), the precancerous HOK-16B cells, and the cancerous HOK-16B-BaP-T cells. The HOK-16B cells are NHOKs that have been transfected with HPV 16 DNA and the HOK-16B-BaP-T cells are HOK-16B cells that have been exposed to Benzo(a)pyrene, a highly carcinogenic hydrocarbon found in tobacco, for six months. Due to their chronic exposure to Benzo(a)pyrene, the HOK-16B-BaP-T cells have developed tumorigenic qualities. **Objective**: This study sought to understand in which stage of carcinogenesis CSCs are generated or present. **Methods**: We evaluated CSC phenotypes in the three different cell types by performing tumor sphere formation assay and chemotherapy-sensitivity assay. We also performed quantitative polymerase chain reaction to measure various stem cell markers' expression. **Results**: The BaP-T cells demonstrated tumor sphere forming ability which is a key characteristic of CSCs while the other two cell lines did not. Furthermore, the Bap-T cells were more resistant to various chemotherapeutic drugs compared to other cell types. **Conclusion**: The data indicates that CSCs are present only in the cancerous BaP-T cell population but not in the NHOK and HOK-16B populations, suggesting that CSCs are generated at a late stage of cancer development.

196 *The Mitigation Effects of Bio-Radioprotectors Pentoxifylline and Norfloxacin on Radiated Bone Marrow Mesenchymal Stem Cells In-Vitro*, **IMANI SMITH[1]*, CECILIA REYES[1]*, YOSHIMOTO HONDA[2], SIL PARK[2], and ICHIRO NISHIMURA[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program; [2]The Weintraub Center for Reconstructive Biotechnology, UCLA School of Dentistry, Los Angeles, CA 90095; cecygrpurple@hotmail.com, iks1809@gmail.com).

Osteoradionecrosis (ORN) is a condition of improper bone healing of non-vital bone in a site of radiation injury. We hypothesized that radiation causes imbalances between bone formation and resorption through the impairment of bone marrow stem cells. **Objective**: Examine potential mitigating effects of Pentoxifylline and Norfloxacin on irradiated bone marrow mesenchymal stem cells (BMSC) that were selected from the previous high throughput drug screening. **Methods:** Mouse BMSC received 5Gy radiation and was cultured with 10 μM of Pentoxifylline or Norfloxacin. Total protein and ALP assays, and qPCR for P4H were performed to quantify proliferation, osteogenesis and fibrosis, respectively. **Results:** Protein content decreased in drug-treated radiated cells from Day 2-7 and increased from Day 7-12 with little osteogenic differentiation. Pentoxifylline increased fibrosis in radiated cells and lowered fibrosis in non-radiated cells. Norfloxacin's fibrosis effect was not significant. **Discussion:** The radiated group of cells appeared to contain substantial numbers of viable cells. Both drugs initially hindered the proliferation of radiated cells but recovered the protein measurement after the 12-day treatment. The initial decrease in proliferation might be due to selective cell cycle inhibition of radiation-damaged BMSC. **Conclusion:** Our data did not immediately support the postulated effect of these drugs on irradiated BMSC. However, the recovery of proliferation rates after 12 days of treatment may potentially indicate a late-onset mitigation effect. We speculate that therapeutic suppression of proliferation pressure may facilitate the slow recovery of radiation injury. Future studies should address optimal doses and long-term effects of these drugs.

197 *Multilocus Sequence Typing of fomA in Eight Strains of* Fusobacterium nucleatum, **CRYSTAL MACKEY*[1], AMANDA FERRER[2], MICHAELA CHANG[2], SUSAN HAAKE[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program; [2]UCLA School of Dentistry, 10833 Le Conte Avenue, Los Angeles, CA 90095; cbmackey31@yahoo.com).

Fusobacterium nucleatum is a common oral bacterium that is often viewed as a pathogen in infections such as periodontitis. *FomA* is the major outer membrane protein of *F. nucleatum*. We questioned whether the *fomA* gene could be used in an approach known as Multilocus Sequence Typing to classify *F. nucleatum* strains. **Objective:** Amplify and sequence the *fomA* gene within the given set of strains to produce a phylogenetic

molecular tree for comparison to highly conserved genes such as the *16S rRNA* gene. **Methods:** We first identified primer pairs using online databases and DNAstar software. The target genes were then amplified by PCR and analyzed by gel electrophoresis. The gel electrophoresis was used to verify the *F. nucleatum fomA* amplicon size to be 1,070 base pairs. Amplicons that were verified were submitted for DNA sequence analyses. The DNA sequences were then aligned using DNAstar software in order to produce a phylogenetic tree. **Results:** The phylogenetic molecular tree was generated with only eight strains and then compared to our previously generated phylogenetic tree of the highly conserved *16S rRNA* gene. In comparison, three out of the eight strains showed different classifications. **Conclusion:** The eight strains with fomA were able to produce a phylogenetic tree that could be used later to construct a more phylogenetically detailed tree when more strains are included. These findings indicate that the *fom*A gene sequence may be of use in the classification of *F. nucleatum* strains.

198 *Infraorbital Nerve Constriction in Rats to Quantify Neuropathic Pain Symptoms using Novel Thermal Operant Assay*, **ZAYLA COLQUITT*[1], YATENDRA MULPURI[2], and IGOR SPIGELMAN[2]** ([1]Howard Hughes Medical Institute Pre-College Science Education Program; [2]UCLA School of Dentistry, 10833 Le Conte Avenue, 63-007 CHS, Los Angeles, CA 90095; zrudyc@aol.com).

Neuropathic pain is caused by damage to the central or peripheral nervous system. We studied a rat model of neuropathic facial pain caused by chronic infraorbital nerve constriction (IoNC). The use of a thermal operant assay of pain-reward conflict paradigm is a novel approach to study facial pain symptoms. ***Objective:*** To utilize the IoNC model of chronic pain and develop, for use in our lab, the novel thermal operant assay technique in order to quantify neuropathic pain symptoms in the rat face. ***Methods:*** Rats are placed in the assay context, which measures the number of contacts the rat face makes with the thermode, the duration of contact time, and the number of licks of reward solution: sweetened condensed milk. A computer is connected the assay context and data is recorded using 9.2 pCLAMP software. Training to use the operant assay was done both at room temperature and nociceptive temperatures (45˚C and 1˚C) to record baseline values. Experimental surgeries were done for the IoNC rats (n=4), and for non-constricted control rats (sham; n=3). Post-surgical testing was done at all three temperatures. ***Results:*** The data shows that the IoNC rats experience a higher level of pain at nociceptive temperatures while the sham rats showed results that were similar to pre-surgical baseline values. ***Conclusion:*** IoNC rats, after surgery, express higher pain levels compared to sham rats at nociceptive temperatures. Currently values are not statistically significant due to small sample sizes. Further experiments will be done to increase the statistical power of analysis.

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