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

Volume 26, Part I June 17, 2007

88th ANNUAL MEETING of the AAAS PACIFIC DIVISION

PROGRAM WITH ABSTRACTS

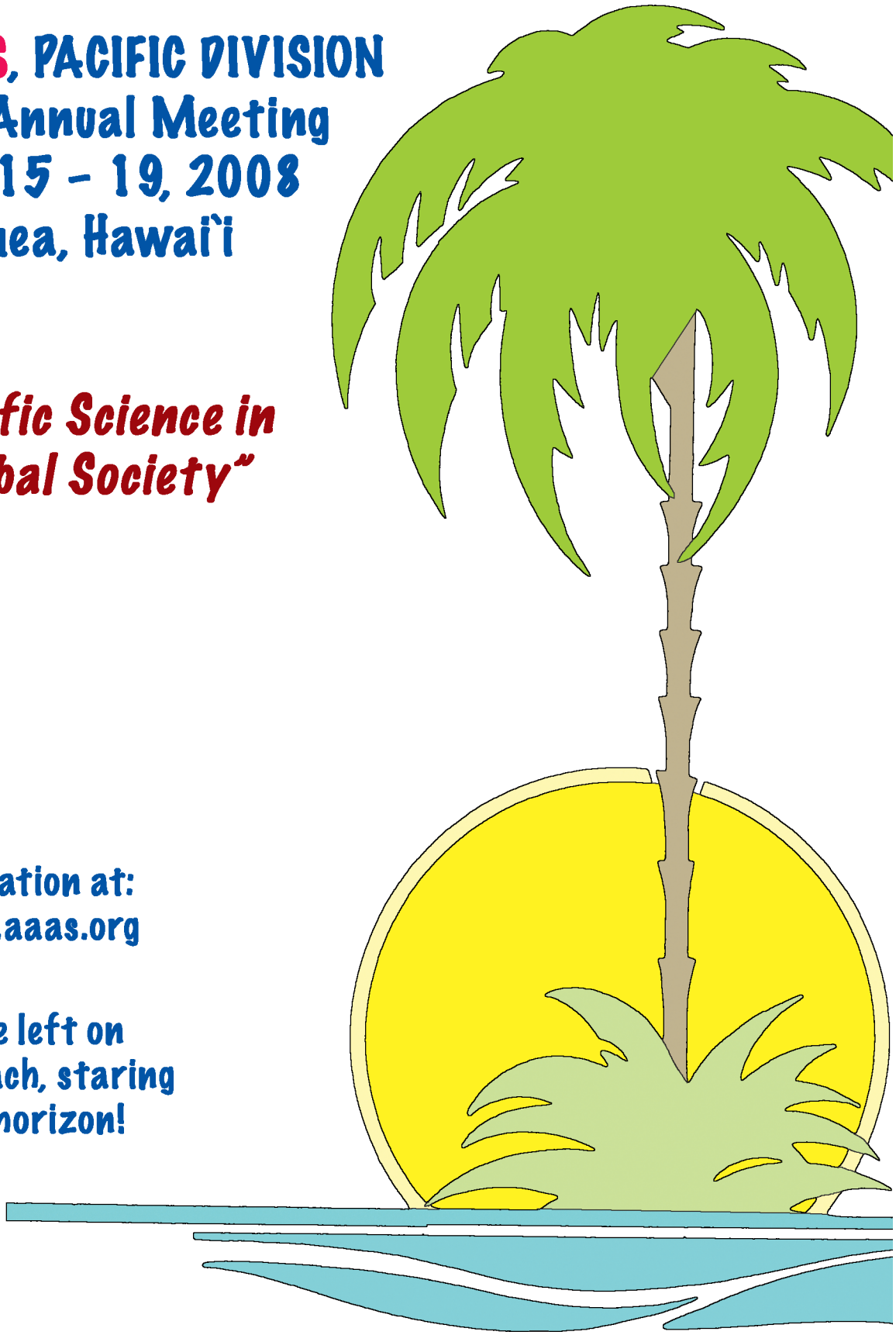
BOISE CENTRE on the GROVE
BOISE STATE UNIVERSITY
Boise, ID
June 17 – 21, 2007

TREASURING THE PAST SHAPING THE FUTURE 75 BOISE STATE UNIVERSITY

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

AAAS, PACIFIC DIVISION
89th Annual Meeting
June 15 - 19, 2008
Waimea, Hawai`i

"Pacific Science in a Global Society"



information at:
pacific.aaas.org

Don't be left on the beach, staring at the horizon!

PROCEEDINGS
of the
Annual Meeting
of the
AAAS, PACIFIC DIVISION

Volume 26, Part I **June 17, 2007**

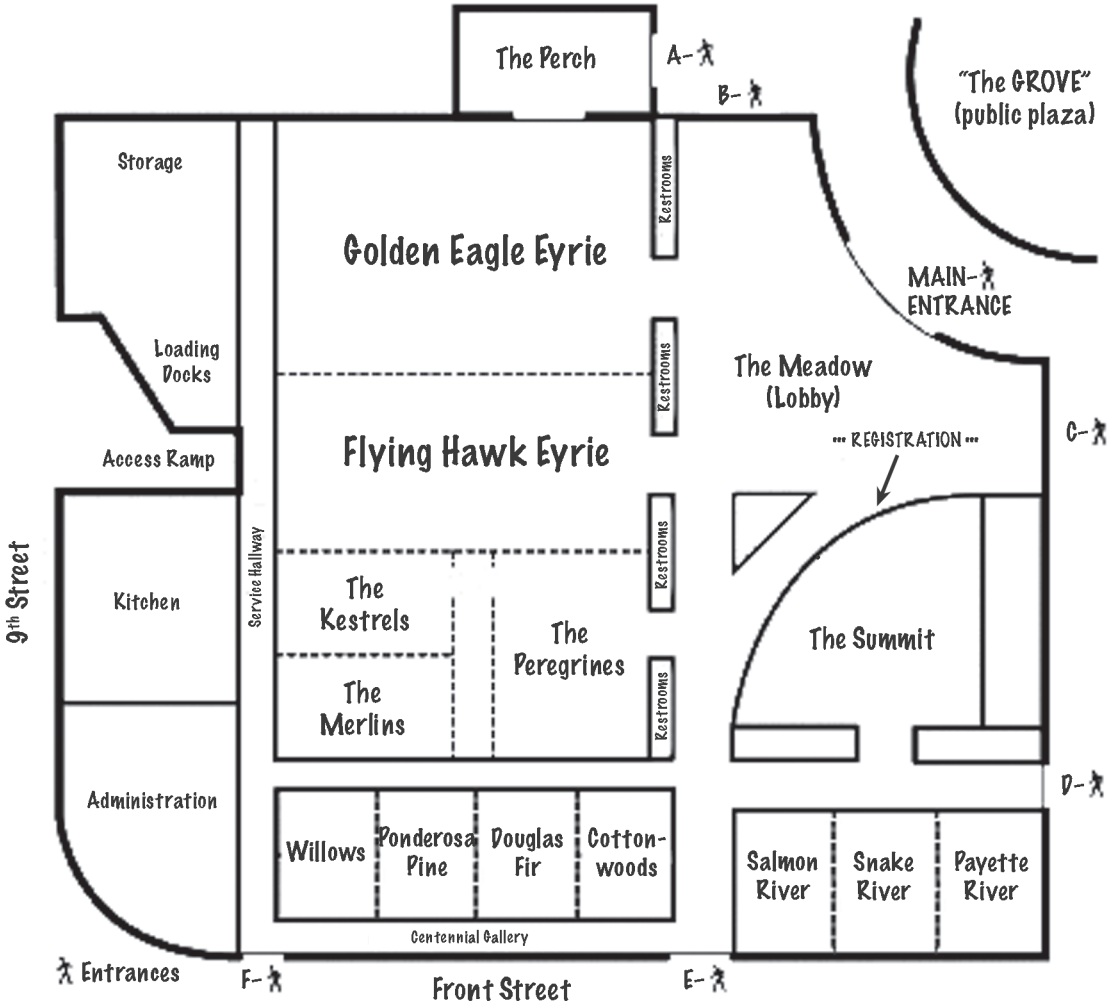
PROGRAM with ABSTRACTS

88th Annual Meeting of the Pacific Division of the American Association for the Advancement of Science

Boise Centre on the Grove
Boise State University
Boise, ID
June 17 – 21, 2007

Contents accurate as of June 1, 2007.
Times and/or locations of events may change.
Please refer to the Day-At-A-Glance for the most up-to-date information.

AAAS
ADVANCING SCIENCE, SERVING SOCIETY



Above: Layout of the Boise Centre on the Grove.

Left: Map of downtown Boise, showing the location of the Boise Centre on the Grove (black) and three public parking garages. The two garages above the Boise Centre on the map each have entries off of Idaho St. [one way to left] and off of Main St. [one way to right]. The nearest garage, just below the Boise Centre on the map, has its entry off of 9th St. Refer to the broken arrows on the maps for approximate locations of entries. Straight arrows on the map indicate direction of traffic flow on one-way streets.

CONTENTS

88th ANNUAL MEETING of the AAAS PACIFIC DIVISION

PROGRAM with ABSTRACTS

GENERAL INFORMATION

Policies 4
Governance 5
Greeting from Mr. David H. Bieter, Mayor, Boise 6
Greeting from Dr. Bob Kustra, President, Boise State University 7
Sections Sponsoring Sessions at the Annual Meeting 9
Boise and Boise State University 9
Registration 11
Accommodations and Food Service 12
Transportation and Campus Parking 12
Registration Center 12
Messages 12
Breaks 12
Meeting Rooms and Times of Presentations 13
Computers and PowerPoint Presentations 13
Poster Session 13
Student Awards for Excellence 13
Special Events 14
Public Lectures 14
Field Trips 15
Workshops 17
Program at a Glance 20

SPECIAL EVENTS and LECTURES

Sunday Evening Plenary Lecture 21
Sunday Evening Reception 21
Monday Noon Public Lecture 21
Monday Evening Plenary Lecture 21
Boise State University President's Reception 21
Tuesday Noon Public Lecture 22
Meeting of the Western Society of Soil Science 22
Reception and Student Awards Banquet 22
Meeting of the Council of the Pacific Division 22
Wednesday Noon Public Lecture 22

TECHNICAL SESSIONS

I. Symposia

Monday, June 18

Sensors and Sensor Technology* 23
The Chemistry of Advanced Nuclear Systems: Separations* 24
Soilscapes of the Western U.S.: Perspectives on Change 25
New Humanities and Science Convergences III: The Greening of the Disciplines 26
Biomedical/Bio-Related Materials, Part I 27
The Chemistry of Advanced Nuclear Systems: Separations and Environmental* 27

Tuesday, June 19

The Chemistry of Advanced Nuclear Systems: Modeling and Simulation* 28
Corrosion and Coatings Challenges in Industry 29
Infectious Disease, Part I 30
Biomedical/Bio-Related Materials, Part II 31
What Makes a Green City – The Boise Experiment 31
One Hundred Fifty Years of Human Activity in Sagebrush Steppe: Ecological and Genetic Consequences 32

Wednesday, June 20

The Chemistry of Advanced Nuclear Systems: Waste Forms* 33
Environmental Issues in Idaho: Earth, Wind, and Water 33
New Strategies for Cancer Treatment 34
Infectious Disease, Part II 35
The Great Wilderness Compromise 35

II. Workshops

Tuesday, June 19

The Winning Equation: Access + Attitude = Success in Science 37

Wednesday, June 20

Bio-Rad Genes in a Bottle™ Kit 37
Bio-Rad ELISA Immuno Explorer™ Kit 37
Bio-Rad Forensic DNA Fingerprinting™ Kit 37

Thursday, June 21

Bio-Rad Crime Scene Investigator PCR Basics™ Kit 38
Bio-Rad Protein Profiler™ Kit 38

III. Contributed Paper Sessions

Monday, June 18

Anthropology and Archaeology; Earth Sciences; Ecology and Environmental Sciences 39
Chemistry; Engineering and Industrial Sciences and Technology; Physics 39

Tuesday, June 19

Agriculture and Horticultural Sciences; Biological Sciences 40
Western Society of Soil Science 41
General and Interdisciplinary; Health Sciences; Science and Technology Education 42
History and Philosophy of Science; Psychology; Social, Economic and Political Sciences 42

IV. Contributed Poster Session

Monday, June 18

Agriculture and Horticultural Sciences 43
Anthropology and Archaeology 43
Biological Sciences 43
Ecology and Environmental Sciences 44
Health Sciences 45
Earth Sciences 45
Western Society of Soil Science 45
Industrial Sciences and Technology 46
Chemistry 46
Physics/Chemistry 47
Physics 47

ABSTRACTS 49

INDEX to AUTHORS 109

MAPS

Boise Centre on the Grove and Downtown Boise 2
Boise State University 38

*Program co-sponsored by NORM 07 and AAAS, Pacific Division.

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 are not permitted without prior approval from the speakers, organizers and AAAS, Pacific Division.

The AAAS, Pacific Division is not responsible for the accuracy of advertising information in this Proceedings. Advertising information contained herein is provided by the participating advertisers and does not constitute endorsement by the AAAS, Pacific Division.

Abstracts and summaries published in this Proceedings reflect entirely the individual views of the authors and not necessarily that of the AAAS, Pacific Division, its Council, Executive Committee or its officers. Presentation of ideas, products or publications at this AAAS, Pacific Division meeting or the reporting of them in news accounts does not constitute endorsement by the AAAS, Pacific Division.

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 this Proceedings.

Edited by Roger G. Christianson and Angela R. Christianson.
Photograph of David Bieter courtesy his office. Photograph of Bob Kustra courtesy Boise State University.
Front Cover: Boise River in the Fall. Courtesy Boise Convention and Visitors Bureau.
Printed at Valley Web Printing, 1299 Stowe Ave., Medford, OR 97501.

Planning Committee for the 88th Annual Meeting

Chair: *Owen McDougal*, Chemistry and Biochemistry, Boise State University

General Planning Support:

Janelle Brown, Office of Communications and Marketing, Boise State University
Helen Lojek, College of Arts and Sciences, Boise State University
Mike McCormick, Chemistry and Biochemistry, Boise State University
Sean Ruettgers, Chemistry and Biochemistry, Boise State University
Darcy Thie, Chemistry and Biochemistry, Boise State University
Jenny Weaver, Chemistry and Biochemistry, Boise State University

Program Development:

David Bahr, School of Mechanical and Materials Engineering, Washington State University, Pullman
Ken Baker, Boise, ID
James R. Belthoff, Biology, Boise State University
Henry A. Charlier, Jr., Chemistry and Biochemistry, Boise State University
Robert L. Chianese, English, California State University, Northridge
Jon Christensen, Center for Environmental Science and Policy, Stanford University
Robert Christiansen, U.S. Geological Survey, Menlo Park, CA
Aurora Clark, Chemistry, Washington State University, Pullman
Bill Clement, Center for Geophysical Investigation of the Shallow Subsurface, Boise State University
Ken Cornell, Chemistry and Biochemistry, Boise State University
Wibe de Jong, Pacific Northwest National Laboratory, Richland, WA
J. Thomas Dutro, Jr., U.S. Geological Survey, Washington, D.C.
Tomoko Fujiwara, Chemistry and Biochemistry, Boise State University
Robert Graham, Environmental Sciences, University of California, Riverside
Alan E. Leviton, California Academy of Sciences, San Francisco
Paul McDaniel, Plant, Soil and Entomological Sciences, University of Idaho, Moscow
Carl A. Maida, Schools of Dentistry and Medicine, University of California, Los Angeles
Abdel Salam Hamdy Makhlouf, Materials Science and Engineering, Boise State University
Sondra Miller, Civil Engineering, Boise State University
Amy J. Moll, Materials Science and Engineering, Boise State University
Jay Noller, Crop and Soil Science, Oregon State University
Stephen Novak, Biology, Boise State University
Panos Photinos, Physics and Engineering, Southern Oregon University
Shalini Prasad, Electrical and Computer Engineering, Portland State University
Morty Prisament, Tetra Tech, Boise, ID
Marcelo Serpe, Biology, Boise State University
Todd Shallet, Center for Idaho History and Politics, Boise State University

Officers of AAAS

2006 – 2007

Chairman of the Board: *John Holdren*, Harvard University and The Woods Hole Research Center
President: *David Baltimore*, California Institute of Technology
President-elect: *James McCarthy*, Harvard University
Treasurer: *David E. Shaw*, D.E. Shaw & Co., Inc.
Treasurer Emeritus: *William T. Golden*
Chief Executive Officer: *Alan I. Leshner*, AAAS, Washington, D.C.

Officers of the Pacific Division

2006 – 2007

President: *Carl A. Maida*, University of California, Los Angeles, Los Angeles, CA
President-elect: *Terrence Gosliner*, California Academy of Sciences, San Francisco, CA
Past President: *Kathleen M. Fisher*, San Diego State University, San Diego, CA
Executive Director: *Roger G. Christianson*, Southern Oregon University, Ashland, OR

Executive Committee of the Pacific Division

2006 – 2007

Robert L. Chianese, California State University, Northridge, Northridge, CA
Robert L. Christiansen, U.S. Geological Survey, Menlo Park, CA
Roger G. Christianson, Southern Oregon University, Ashland, OR
Kathleen M. Fisher, San Diego State University, San Diego, CA
Walter Carl Hartwig, Touro University College of Osteopathic Medicine, Mare Island, CA
Richard T. Koenig, Washington State University, Pullman, WA
Matthew J. La Force, San Francisco State University, San Francisco, CA
Carl A. Maida, University of California, Los Angeles, Los Angeles, CA
Owen M. McDougal, Boise State University, Boise, ID
Anne A. Sturz, University of San Diego, San Diego, CA

Counselor, non-voting:
Alan E. Leviton, California Academy of Sciences, San Francisco, CA

Council of the Pacific Division

2006 – 2007

T. Mark Aldrich, Smith College, Norhampton, MA
Michele Aldrich, California Academy of Sciences, San Francisco, CA
William B.N. Berry, University of California, Berkeley, Berkeley, CA
John J. Carroll, Davis, CA
Robert L. Chianese, California State University, Northridge, Northridge, CA
Robert L. Christiansen, U.S. Geological Survey (retired), Menlo Park, CA
Roger G. Christianson, Southern Oregon University, Ashland, OR
Lynn M. Dudley, Florida State University, Tallahassee, FL
J. Thomas Dutro, Washington, D.C.
Kathleen M. Fisher, San Diego State University, San Diego, CA
Armando J. Galindo, Robert Louis Stevenson School, Pebble Beach, CA
Terrence Gosliner, California Academy of Sciences, San Francisco, CA
Walter Carl Hartwig, Touro University College of Osteopathic Medicine, Mare Island, CA
Richard T. Koenig, Washington State University, Pullman, WA
Matthew J. La Force, San Francisco State University, San Francisco, CA
Lawrence Larsen, Bureau of Land Management, Portland, OR
Alan E. Leviton, California Academy of Sciences, San Francisco, CA
Carl A. Maida, University of California, Los Angeles, Los Angeles, CA
Owen M. McDougal, Southern Oregon University, Ashland, OR
Donald J. McGraw, Chula Vista, CA 91913
Kenneth Nishita, California State University, Monterey Bay, Seaside, CA
Henry Oman, Seattle, WA
Michael Parker, Southern Oregon University, Ashland, OR
Panos Photinos, Southern Oregon University, Ashland, OR
Anne A. Sturz, University of San Diego, San Diego, CA

David H. Bieter
Mayor

City Council

President
Elaine Clegg

Council ProTem
David Eberle

Vernon L. Bisterfeldt
Maryanne Jordan
Alan W. Shealy
Jim Tibbs

Boise City Hall
Third Floor
150 N. Capitol Boulevard

Mailing Address
P. O. Box 500
Boise, Idaho 83701-0500

Phone
208/384-4422

Fax
208/384-4420

TDD/TTY
800/377-3529

Web
www.cityofboise.org/mayor

Office of the Mayor

June 17, 2007

Dear friends:

It gives me great pleasure to welcome the American Association for the Advancement of Science Pacific Division (AAASPD) and the regional American Chemical Society (ACS-NORM) to Boise for your 2007 joint meeting. The capital city is pleased to 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 Dr. Boise, Idaho 83725-1000
Phone 208-426-1491
Fax 208-426-3779

June 17, 2007

Dear Conference Attendees:

On behalf of Boise State University, welcome to the 88th annual meeting of the American Association for the Advancement of Science, Pacific Division!

You have come to a place filled with energy and excitement. We extend to you our warmest hospitality as you gather in Boise — one of the most vibrant cities in America and home of Idaho's largest university.

As an emerging metropolitan research university, Boise State if very pleased to host the annual AAAS meetings. We are also happy to welcome the American Chemical Society Northwest Region, whose meetings are being held in conjunction with the AAAS, and whose presence certainly adds a new dimension of excitement to this annual event.

We're particularly pleased to host this important gathering as we prepare to celebrate Boise State's 75th anniversary this fall. With an enrollment of nearly 19,000 students, undergraduate and graduate programs in eight colleges and 190 fields of interest, and growing interdisciplinary research programs in nanotechnology, biomedicine, geophysics and other fields, Boise State is a university on the move. We're excited for this opportunity to welcome you as our guests during this pivotal time in our history.

During the next five days, you'll have opportunities for intellectual stimulation, cultural explorations and outdoor expeditions. From the first field trips on June 17 to the Bruneau Sand Dunes and Snake River Birds of Prey National Conservation Area, through the final symposia and workshops on June 21, there will be much to see and do. We hope you'll 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. Enjoy all that our campus and community have to offer!

Sincerely,

Bob Kustra
President, Boise State University

Courtesy Boise Convention and Visitor's Bureau

Boise Centre on the Grove

ANNUAL MEETING of the AAAS, PACIFIC DIVISION and its AFFILIATED SOCIETIES and SECTIONS at the BOISE CENTRE on the GROVE and BOISE STATE UNIVERSITY BOISE, ID June 17 – 21, 2007

GENERAL INFORMATION

Societies and Sections Sponsoring Sessions at the Boise Meeting

Western Society of Soil Science
Agriculture and Horticultural Sciences Section
Anthropology and Archaeology Section
Atmospheric and Oceanographic Sciences Section
Biological Sciences Section
Chemistry Section
Computer and Information Sciences Section
Earth Sciences Section
Ecology and Environmental Science Section
Education Section
Engineering and Industrial Sciences Section
General and Interdisciplinary Section
Health Sciences Section
History and Philosophy of Science Section
Physics Section
Psychology Section
Social, Economic and Political Sciences Section

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 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

[1]History of Boise, courtesy Boise Convention and Visitors Bureau (http://www.boise.org/static/index.cfm?contentID=30).

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 various spots 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 185,000 residents. Numerous international, national, regional and state corporations have their headquarters in Boise. Some of these include Boise (formerly Boise Cascade), Simplot Corporation, Albertson's, Micron and Washington Group International. Boise is the hub of commerce, banking and government for the state and is located midway between Salt Lake City, UT and Portland, OR.

Boise[2]

Known as the City of Trees, Boise is located in a land of infinite 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 Area. To the north, forests, whitewater rivers, and mountain lakes provide opportunities for kayaking, fishing, hunting, and hiking. For example, 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—fishing, hiking, skiing, river rafting, golf, tennis, and camping—are available only a short distance from campus.

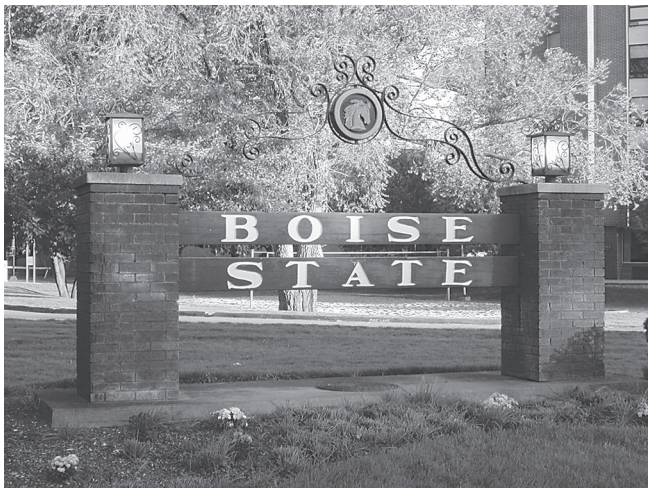
The city and campus offer many cultural opportunities, such as the Boise Philharmonic, American Festival Ballet, Boise Civic Opera, Idaho Shakespeare Festival, Gene Harris Jazz Festival, and a variety of other theatrical and musical productions. Touring artists frequently perform in the Morrison Center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

Boise State University

Boise State University is Idaho's metropolitan research university, located in the state's population center and capital city, a hub of government, business, the arts, health care, industry and technology. The campus is the home of 10 Idaho Professor of the Year honorees since 1990 and the 2005 national champion student debate and speech team.

Boise State is the largest university in Idaho with an all-time state enrollment record of 18,876 students. The university offers more than 190 fields of interest. Undergraduate, graduate and technical programs are available in eight colleges: Arts and Sciences, Business and Economics, Educa-

[2]Boise information excerpted from Boise State University Undergraduate Catalog, 2006 – 2007, Chapter 1.



tion, Engineering, Graduate Studies, Health Sciences, Social Sciences and Public Affairs, and Applied Technology.

Students can also study abroad, participate in one of the largest internship programs in the Northwest, and work with professors on health-related research to fight cancer, arthritis and Alzheimer's disease, among others. Boise State is the only university in the United States, and possibly the world, to offer a master's degree in raptor biology.

Campus life offers adventure and activity. More than 200 student organizations, new residence halls along the Boise River Greenbelt and a state-of-the-art Student Recreation Center provide opportunities for both individual development and fun. More than one million visitors come to campus annually for Nobel and Pulitzer Prize-winning speakers, Bronco football, Martin Luther King Jr. Human Rights Celebration and other events.

Boise State faculty conduct research in a broad range of areas, including biomedicine, sensor development, nanotechnology, geophysics, health policy and many others. Among the university's laboratories is a new Isotope Geology Lab that houses a thermal ionization mass spectrometer, acquired with a $620,000 National Science Foundation instrumentation grant. The lab is the only one of its kind in the interior Northwest. Boise State received $23.8 million for research and sponsored projects in fiscal 2006.

The university is part of two Federal Aviation Administration research centers with other universities such as MIT, Stanford, Harvard and Cal Berkeley. Altogether, the university houses more than 50 centers and institutes, including the Center for Health Policy, the Center for Environmental Sensing, the Idaho Council on Economic Education and the Andrus Center for Public Policy.

Boise State faculty have received national and international recognition. College of Engineering Dean Cheryl Schrader was one of 11 recipients nationwide of the 2005 Presidential Award for Excellence in mentoring. In 2006, mathematics professor Justin Moore won an international mathematics competition in Vienna, Austria. Kinesiology professor Werner Hoeger competed in the 2002 and 2006 Olympic Winter Games in the sport of luge as the oldest U.S. male athlete. Other award-winning faculty include Idaho Environmental Educator of the Year, national Marketing Educator of the Year and Idaho Nurse of the Year for Academic Education.

Boise State will celebrate its 75th anniversary this fall with a number of gala activities. The university has its beginnings in 1932, when the Episcopal Church founded Boise Junior College. The school attained four-year status in 1965, moved to the state system of higher education in 1969, and gained university status in 1974.

Today, the 175-acre campus bustles with activities and new construction. The new Interactive Learning Center, a four-story, 54,000-square- foot building adjacent to the Multipurpose Classroom Building is scheduled to open this summer. It will include a 200-seat lecture hall and 12 standard classrooms in addition to a multi-media lab, multi-purpose/distance learning classroom, visualization classroom, and numerous study lounges.

REGISTRATION

The Registration Center is in the lobby of the Boise Centre on the Grove (850 W. Front Street), across from the snack bar. Hours for registration are:

Sunday, 2:00 – 7:00 p.m.
Monday, 7:30 a.m. – 5:00 p.m.
Tuesday, 7:30 a.m. – 4:00 p.m.
Wednesday, 8:00 a.m. – 3:00 p.m.

All persons attending the meeting should be registered. On-site registration fees are as follows: $100 professional; $75 presenter/program planner and one-day professional; $60 retiree/emeritus and K – 14 teachers; and $40 students and spouses of registrants. Those who attend more than one day must pay the full registration fee.

Special stipends of $75 were available to the first twenty K – 12 and community college instructors that registered in advance for this meeting.

Students were given the opportunity to apply for travel awards to help defray their costs to the meeting.

About field trips: Advance registration was required for all field trips because of limited seating in the vehicles and the need to inform some destinations of the number of people arriving. However, space may be available on some of the excursions. If you are interested in one or more of the trips, please inquire at the Registration Desk 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. Non-registrants are assessed an additional one-time-only $10 field trip registration fee, regardless of how many field trips they sign up for during this meeting.

About workshops: All workshops are available to persons already registered for the meeting registrants at no additional charge. In order to ensure adequate space for attendees, we asked those planning to attend the Bio-Rad workshops to in-

dicate so on their early registration forms. For those coming to attend the Bio-Rad workshops but not the meeting, there is a $10 workshop-only fee. If you are interested in attending one of the Bio-Rad workshops but didn't register early or indicate your interest on the early registration form, please inquire at the Registration Desk to see if space is still available.

ACCOMMODATIONS and FOOD SERVICE

Boise offers a wide variety of motels and hotels from which one may choose. Below is a list of hotels that offered meeting attendees identifying themselves as part of the AAAS, Pacific Division meeting rooms at reduced rates. All hotels with the exception of the Harrison Plaza Suite are within two blocks of the Boise Centre. All rates listed are for one to four people in a room, as available and unless otherwise noted, and are exclusive of taxes and other fees. Some hotels allowed those interested in arriving earlier than the 15th and/or staying later than the 20th to stay extra days at the negotiated block rate.

Safari Inn
1070 Grove St.
Boise, ID 83702
800-541-6556
Rate: $64.00 one person/one queen bed
$73.00 one person/one king bed (much larger room)
$5.00 each additional person
Includes:
parking
high speed internet (wired and wireless)
continental breakfast (6:00 a.m. – 10:00 a.m.)
airport shuttle service
Web site: http://www.safariinnboise.com/

Hampton Inn and Suites
495 S. Capitol Blvd.
Boise, ID 83702
208-331-1900
Rate: $89[1]/$99[2] one king or two queens standard
$99[1]/109[2] one king or two queens suite
[1]Fri/Sat nights; [2]Sun – Thurs nights
Includes:
hot breakfast
airport shuttle service
Web site: http://hamptonboise.com/

Harrison Plaza Suite Hotel
Approximately four miles from Boise Centre
409 S. Cole Road
Boise, ID 83709
800-376-3608; 208-375-7666
Rate: $72.00
Includes:
parking
hot continental breakfast
airport shuttle service
shuttle service to downtown locations for conference meetings
Web site: http://www.harrisonhotelboise.com/

Information about additional hotels may be found at http://www.boise.org/. Other options, including a variety of web sites such as expedia.com and travelocity.com that provide hotel information and rates, are available to help locate suitable accommodations in Boise.

Please note that AAAS, Pacific Division lists the above hotels and web sites for information only, not as an endorsement for any specific commercial enterprise.

TRANSPORTATION AND PARKING

By Automobile: The Boise Centre on the Grove is located in downtown Boise. A map of downtown Boise, which also shows parking, is on page 2 of this *Proceedings*.

From the west on I-84 E:
- Keep left to take I-184 E via EXIT 49 toward CITY CENTER. I-184 E becomes W. MYRTLE ST / US-20 E / US -26 E.
- Turn LEFT onto S. CAPITOL BLVD.
- Turn LEFT onto W. FRONT ST / US-20 W / US-26 W.
- BOISE CENTRE is at 850 W. Front Street (see parking map on page 2).

From the east on I-84 W:
- From I-84 W take BROADWAY Ave / US-20 / US-26 exit – EXIT 54 – toward CITY CENTER.
- Turn RIGHT onto S. BROADWAY AVE / US-20 / US-26.
- Turn LEFT onto W. FRONT ST / US-20 / US-26 W.
- BOISE CENTRE is at 850 W. Front Street (see parking map on page 2).

By Air: Boise is served by several commercial airlines that fly into the Boise Air Terminal (BOI). The air terminal is about a 10-minute drive from downtown Boise and the Boise Centre.

REGISTRATION CENTER

The Registration Center will be set up in the foyer of the Boise Centre (see map on page 2), across from the snack bar. Hours are:
Sunday 2:00 – 7:00 p.m.
Monday 7:30 a.m. – 5:00 p.m.
Tuesday 7:30 a.m. – 4:00 p.m.
Wednesday 8:00 a.m. – 3:00 p.m.

MESSAGES

To leave a message for a meeting registrant or contact AAAS, Pacific Division staff, call 541-292-1115. Please note that this line will be monitored only between the dates of 14 – 24 June. After that date, 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, as appropriate, for each session. Refreshments will be served

during break times in the exhibit hall Monday and Tuesday and the Golden Eagle Eyrie on Wednesday.

MEETING ROOMS

This year's technical sessions meet in the Boise Centre concurrently with the technical sessions of the Northwest Region of the American Chemical Society (NORM 07). Meeting rooms for contributed paper sessions are expected to be equipped with computers running Windows XP and PowerPoint 2003, and standard computer projectors. Speakers requiring other specialized equipment such as slide or overhead projectors must have made their requests at the time they submitted their abstracts. Specialized equipment will be provided if available. If rental costs are incurred, payment is the responsibility of the requestor.

The meeting rooms, times of presentations, and abstracts for both the Pacific Division and NORM 07 programs are published in this "Program with Abstracts" issue of the *Proceedings* (vol. 26, part 1), which is given to each registrant for either the Pacific Division or the NORM 07 (ACS) meeting.

COMPUTERS and POWERPOINT PRESENTATIONS

Each meeting room is outfitted with a computer projector with a standard 15-pin VGA connector. If you are planning to use your own computer for your presentation, it is your responsibility to have the proper cables and connectors for hooking your computer up to the projector. Rooms in which contributed paper sessions will be held will also have computers running Windows XP and PowerPoint 2003. If you are presenting in a symposium, the symposium planner should have contacted you with computer specifications and to solicit your PowerPoint presentation for loading in advance onto the computer. Some rooms may be outfitted with Macintosh computers running OS X and PowerPoint 2004. If you are planning to use PowerPoint for your presentation, you must make sure that it will run on both platforms. Only CD-ROMs and thumb/USB/flash drives may be used to load presentations onto the computers. If you are preparing your presentation on a Macintosh computer, make sure it will load to a PC running Windows XP, and vice versa.

POSTER SESSION

Posters are assigned a display space of 48" tall X 96" wide (1.2 m X 2.4 m). By action of the Pacific Division Council in order to assure fairness, all student posters must fit within the assigned display space of 48" X 96" to be eligible for student Awards of Excellence. Posters are grouped by discipline and subject matter.

One combined poster session will be held on Monday, June 18. Presenters should have their posters set up no later than 12:00 p.m. to allow registrants to view them as they have time. The session will run officially from 4:00 – 7:00 p.m. Presenters must post at least one hour during this time when they will be available to discuss their work. Student posters will be judged for Awards of Excellence. Students must be present between 4:30 p.m. and 6:30 p.m. to allow judges the opportunity to discuss their work and to evaluate their posters. Posters are to remain up until 9:30 p.m. to allow for extended viewing by meeting participants.

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 $75 for second place. Each winner also receives a one-year student membership in AAAS, which includes weekly delivery of Science magazine. Societies may supplement these awards with their own cash prizes.

In 2007, seven Division-wide awards are available: Laurence M. Klauber Award for Excellence (unrestricted); Geraldine K. Lindsay Award for Excellence in the Natural Sciences; J. Thomas Dutro, Jr. Award for Excellence in the Geosciences; Presidents' Award for Excellence (unrestricted); Rita W. Peterson Award for Excellence in Science Education; Best Poster Award (for posters only but otherwise unrestricted); and the AAAS Robert I. Larus Travel Award, which provides money for travel and other expenses for the awardee to attend the 2008 national meeting of AAAS in Boston, MA, February 14 – 18, 2008, 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 register for the meeting, 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). The 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 Division Banquet Tuesday evening, June 19. Festivities that evening include the presentation of student awards. Students planning to attend the banquet need to have indicated such through advance registration. Students who did not so indicate but now desire to attend should check at the Registration Center to see if any tickets are still available.

IMPORTANT NOTE: All judging for student awards ends by 3:00 p.m. on Tuesday, at which time the judges go into closed session to determine the winners for presentation at the banquet that evening. Students wishing to compete for an Award of Excellence whose oral presentation is scheduled later Tuesday afternoon or Wednesday must, in addition to

presenting orally as part of the symposium, prepare a poster for presentation at the poster session on Monday. That way the presentation will be judged and the student will be in the pool of potential prizewinners. This may only occur if a student's presentation is part of a symposium. All oral contributed paper sessions are scheduled to ensure that student presenters are judged prior to the cut-off on Tuesday afternoon.

SPECIAL EVENTS

The following special events are planned for the meeting.

Sunday Evening Reception, hosted by the Pacific Division and its affiliated societies and sections and the Northwest Region of ACS (NORM 07). All registrants and their families are invited to enjoy the conviviality of this social event. A selection of soft drinks, chips, pretzels, and good conversation will be available.

Monday Evening President's Reception. Boise State University President Dr. Robert W. Kustra will sponsor an informal reception following the evening public lecture. All participants and their families are invited to enjoy this relaxed occasion. Non-registered family members are welcome, but must be accompanied by a registrant. Please wear your registration badge.

Tuesday Evening Reception, Banquet, and Announcement of the Winners of the Student Awards for Excellence. The Divisional Reception and Dinner will be held Tuesday evening beginning at 6:00 p.m. in the Jordan Ballroom of the Boise State University Student Union. The cost is $26 per person and you must have signed up in advance. A portion of the fee for the dinner helps to support student attendance at the banquet. Students who are in competition for an Award of Excellence are invited to attend at no charge as guests of the Division. Students planning to attend the dinner should have indicated so on the Advance Registration form. If you didn't sign up in advance for the dinner but would like to attend, please inquire at the Registration Center to see if any tickets are still available.

Dinner will be preceded by a no-host reception that starts at 6:00 p.m. and includes a cash bar. The following two entrees are offered for dinner: Garlic and Rosemary Roasted Tri-tip steak and Towering Grilled Eggplant Napoleon. Both selections include salad; fresh vegetables; freshly baked rolls; coffee, tea and water; and dessert.

Following dinner, AAAS, Pacific Division President Carl A. Maida will present the Presidential Lecture, "*Sustainability: Thinking and Designing a New World*." Division representatives will also announce the names of student winners of Awards of Excellence for their presentations at the meeting and also the winners of the Division's Laurence M. Klauber Award (unrestricted), Geraldine K. Lindsay Award in the Natural Sciences, J. Thomas Dutro, Jr. Award in the Geosciences, Rita W. Peterson Award in Science Education, the President's Award (unrestricted), the Best Poster Award (for poster presentations only but otherwise unrestricted), and the AAAS Robert I. Larus Travel Award, which provides money for travel and other expenses for the awardee to attend the 2008 annual meeting of AAAS in Boston, MA February 14 - 18, in order to present his/her winning presentation as a poster.

The Klauber, Lindsay, Dutro, Presidents', Best Poster, Peterson, and AAAS Larus awards are given to those students whose presentations are judged the most significant in the advancement or understanding of science. Eligible students must: (1) register for the meeting, (2) present the paper or poster being judged, and (3) 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). Examples of the evaluation forms (oral and poster) are posted on the Division's meeting web site.

Wednesday Morning Business Meeting of the Council of the Pacific Division. The Council of the AAAS, Pacific Division will hold its annual breakfast business meeting starting at 7:00 a.m. on Wednesday, June 20, at the Hampton Inn. The Council will elect officers, discuss programs for the 2008 and 2009 annual meetings, and transact such other business as is required by the Division's By-Laws.

PUBLIC LECTURES

Members of the general public are invited to attend these public lectures at no cost.

Sunday Evening Greeting. Sunday evening at 6:00 p.m. Dr. Catherine T. (Katie) Hunt, 2007 President of the American Chemical Society, will greet meeting attendees. Dr. Hunt is the Leader for Technology Partnerships (Emerging Technologies) at the Rohm and Haas Company, Spring House, PA. She serves on the executive board of the Council for Chemical Research where she is active in their Research Investment Network, drafting Science and Technology (S&T) policy statements and advocating for science on "the Hill" (Capitol Hill). Dr. Hunt was an organizing member of the Vision 2020 Nanotechnology Roadmap and continues to be active in the rollout. She is a member of several associations including: ACS, AAAS, Sigma Xi and the NY Academy of Science.


Courtesy University of Tennessee at Martin
Dr. Catherine Hunt

Sunday Evening Plenary Lecture. At 7:15 p.m. Mr. Jon Christensen, Research Fellow at the Center for Environmental Science and Policy, Stanford University, and also PBS "Now" correspondent, will present the lecture, "*How Green Is Idaho*." Mr. Christensen will screen his short documentary on controversial new approaches to protecting wilderness in the West being tested in the Boulder-White Cloud Mountains of central Idaho. He'll discuss the politics that brought together conservative Republican Con-


Courtesy Stanford University
Jon Christensen

gressman Mike Simpson and environmentalist Rick Johnson in an effort to find common ground on wilderness protection in the "reddest" state in America, the high-profile debate that brought singer-songwriter Carole King into the fray, and the beautiful remote high-country at stake. Mr. Christensen will also field questions about bringing a complex story involving people, politics, the environment, and science, from way out west to the TV screens in 1.2 million households across the country.

Preceding Mr. Christensen's presentation with be a DVD slide show of the Boulder-White Clouds area photographed and assembled by landscape photographer Eric Zamora.

Monday Noon Public Lecture. The Monday noon public lecture, "*From Vegas to Boise: A Theme of Collaborative Research,*" will be presented by Dr. Mark Rudin (Vice President for Research, Boise State University, Boise, ID). Dr. Rudin is a relative newcomer to the Boise State University community, having moved this past Jaunary from the University of Nevada, Las Vegas, where he most recently served as interim Vice President for Research and Graduate Dean. Previously, he was a technical/administrative assistant with the U.S. Department of Energy, Office of Environmental Restoration and Waste Management, senior program specialist/project engineer with EG&G Idaho at the Idaho National Laboratory in Idaho Falls, and an instructor in the Department of Health Physics at Idaho State University.


Courtesy Boise State University
Dr. Mark Rudin

Monday Evening Plenary Lecture. At 7:30 p.m. Dr. Shirley Malcom will deliver the lecture, "*Science: The Publics' Need (and Right) to Know*." Dr. Malcom is Head of the Directorate for Education and Human Resources Programs, AAAS, Washington, D.C. The directorate includes AAAS programs in education, activities for underrepresented groups, and public understanding of science and technology. Dr. Malcom serves on several boards—including the Howard Heinz Endowment and the H. John Heinz III Center for Science, Economics and the Environment—and is an honorary trustee of the American Museum of Natural History. In 2006 she was named as co-chair (with Leon Lederman) of the National Science Board Commission on 21st Century Education in STEM. She serves as a Regent of Morgan State University and as a trustee of Caltech. In addition, she has chaired a number of national committees addressing education reform and access to scientific and technical education, careers and literacy. Dr. Malcom is a former trustee of the Carnegie Corporation of New York. She is a fellow of the AAAS and the American Academy of Arts and Sciences. She served on the National Science Board, the policy making body of the National Science Foundation, from 1994 to 1998, and from 1994 – 2001 served on the President's Committee of Advisors on Science and Technology.


Courtesy AAAS
Dr. Shirley Malcom

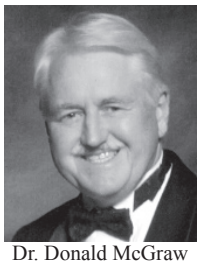
Tuesday Noon Public Lecture. The Tuesday noon public lecture, "*Geology and Fauna of Four Galapagos Islands 2006*," will be presented by Dr. Kathleen M. Fisher, Past-president of the AAAS, Pacific Division. Dr. Fisher's lecture will detail her recent trip to the Galapagos Islands and will include many pictures and a discussion of biology/evolution. Dr. Fisher is a Professor of Biology and also past Director of the Center for Research in Mathematics and Science Education at San Diego State University, San Diego, CA. Before becoming Pacific Division President, Dr. Fisher chaired the Division's Science and Technology Education Section.


Courtesy Kathleen M. Fisher
Dr. Kathleen Fisher

Tuesday Evening Presidential Lecture. Dr. Carl A. Maida, President of AAAS, Pacific Division, will be the featured speaker at the Division Banquet with his talk, "*Sustainability: Thinking and Designing a New World*." Dr. Maida is a Professor in the Schools of Dentistry and Medicine at the University of California, Los Angeles. He has been active in the Pacific Division for over 25 years, helping to develop programs, serving as chair to both the Health Sciences and the Social, Economic and Political Sciences Sections, and serving on both the division's Executive Committee and Council.


Courtesy Barbara Yablon Maida
Dr. Carl A. Maida

Wednesday Noon Public Lecture. Dr. Donald McGraw will present a lecture titled, "*Tree-Ring Science: How it All Began*." Dr. McGraw, formerly Associate Provost at the University of San Diego, is a historian of science with a special interest in tree ring dating. He organized the symposium, "Lords of the Rings: Dendrochronology Yesterday, Today, and Tomorrow" at the 2004 Pacific division meeting in Logan, UT.


Courtesy Donald McGraw
Dr. Donald McGraw

FIELD TRIPS

All field trips are open to meeting registrants and their families. At least one member of a group must be registered for the meeting. Those who are not registered for the meeting will be charged an additional one-time-only $10 field trip registration fee for this meeting. This fee is paid only once for the entire meeting, regardless of how many field trips a non-registrant participates in.

Due to limited space, advance registration is required for all field trips. Reservation and payment of field trip fee(s)

were included on the Advance Registration Form. If you didn't advance register for a particular field trip but would like to go on it, please check at the Registration Center to see if any tickets are yet available.

A full refund will be granted if a trip is cancelled by the Division. If a registrant cancels via e-mail or written notification postmarked no later than May 23, 2007, the registrant will receive a refund of the fee(s) paid less a $10 processing fee. If paid by credit card, an additional 3.25% 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.

All field trips *except #3* (The Nature of the Boise River: Science, Engineering, and Design) depart from and return to the plaza entrance to the Boise Centre on the Grove. Field trip #3 departs from the Friendship Bridge, which crosses the Boise River between Julia Davis Park and Boise State University. Departure times are absolute. Return times are approximate. Plan to arrive a few minutes early. It's always a good idea to bring along a day pack and extra water, especially if the weather is warm. Please dress according to the weather and bring a hat and sun screen. Depending on the activities of the field trip, you may want to include a pair of binoculars, a camera and/or other items.

If you are going on one of the Sunday field trips, Pacific Division staff will provide drivers with lists of participants so you do not need to worry about picking up your registration packet in advance. If you return after the Registration Center is closed, registration will open at 7:30 a.m. on Monday.

SUNDAY

(1) Bruneau Dunes State Park. Departs from the plaza entrance to the Boise Centre on the Grove at 8:00 a.m.; returns 4:00 p.m. Includes transportation, applicable entrance fees, box lunch, and water. Fee: $35.

Out on the expansive Snake River Plain there exist countless insights and windows into the past. Join an Idaho Parks and Recreation Naturalist for a bus ride from Boise to Bruneau Dunes State Park. From the hotspot volcanism of the last 16 million years, through the grand 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. With a morning hike and first-rate presentations in the Bruneau Dunes State Park multimedia auditorium, each participant will gain an exciting new perspective of this sandy, desert gem. Be sure to bring sturdy shoes, a hat, bug repellent, and sunscreen. The sand will potentially be hot, with a high heat index. The hike will be uphill in loose sand for approximately one-quarter mile or more, depending on the heat.

(2) Snake River Birds of Prey National Conservation Area. Departs from the plaza entrance to the Boise Centre on the Grove at 9:00 a.m.; returns 3:00 p.m. Includes transportation, field guide, applicable entrance fees, box lunch, and water. Fee: $35.

Courtesy Alan E. Leviton

Craters of the Moon Landscape

This field trip will tour the world famous Snake River Birds of Prey National Conservation Area (NCA), located south of Boise. The NCA was established in 1993 to recognize and perpetuate the area's wildlife values, especially related to raptors (birds of prey). Fifteen species of raptors nest within the NCA, and nine others use the area during migration or winter. Participants will be able to observe a variety of hawks, falcons, eagles, and owls in their natural surroundings. There will also be an opportunity for up-close observation of ongoing raptor research and banding projects. Afternoons in June could be sunny and quite warm. Alternatively, the weather could be windy and rainy. Be sure to wear field clothes appropriate for the weather and bring binoculars, camera, sunscreen and insect repellent.

(3) The Nature of the Boise River: Science, Engineering, and Design. Departs from the Friendship Bridge, which spans the Boise River between Julie Davis Park and Boise State University, at 1:30 p.m.; returns 3:00 p.m. Fee: none.

Led by Todd Shallet (Center for Idaho History and Politics, Boise State University, Boise, ID), this field trip is a walking tour along the Boise River from Boise State University through Julia Davis Park and back. The Boise River is a human artifact shaped by science, politics, grandiose dreams, and nightmarish expectations. The walk considers human and non-human factors that shaped the engineering design and continue to affect the ecology of the region. Included will be discussions of issues of historical and ecological importance related to the river. Participants should meet by 1:30 p.m. at the Friendship Bridge (spans the Boise River, connecting Julia Davis Park to the Boise State University campus) in Julia Davis Park. The walking tour will take about one and one-half hours. It is over fairly flat and paved terrain.

Plan to explore the many museums and the zoo of Julia Davis Park, both before and after the tour. The museums and zoo charge admission fees, which vary by institution.

TUESDAY

(7) Green Buildings of Boise. Departs from the plaza en-

trance to the Boise Centre on the Grove at 2:00 p.m.; returns 4:30 p.m. Fee: none.

Led by Morty Prisament (Environmental Planning Manager, Energy and Water Resources Programs, Tetra Tech, EMI, Boise, ID), this is a walking tour of the Banner Bank Building. This tour is open to everyone who is interested in green buildings, in addition to participants in the symposium, "What Makes A Green City – The Boise Experiment."

WEDNESDAY

(4) Western Society of Soil Science Field Trip. Departs from the plaza entrance to the Boise Centre on the Grove at 9:00 a.m.; returns 5:00 p.m. Includes transportation, box lunch. Fee: $30.

Organized by Paul McDaniel (Soil Scientist, University of Idaho) and Kurt Othberg (Research Geologist, Idaho Geological Survey), this field trip will feature some of the soils, geomorphology, and land use in the Boise area. We will look at soil formation on Boise River terraces, specifically the formation and expression of carbonate- and silica-cemented duripans. These indurated features are common on older terraces of the area and dramatically affect land use. Important geologic features will also be highlighted. Participants should be prepared for some light hiking.

(5) Boise Hydrogeophysical Research Site. Departs from the plaza entrance to the Boise Centre on the Grove at 1:00 p.m.; returns 5:00 p.m. Includes transportation and a short field guide. Fee: $15.

Organized by Bill Clement (Center for Geophysical Investigation of the Shallow Subsurface (CGISS), Boise State University, Boise, ID), the trip will first visit a gravel outcrop near Discovery Park and then continue about 15 minutes to the mesoscale field laboratory. This research site is designed to investigate ground water flow problems. At the site, participants will have the opportunity to learn about and look at the capabilities and methods used to investigate the subsurface. The site itself is a flat gravel bar along the Boise river. Participants may walk down a dirt road at a slight incline to get to the site. At the site, the walking is easy on the gravel surface, but is not recommended for wheelchairs or walkers.

THURSDAY – SATURDAY

(6) Craters of the Moon, Volcanoes, and the Traveling Hot Spot. Departs from the plaza entrance to the Boise Centre on the Grove at Thursday, June 21: 8:00 a.m.; returns Saturday, June 23, about 5:00 p.m. Includes two nights stay (Arco and Pocatello), three lunches, transportation, a road log, a guidebook to the geology of Idaho, and all admission fees. Other items of personal nature are the responsibility of participants. Fee: $250 per person double occupancy, $375 per person single occupancy (as available).

Led by Drs. J. Thomas Dutro, Jr. (retired, U.S.G.S. and Smithsonian Institution, Washington, D.C.) and Robert L. Christiansen (retired, U.S.G.S., Menlo Park, CA), this is a three-day field trip to explore the wonders of the Craters of the Moon National Monument and the volcanic activity that has dominated the Snake River plain for the past 2.5 million years. The trip will feature a traverse from Boise through the Salmon River Valley to Challis, highlighting the geological framework of the volcanics, including the Paleozoic limestone sequence, the Idaho granitic intrusion of Late Cretaceous age and the related, Eocene (50 million year old), and Challis volcanic rocks. The highway trip from Challis to Arco parallels the Lost River Range, which mostly consists of Paleozoic sedimentary rocks, and contains Borah Peak, the highest point in Idaho (12,862 ft.). We will spend the first night in a rustic motel in Arco. Most of the second day will be devoted to Craters of the Moon National Monument and its remarkable volcanic features that remind many of an Hawaiian analogue. The second night will be spent in Pocatello. The third day's return westward to Boise will provide an opportunity to review the volcanic evidence of the northeastward, relative movement of the volcanic "hotspot" that has ultimately reached the Yellowstone Park region. We will also stop at the Hagerman Fossil Bed National Monument, where bones of 3-million-year-old ancestors of the modern horse helped scientists to unravel mammalian evolution. We will return to Boise at about 5:00 p.m. on Saturday.

WORKSHOPS

SCIENCE EDUCATION ENRICHMENT

Tuesday morning, June 19
Boise Centre, Ponderosa Pines

The Winning Equation: Access + Attitude = Success in Science. Organized by Valerie Sundby (University of Washington DO-IT, Box 355670 Seattle, WA 98195-5670; e-mail: vsundby@u.washington.edu) and Lyla Crawford (University of Washington DO-IT, 606 West Sharp Ave, Spokane, WA 99201; e-mail: lylac@u.washington.edu). The Winning Equation is an interactive workshop to introduce concepts, strategies, and high/low-tech tools to fully include students with diverse learning needs, including those with disabilities, in science education. This workshop will focus on universal design concepts as a foundation and framework for increasing student achievement in science. It will also present strategies for general science curriculum access for students with diverse learning needs. Strategies include the use of technology, universal curriculum design, and collaborative learning to create a supportive and responsive learning environment for students with different strengths, needs, and backgrounds. The use of academic accommodations and the role of student self-advocacy in enhancing overall student success will also be integrated into session content. Participants will engage in small group learning activities that explore a universally de-

signed curriculum model and a step-by-step accommodation model to fully include students with various disabilities and learning needs. Specifically, teachers will explore science activities from the regional MESA (Mathematics, Engineering, and Science Achievement) curriculum and work collaboratively to explore examples of teaching strategies and accommodations to enhance participation of students with various types of disabilities, and engage students with a variety of learning styles. Participants will be introduced to a variety of concepts and strategies that utilize mainstream and assistive technology to improve curriculum access and active participation for students in grades K-12. They will have hands-on experiences with both high and low-tech tools that can make today's curriculum accessible to all students.

HANDS-ON PRACTICE with MOLECULAR BIOLOGY KITS

Bio-Rad Corporation of Hercules, CA, will be presenting several hands-on workshops to give middle school, high school and university instructors the opportunity to try out some of the molecular biology kits they offer to educators. Bio-Rad representatives will provide certificates of attendance for those desiring to utilize these workshops for professional development credits.

More information about these and other Bio-Rad kits can be found on the internet at explorer.bio-rad.com.

There is no additional charge for those registered for the meeting. For those coming just for these Bio-Rad workshops, there is a $10 "Bio-Rad only" registration fee (covers all five sessions), which must be paid in advance. Participation is limited to twenty-four in each session.

These workshops will take place in a laboratory located in the Biology Department, which is situated in the Science-Nursing Building on the Boise State University campus. For those driving onto campus, parking is located in the large parking structure just to the west of the Science-Nursing Building. Please see Campus Map on page 38 of this *Proceedings*. The cost for parking is $1.00 per hour, with a maximum of $10.00 per day. Machines in the parking structure accept cash and credit cards.

Wednesday, June 20
Science-Nursing Building, Room 205

8:30 a.m. – 10:00 a.m. Genes in a Bottle™ Kit
Can I see your DNA? The first step in many research applications is isolating the DNA sample. Introduce your students to molecular biology with their own DNA. In this hands-on workshop you will extract the DNA from your own cheek cells and watch it precipitate from solution as floating white strands. You will then collect and transfer the DNA strands to create a fashionable necklace. This simple procedure is used to extract DNA from many different organisms for a variety of real research applications. Bring only your imagination and take home your own DNA - in a necklace. This is another Bio-Rad lab your students will never forget! Learn key background and how to prep the lab. Do exactly what your students will do.

10:30 a.m. – 12:00 p.m. ELISA Immuno Explorer™ Kit
Biology's magic bullet? Unleash nature's tool kit and the power of antibody specificity to explore health science and immunology. In this hands-on workshop you will perform an ELISA (enzyme-linked immunosorbent assay), a real-world antibody-based assay used to diagnose HIV/AIDS or bird flu, and to detect the molecular markers of cancer, pregnancy, and drug use. Germs spread via human contact, water, food, and the air - whether they emerge naturally or through acts of aggression. You will also learn to simulate a disease outbreak in your classroom and use ELISA to detect and track it. Designed for biology, physiology, anatomy, and health science courses. Learn key background and how to prep the lab. Do exactly what your students will do.

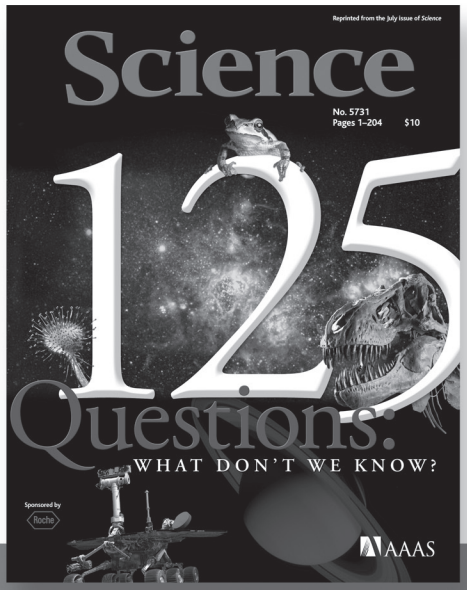
1:30 p.m. – 4:00 p.m. Forensic DNA Fingerprinting Kit
Assume the role of a forensic scientist in this hands-on workshop. Use DNA restriction analysis and gel electrophoresis (popularly known as DNA Fingerprinting) to manipulate and analyze biological evidence found at a crime scene and to determine which of a number of suspects could have committed the crime - based on DNA evidence. Explore the scientific, ethical, and legal implications of DNA profiling. Learn key background and how to prep the lab. Do exactly what your students will do. AP Biology Lab 6.

Thursday, June 21
Science-Nursing Building, Room 205

9:00 a.m. – 11:30 a.m. Crime Scene Investigator PCR Basics™ Kit
Which human DNA sequences are used in crime scene investigations, and why? In this workshop you assume the role of crime scene investigator. You will learn which human DNA sequences are used by forensic scientists and how trace amounts of DNA can be used to identify a person. You will learn to use the polymerase chain reaction (PCR) and gel electrophoresis to identify which of a number of suspects can be exonerated based on DNA evidence. This hands-on workshop teaches the basics of polymerase chain reaction (PCR), gel electrophoresis, and the statistics of chance associated with modern DNA fingerprinting. Learn key background and how to prep the lab. Do exactly what your students will do.

1:00 p.m. – 3:30 p.m. Protein Profiler™ Kit
Can molecular evidence determine evolutionary relationships? Explore fundamental principles of evolution and natural selection with this inquiry-based wet lab. In this hands-on workshop you will extract muscle proteins from closely and distantly related fish species and use protein electrophoresis to generate protein fingerprints and acquire molecular data to construct an evolutionary tree for five fish species. Learn key background and how to prep the lab. Do exactly what your students will do.

Pick up your
FREE
125 Questions: What Don't We Know?



Stop by the *AAAS/Science booth #21* at the AAAS Pacific Division/NORM 2007 meeting in Boise and get your FREE copy!

Visit the AAAS/***Science*** booth at the AAAS Pacific Division/NORM 2007 meeting in Boise and pick up a limited edition reprint of ***Science's*** *125 Questions: What Don't We Know?* It explores the most challenging scientific questions, such as:

Why do humans have so few genes? • How much can the human life span be extended? What is the biological basis of consciousness? • What is the universe made of? What can replace oil and when?

While you are at the booth, find out about our special discounted membership rates and about career advice and job listings at ScienceCareers.org.

Plus, pick up the latest issue of ***Science!***

Science
AAAS

SUNDAY	MONDAY	TUESDAY	WEDNESDAY
	Vendor Exposition *Boise Centre on the Grove* 8:00 AM - 12:00 PM	Vendor Exposition *Boise Centre on the Grove* 8:00 AM - 12:00 PM	Business Meeting of the Council of the Pacific Division *Hampton Inn* 7:00 AM - 10:00 AM
	Sensors and Sensor Technology *The Kestrels* 8:00 AM - 3:30 PM	The Chemistry of Advanced Nuclear Systems: Modeling and Simulation *The Summit* 8:00 AM - 12:00 PM	The Chemistry of Advanced Nuclear Systems: Waste Forms *The Summit* 8:00 AM - 12:00 PM
	The Chemistry of Advanced Nuclear Systems: Separations *The Peregrins* 8:00 AM - 12:00 PM	Joint Session – Agricultural and Hort. Sciences; Biological Sciences *Douglas Firs* 8:10 AM - 12:00 PM	Bio-Rad Genes in a Bottle™ Kit *BSU Campus* *Science-Nursing Room 205* 8:30 AM - 10:00 AM
	Soilscapes of the Western US: Perspectives on Change *Samon River* 8:10 AM - 12:00 PM	Western Society of Soil Science *Salmon River* 8:15 AM - 12:00 PM	Environmental Issues In Idaho: Earth, Wind, and Water *Salmon River* 8:45 AM - 12:00 PM
	New Humanities and Science Convergences III: The Greening of the Disciplines *Cottonwoods* 8:30 AM - 4:30 PM	Corrosion and Coatings Challenges in Industry *Willows* 8:30 AM - 11:35 AM	New Strategies for Cancer Treatment *Douglas Firs* 8:45 AM - 4:45 PM
	Biomedical/Bio-related Materials I *Payette River* 9:00 AM - 4:30 PM	Infectious Disease I *Cottonwoods* 8:30 AM - 4:30 PM	Infectious Disease II *Cottonwoods* 9:00 AM - 12:00 PM
	Joint Session – Anthropology and Archaeology; Earth Sciences; Ecology and Environmental Sciences *Douglas Firs* 9:00 AM - 11:30 AM	The Winning Equation: Access + Attitude = Success in Science *Ponderosa Pines* 8:30 AM - 12:00 PM	Bio-Rad ELISA Immuno Explorer™ Kit *BSU Science-Nursing 205* 10:30 AM - 12:00 PM
		Biomedical/Bio-related Materials II *Payette River* 9:00 AM - 3:00 PM	
	Contributed Posters *Golden Eagle Eyrie* 12:00 PM - 9:30 PM	What Makes a Green City – The Boise Experiment *The Kestrels* 9:00 AM - 12:00 PM	
	Monday Noon Public Lecture *The Summit* 12:15 PM - 1:00 PM	Tuesday Noon Public Lecture *The Summit* 12:15 PM - 1:00 PM	Wednesday Noon Public Lecture *The Summit* 12:15 PM - 1:00 PM
	Joint Session – Chemistry; Industrial Science and Technology; Physics *Douglas Firs* 1:15 PM - 5:00 PM	One Hundred Fifty Years of Human Activity In Sagebrush Steppe: Ecological and Genetic Consequences *Ponderosa Pines* 1:15 PM - 5:20 PM	Bio-Rad Forensic DNA Fingerprinting™ Kit *BSU Campus* *Science-Nursing Room 205* 1:30 PM - 4:00 PM
	The Chemistry of Advanced Nuclear Systems: Separations and Environmental *The Summit* 1:15 PM - 5:05 PM	Joint Session - General and Interdisciplinary; Health Sciences; Science Education *Willows* 1:30 PM - 5:00 PM	The Great Wilderness Compromise *The Summit* 1:30 PM - 5:00 PM
Vendor Exposition *Boise Centre on the Grove* 5:00 PM - 10:00 PM		Joint Session – History and Phil. of Science; Psychology; Social, Economic and Political Sciences *Douglas Firs* 1:30 PM - 4:00 PM	
			THURSDAY
Welcoming Comments *Golden Eagle Eyrie* 6:00 PM - 6:45 PM		Business Meeting of the Western Society of Soil Science *Salmon River* 1:30 PM - 4:00 PM	Bio-Rad Crime Scene Investigator PCR Basics™ Kit *BSU Science-Nursing Room 205* 9:00 AM - 11:30 AM
Sunday Evening Plenary Lecture *The Summit* 7:15 PM - 8:15 PM	Monday Evening Plenary Lecture *The Summit* 7:30 PM - 8:30 PM	Reception and Student Awards Banquet *Jordan Ballroom, BSU* 6:00 PM - 9:30 PM	Bio-Rad Protein Profiler™ Kit *BSU Science-Nursing Room 205* 1:00 PM - 3:30 PM
Sunday Evening Reception *Golden Eagle Eyrie* 8:00 PM - 9:30 PM	BSU President's Reception *Golden Eagle Eyrie* 8:15 PM - 9:30 PM		

GENERAL SESSIONS

Sunday, 17 June 2007

WELCOMING COMMENTS

Golden Eagle Eyrie (Boise Centre on the Grove)
Sunday
6:00 PM

Katherine T. (Katie) Hunt, 2007 President of the American Chemical Society and Rohm and Haas Company, Spring House, PA.

SUNDAY EVENING PLENARY LECTURE

The Summit (Boise Centre on the Grove)
Sunday
7:15 PM - 8:15 PM

1 *How Green Is Idaho?* **Jon Christensen**, History Department, Stanford University, Palo Alto, CA

SUNDAY EVENING RECEPTION

Golden Eagle Eyrie (Boise Centre on the Grove)
Sunday
8:00 PM - 9:30 PM

Jointly hosted by the Pacific Division and NORM 07, all registrants and their families are invited to enjoy the conviviality of this social event.

Monday, 18 June 2007

MONDAY NOON PUBLIC LECTURE

The Summit (Boise Centre on the Grove)
Monday
12:15 PM - 1:00 PM

2 *From Vegas to Boise: A Theme of Collaborative Research*. **Mark Rudin**, Research, Boise State University, Boise, ID

MONDAY EVENING PLENARY LECTURE

The Summit (Boise Centre on the Grove)
Monday
7:30 PM - 8:30 PM

3 *Science: The Publics' Need (and Right) to Know*. **Shirley Malcom** Directorate for Education and Human Resources Programs, American Association for the Advancement of Science, Washington, DC

BSU PRESIDENT'S RECEPTION

Golden Eagle Eyrie (Boise Centre on the Grove)
Monday
8:15 PM - 9:30 PM

Boise State University President Dr. Bob Kustra will host an informal reception following the evening Plenary Lecture. All participants and their families are invited to enjoy this relaxed occasion. Non-registered family members are welcome, but must be accompanied by a registrant. Please wear your registration badge.

Tuesday, 19 June 2007

TUESDAY NOON PUBLIC LECTURE

The Summit (Boise Centre on the Grove)
Tuesday
12:15 PM - 1:00 PM

4 *Geology and Fauna of Four Galapagos Islands 2006*. **Kathleen M. Fisher**, Department of Biology, San Diego State University, San Diego, CA

MEETING of the WESTERN SOCIETY OF SOIL SCIENCE

Salmon River (Boise Centre on the Grove)
Tuesday
1:30 PM - 4:00 PM

The Western Society of Soil Science will hold its annual meeting starting at 1:30 p.m. All members of the society are welcome to attend this meeting, which will include, among other items of business, choosing the site for the 2008 meeting.

RECEPTION AND STUDENT AWARDS BANQUET

Student Union – Jordan Ballroom (Boise State University)
Tuesday
6:00 PM - 9:30 PM

The annual Pacific Division Student Awards Banquet will begin at 6:00 p.m. with a no-host reception that includes a cash bar. Dinner will be served at about 6:45 p.m. The cost is $26.00 and attendees must have purchased a ticket in advance. Students competing for presentation awards are invited to be guests of the Division at this dinner. Students must also have indicated their desire in advance and be holding a ticket. If you failed to purchase a ticket in advance and would like to attend the banquet, please check at the Registration Desk prior to 4:00 p.m. on Tuesday to see if any tickets are available. Following dinner will be the announcement by representatives of affiliates and sections of the Pacific Division of the student winners of the Awards of Excellence for their presentations at the meeting. Division-wide awards will also be announced. Following the presentation of the awards, Dr. Carl A. Maida, President of the Pacific Division and Adjunct Professor of Health and Anthropology, UCLA Schools of Dentistry and Medicine, University of California, Los Angeles, will deliver the Pacific Division Presidential address, "*Sustainability: Thinking and Designing a New World.*"

AAAS, PACIFIC DIVISION PRESIDENTIAL LECTURE

Student Union – Jordan Ballroom (Boise State University)
Tuesday
8:30 PM - 9:15 PM

5 *Sustainability: Thinking and Designing a New World*. **Carl A. Maida**, University of California, Los Angeles, Los Angeles, CA

Wednesday, 20 June 2007

MEETING of the COUNCIL of the PACIFIC DIVISION

Hampton Inn
Wednesday
7:00 AM - 10:00 AM

The Council of the AAAS, Pacific Division will hold its annual breakfast and business meeting starting at 7:00 a.m. in the meeting room of the Hampton Inn. The Council will elect officers, discuss programs for the 2008 and 2009 annual meetings, and transact such other business as is required by the Division's By-laws.

WEDNESDAY NOON PUBLIC LECTURE

The Summit (Boise Centre on the Grove)
Wednesday
12:15 PM - 1:00 PM

6 *The Early Years of Tree-Ring Science*. **Donald J. McGraw**, Private Contractor, Chula Vista, CA

TECHNICAL SESSIONS

1100 (time italicized and underlined) indicates a student presentation in competition for Awards of Excellence
* indicates the speaker from among several authors listed
63 (bolded number) indicates the abstract number

I. SYMPOSIA

Monday, 18 June 2007

Sensors and Sensor Technology

The Kestrels (Boise Centre on the Grove)
Monday
8:00 AM - 3:30 PM

Program Organizers: Amy J. Moll, Boise State University; David Bahr, Washington State University; Shalini Prasad, Portland State University; Panos Photinos, Southern Oregon University

Sponsored by: NORM 07 and the Pacific Division Chemistry and Physics Sections

This third annual symposium on Materials Science and Nanotechnology emphasizes recent advances in sensors and applications. We solicit contributions from all individuals doing research in these areas, and especially graduate and undergraduate students.

Session Presider: Amy J. Moll

0800 *Introductory Remarks.*

0810 **7** *Development of Biomolecular Nanostructure Sensor Arrays*. **William B. Knowlton**[*1], **David Araujo**[2], **Patrick Price**[2], **Jason Brotherton**[2], **Kendra Coonse**[3], **Richard G. Southwick III**[4], **Amy J. Moll**[2] and **Julia Thom Oxford**[3], [1]Departments of Electrical & Computer Engineering and Materials Science & Engineering, Boise State University, Boise, ID; [2]Materials Science & Engineering, Boise State University, Boise, ID; [3]Biology, Boise State University, Boise, ID,;[4]Departments of Electrical & Computer Engineering, Boise State University, Boise, ID

0840 **8** *Electrophoretic Flow Cell System for Biological Sensing*. **Vindhya Kunduru**[*] and **Shalini Prasad**, Electrical and Computer Engineering, Portland State University, Portland, OR

0910 **9** *Novel Waveguide Structures for Bioassays with Broad Applications to Analytical Instrumentation*. **Heather Edberg**[*], **Richard Ozanich**, **R. Shane Addleman**, **Michael Wojcik**, **Summer Ziegler** and **Kathryn Antolick**, Pacific Northwest National Laboratory, Richland, WA

0940 **10** *Field Portable Electrochemical Sensor for Uranium and other Actinides in Aqueous Samples*. **Dale D. Russell**[*], Department of Chemistry and Biochemistry, Boise State University, Boise, ID and **Noah Minskoff**, Chemistry and Biochemistry, Boise State University, Boise, ID

1010 *Break.*

1030 **11** *Nanomonitors: Electrical Immunoassay*. **Ravikiran K. Reddy**[*]and **Shalini Prasad**, Department of Electrical and Computer engineering, Portland State University, Portland, OR

1100 **12** *Reservoir Characterization of Pulsed Vapor Generators Developed at the Idaho National Laboratory*. **Carla Miller**[*], Chemistry, Idaho National Laboratory, Idaho Falls, ID, **Timothy Kaser**, Controls/Power, Idaho National Laboratory, Idaho Falls, ID and **Jessica Rodriquez**, Engineering, University of Idaho, Moscow, ID

1130 **13** *Developing an In-Situ Sensor for Monitoring Oil Quality*. **B. Marx**[*], **Michael F. Hurley**, **D.P. Butt** and **Matthew Luke**, Department of Materials Science and Engineering, Boise State University, Boise, ID

1200 *Lunch Break.*

1330 **14** *Detection of Interleukin-6 Based on Dye-Doped Silica Nanoparticle Label/Protein Microarray*. **Hong Wu**[*], **Qisheng Huo**, **Guodong Liu**, **Jun Wang**, **Susan Varnum**, **Zimin Nie**, **Jun Liu** and **Yuehe Lin**, Pacific Northwest National Laboratory, Richland, WA

1400 **15** *Disposable Electrochemical Immunosensor Diagnosis Device Based on Nanoparticle Probe and Immunochromatographic Strip*. **Ying-Ying Lin**[*1], **Guodong Liu**[2], **Jun Wang**[2], **Yuehe Lin**[2], **Hong Wu**[2], **Chien Wai**[1] and **Ai-Cheng Lee**[2], [1]Department of Chemistry, University of Idaho, Moscow, ID; [2]Pacific Northwest National Laboratory, Richland, WA

1430 **16** *Direct Deposition of Noble Metal Nanoparticles onto Nanosprings and Nanowires*. **Timothy Cantrell**[1], **Pamela J. Shapiro**[1] and **David N. McIlroy**[*2], Departments of [1]Chemistry and [2]Physics, University of Idaho, Moscow, ID

1500 **17** *Biofunctionalization of Nanopatterned Silica from the Diatom Cyclotella sp.*. **Debra Gale**[*1], **Gregory L. Rorrer**[1] and **Timothy Gutu**[2], [1]Department of Chemical Engineering, Oregon State University, Corvallis, OR; [2]Department of Physics, Portland State University, Portland, OR

The following five posters were submitted as part of the above symposium. Please turn to page 43 for more information about the poster session. The number on the left is the poster number and also the abstract number.

244 *Polymer Nanocomposite Based Chemiresistive NOx Sensor*, **Divakara A.B.S. Meka**[*], **Linda A. George** and **Shalini Prasad**

245 *Correction of the Amplification Factor in SAW Sensor's Semi-Empirical Response Equation by Perturbation Theory*, **Zhixiong Cha**[*]

246 *Iridium Oxide Nanowire Monitors for Protein Detection*, **Vinu L. Venkatraman**[*], **Ravikiran K Reddy**, **Fengyan Zhang**, **Victor Hsu**, **Bruce Ulrich** and **Shalini Prasad**

247 *Development of a Magnetic-Shape-Memory-Based Micro-Accelerometer*, **Chris Pohl**[*], **Michael Hagler**, **Volodymir Chernenko**, **Makato Ohtsuka** and **Peter Müllner**

248 *Development of Metallic Periodic Structures for Surface Plasmon Polariton Sensor*, **Cory Sparks**[*], **Lincoln Bollschweiler** and **Wan Kuang**

The Chemistry of Advanced Nuclear Systems: Separations

The Peregrins (Boise Centre on the Grove)
Monday
8:00 AM - 12:00 PM

Program Organizers: Aurora E. Clark, Washington State University; Wibe (Bert) De Jong, Pacific Northwest National Laboratory

Sponsored by: NORM 07 and the Pacific Division Chemistry Section

The northwest is a hotbed of research geared towards understanding the fundamental chemistry and behavior of actinide and lanthanide elements as it pertains to the design and implementation of the next generation of nuclear energy systems and environmental remediation. This research area encompasses scientists from both academia and national laboratories, including (but not limited to) Washington State University, University of Idaho, Pacific Northwest National Laboratory, and Idaho National Laboratory. Given current trends in federal funding, the formation of the Global Nuclear Energy Partnership, and the anticipated construction of several new nuclear reactors in the U.S., researchers in the northwest are poised to take center stage in what will be a national effort to tackle the major scientific challenges associated with advanced nuclear systems. These include: 1) mastering the chemistry and physics of actinides and actinide-bearing materials, 2) developing multiscale descriptions of material properties in complex materials under potentially extreme conditions, and 3) understanding and designing new molecular systems to gain control of chemical selectivity during processing. The proposed symposium provides a forum for computational and experimental researchers from these and other institutions to share their progress on these issues, foster collaborative relationships, and address future areas of interest. There will be four umbrella topics, one for each half-day session. These will include: 1) environmental actinide chemistry, 2) theoretical modeling and simulation of heavy elements and new materials for nuclear systems applications, 3) separations for spent fuel processing, and 4) fuels and waste forms, including material performance under radiative fields.

Session Presider: Aurora E. Clark

0800 *Introductory Remarks*.

0805 **18** *Challenges for Actinide Separations in Advanced Nuclear Fuel Cycles*. **Ken Nash**[*], Department of Chemistry, Washington State University, Pullman, WA

0835 **19** *Selective Extraction of Americium and Curium in Acidic Media by Symmetric and Asymmetric Dithiophosphinic Acids*. **Dean R. Peterman**[*1], **Mitchell R. Greenhalgh**[1], **John R. Klaehn**[2], **Mason K. Harrup**[3], **Richard D. Tillotson**[1], **Thomas A. Luther**[3] and **Jack D. Law**[3], [1]Aqueous Separations and Radiochemistry Department, Idaho National Laboratory, Idaho Falls, ID; [2]Chemical Sciences, Idaho National Laboratory, Idaho Falls, ID; [3]Department of Chemical Sciences, Idaho National Laboratory, Idaho Falls, ID

0905 **20** *Identifying Americium Speciation for Advanced Separations*. **Leigh R. Martin**[*], **Bruce J. Mincher** and **Nicholas C. Schmitt**, Aqueous Separations and Radiochemistry, Idaho National Laboratory, Idaho Falls, ID

0935 **21** *Phase Transfer Kinetics of Trivalent Actinides and Lanthanides in Phosphorus Reagent Extraction Systems*. **Mikael Nilsson**[*] and **Ken Nash**, Department of Chemistry, Washington State University, Pullman, WA

0955 *Break*.

1015 **22** *Separation Uranium/Technetium for the UREX process*. **Julie Du Mazaubrun**[*1], **Frederic Poineau**[1], **Ken Czerwinski**[1], **Gordon Jarvinen**[2] and **Doris Ford**[2], [1]Harry Reid Center for Environmental Studies, University of Nevada Las Vegas, Las Vegas, NV; [2]Los Alamos National Laboratory

1045 **23** *Separation Potential of Cloud Point Extraction of Lanthanide Salts*. **Melissa A. Ensor**[*] and **Ken Nash**, Department of Chemistry, Washington State University, Pullman, WA

1105 **24** *Effect of Acetohydroxamic Acid on Distribution of Pu(IV) in 30% TBP*. **Alena Paulenova**[*] and **Peter Tkac**, Radiation Center, Oregon State University, Corvallis, OR

1135 **25** *Development of a Two-phase Calorimetric Method for the Studies of Thermodynamics of Solvent Extraction*. **Peter Zalupski**[*] and **Ken Nash**, Department of Chemistry, Washington State University, Pullman, WA

Soilscapes of the Western U.S.: Perspectives on Change

Salmon River (Boise Centre on the Grove)
Monday
8:10 AM - 12:00 PM

Program Organizers: Bob Graham, University of California, Riverside; Jay S. Noller, Oregon State University
Sponsored by: The Western Society of Soil Science and the Western Cooperative Soil Survey

Driven by curiosity about the Critical Zone, especially with regard to its sensitivity and vulnerability to global change impacts, the soil-landscape paradigm (once almost solely the rational construct for pedology) has become a major focus of attention for Earth and biological scientists. This interest was largely developed through the needs and contributions of pedologists exploring and positing key hypotheses relating the flow of water, biological activity (including nutrient cycling), and landscape evolution. This symposium will provide an overview of current research efforts in this arena. The Oral Session, scheduled for Monday morning, will consist of talks organized to define and exemplify approaches – as well as provide forum for discussions on near-future research needs and methods. The Poster Session, scheduled for Monday afternoon, will consist of volunteer poster presentations which will be organized to center on detailed examples of Western soilscape studies.

Session Presider: Jay S. Noller

0810 *Introductory Remarks.*

0815 **26** *Benchmark Soilscapes to Predict Effects of Climatic Change in the Western USA.* **Anthony O'Geen***, Department of Land, Air and Water Resources, University of California, Davis, CA

0835 **27** *Soils of the Mazama Tephra-blanketed Landscapes in Oregon: A Benchmark Soilscape for Global Change Research.* **Jay S. Noller***, Department of Crop and Soil Science, Oregon State University, Corvallis, OR

0855 **28** *Vegetation Influences on Soil Organic Carbon Dynamics in an Arid, Hyperthermic Ecosystem*. **David A. White II*** and **Craig Rasmussen**, Soil, Water and Environmental Science Department, University of Arizona, Tucson, AZ

0915 **29** *Organic Soil Formation on Lava Flows at Craters of the Moon National Monument and Preserve*. **Karen L. Vaughan***, **Paul McDaniel** and **Anita Falen**, Plant, Soil, and Entomological Sciences, University of Idaho, Moscow, ID

0935 **30** *Predictive Mapping and Landscape Analysis using Geographic Information Systems and Classification Trees*. **Sheila Slevin*** and **Jay S. Noller**, Department of Crop and Soil Science, Oregon State University, Corvallis, OR

0955 *Break.*

1010 **31** *Soil Development in a Forested Debris Flow Chronosequence in Southern California*. **Judith K. Turk*** and **Robert C. Graham**, Environmental Sciences Department, University of California, Riverside, CA

1030 **32** *Data Mining and Its Application to Soil-landscapes in the Great Basin*. **Abdelhamid A. Elnaggar*** and **Jay S. Noller**, Department of Crop and Soil Science, Oregon State University, Corvallis, OR

1050 **33** *The Critical Zone Exploration Network Sonoran Desert Environmental Gradient as a Benchmark Soilscape in Southern Arizona*. **Craig Rasmussen***[1], **Michael Crimmins**[1], **Tom Meixner**[1], **Jon Chorover**[1] and **Egbert Schwartz**[2], [1]Soil, Water and Environmental Science Department, University of Arizona, Tucson, AZ; [2]Northern Arizona University

1110 **34** *Development of a Forensic GIS Database*. **Patricia R. Menchaca***[1], **Robert C. Graham**[1] and **Marianne Stam**[2], [1]Environmental Sciences, University of California, Riverside, Riverside, CA; [2]Riverside Criminalistics Laboratory, California Department of Justice, Riverside, CA

1130 **35** *Linking Arid Land Surface Characteristics to Soil Hydrologic and Ecosystem Functions in Mojave Desert Landscapes*. **R.C. Graham***, Department of Environmental Sciences, University of California, Riverside, Riverside, CA

1150 *Concluding Remarks.*

The following seven posters were submitted as part of the above symposium. Please turn to page 43 for more information about the poster session. The number on the left is the poster number and also the abstract number.

225 *Soil Development on a Sequence of Moraines, Eastern Sierra Nevada, CA*, **Ann M. Rossi*** and **Robert C. Graham**

226 *Soil-Geomorphic Classification of an Arid Mountain Range, Mojave Desert, USA*, **Daniel R. Hirmas*** and **Robert C. Graham**

227 *Comparison of Flood Hazard Assessments on Alluvial Fans Using FEMA, NRCS, and Surficial Geologic maps: A Case Study in Ivanpah Valley, Nevada*, **Colin R. Robins***, **Brenda J. Buck**, **Douglas J. Merkler**, **Michael S. Howell**, **Janice L. Morton**, **Amanda J. Williams**, **Maureen L. Yonovitz** and **P. Kyle House**

228 *Predictive Soil Maps Generated from Decision Tree Analysis and GIS Technology*, **Jeffrey S. Pace*** and **Jay S. Noller**

229 *Predictive Mapping in the Fremont National Forest, Oregon*, **Melanie R. Malone*** and **Jay S. Noller**

230 *Using Decision Tree Analysis to Generate Rule Sets for Predictive Soils Mapping*, **Sarah J. Hash*** and **Jay S. Noller**

231 *Impact of Soil Mineral Assemblage and Acidity on Organic Carbon Cycling in a Range of Ponderosa Pine Forests*, **Katherine A. Heckman**, **Amy Welty-Bernard**, **Craig Rasmussen***, **Egbert Schwartz** and **Jon Chorover**

New Humanities and Science Convergences III: The Greening of the Disciplines

Cottonwoods (Boise Centre on the Grove)
Monday
8:30 AM - 4:30 PM

Program Organizers: Robert Louis Chianese, California State University, Northridge; Carl A. Maida, University of California, Los Angeles

Sponsored by: The Pacific Division Section on General and Interdisciplinary Studies

This multidisciplinary symposium explores new or recent connections between the humanities and the sciences in order to survey positive cross-fertilizations they produce. collaborations of unique kinds between the sciences on the one hand, and humanities, art, literature, music, dance, and architecture on the other, mark the current interdisciplinary scene. The symposium seeks to survey collaborations that eclipse former antagonisms between the sciences and the humanities and provoke questions about the very nature of each area as they draw from and influence each other. We give particular focus this year to the influence of ecology and sustainability in the evolution of the academic disciplines in both the humanities and sciences. A "green" concern for the content, theory, and methods in various disciplines has the capacity to transform them. Papers for panel presentations should highlight the potential for creative work and new directions emerging from new humanities and science convergences and the greening of the disciplines.

Session Presider: Robert Louis Chianese

0830 *Introductory Remarks*. **Robert Louis Chianese**

0845 **37** *Marco Polo's visit to Hangzhou, China: A Humanties/GPS Visualization/Convergence*. **James C. Manley***, Department of Philosophy, California State Polytechnic University, Pomona, California, Pomona, CA

0915 **38** *A.R.T. as the Savior of Science and Technology*. **Scott MacFarlane***, Independent scholar, Mount Vernon, WA

0945 **39** *Collaborating on the Wings of a Butterfly: An Interdisciplinary Effort to Understand and Restore a Threatened Species*. **Jon Christensen***, History Department, Stanford University, Palo Alto, CA

1015 *Break*.

1030 **40** *A Century of Misbelief: Milk Sickness in the American Midwest, 1828-1928*. **Barbara Yablon Maida***, Department of Geography, University of California, Los Angeles, Los Angeles, CA

1100 **41** *Micron Scale Examinations of Two Illustrative Environments: Where Reality is the Ultimate Abstraction*. **Roy W. Johnson***, Geology, University of Illinois, Boise, ID

1130 **42** *The New Humanities Field Trip: Sensing/Aesthetics/Mythology/Ecology*. **Robert Louis Chianese***, Department of English, California State University, Northridge, Northridge, CA

1200 *Lunch Break*.

1330 **43** *ORGANIZING KNOWLEDGE: Armadillo, Armoire, Amoeba and Aretology*. **Fred Massarik***, HR&OB, UCLA Anderson School of Management, Los Angeles, CA

1400 **44** *Sustainability and the Re-Greening of Anthropology*. **Carl A. Maida***, University of California, Los Angeles, Los Angeles, CA

1430 **45** *MCCE IGERT: An Experiment in International Interdisciplinary Graduate Education*. **Adam Freeburg*[1], Sara Breslow[1], Julie Combs[2], Emma Flores[3], Steve Harrell[1], Tom Hinckley[2], Joanne Ho[2], Joyce LeCompte-Mastenbrooke[1], Eric Nassau[4], Alicia Robbins[2], Haldre Rogers[5], Patrick Shamberger[6]** and **Lauren Urgenson[2],** [1]Department of Anthropology, University of Washington, Seattle, WA; [2]College of Forest Resources, University of Washington, Seattle, WA; [3]College of Education, University of Washington, Seattle, WA; [4]Civil and Environmental Engineering, University of Washington, Seattle, WA; [5]Department of Biology, University of Washington, Seattle, WA; [6]Department of Materials Science and Engineering, University of Washington, Seattle, WA

1500 *Break*.

1515 **46** *Ethnographic Futures Research: A Method to Facilitate Visioning, Consensus and Organizational Success*. **Bill Gillis***, **Matthew Mitchell** and **Robert Textor**, Center to Bridge the Digital Divide, Washington State University, Spokane, WA

1600 *Discussion: Is There Hope for Knowledge Convergence? Managing Boundaries and Barriers in the Groves of Science*. **Robert Louis Chianese***, Department of English, California State University, Northridge, Northridge, CA

Biomedical/Bio-Related Materials, Part I

Payette River (Boise Centre on the Grove)
Monday
9:00 AM - 4:30 PM

Program Organizer: Tomoko Fujiwara, Boise State University
Sponsored by: The Pacific Division Sections on Biological Sciences, Chemistry, and Health Sciences

Biomaterials made from synthetic and natural polymers or inorganic materials have wide-ranging applications, including use as tissue engineering scaffolds, drug delivery vehicles, clinical devices, and implant devices. Polymers have been used to generate coatings, films, fibers, hydrogels, microspheres, nanoparticles, and sponges. Their chemical modification has allowed for numerous crosslinking methods and combination with a wide variety of other molecules to create composite biomaterials. This session cuts across multiple biomaterial-related disciplines to provide a forum for researchers to present their recent developments in synthesis, characterization, and application of biomaterials.

Session Presider: Tomoko Fujiwara

0900 *Welcoming Remarks.*

0905 **47** *Polymeric Delivery Systems for Genes: Beneficial Effect of Lipophilic Substitutions on Cationic Polymers.* **Hasan Uludag***, Chemical & Materials Engineering, University of Alberta, Edmonton, AB

0940 **48** *Bioinspired Phospholipid Polymers for Biomedical Devices*. **Kazuhiko Ishihara***, Department of materials Engineering and Center for NanoBio Integration, The University of Tokyo, Tokyo

1015 *Break*.

1035 **49** *Antiviral Drug Delivery Systems for the Prevention of HIV Transmission*. **Patrick F. Kiser***, Department of Bioengineering, University of Utah, Salt Lake City, UT

1110 **50** *Molecular Interactions within the Extracellular Matrix of Cartilage*. **Julia Thom Oxford***, **Raquel Brown** and **Noriko Hazeki-Taylor**, Biomolecular Research Center, Department of Biology, Boise State University, Boise, ID

1145 *Lunch Break.*

1315 **51** *Fully Degradable Functionalized Polymers: A Versatile Approach Using Ring-Opening Polymerization of Cyclic Carbonates.* **James L. Hedrick***, IBM Research, San Jose, CA

1350 **52** *Organic Materials via Molecular Self-Organization into Liquid-Crystalline Phase or Crystal Phase*. **Suk-Wah Tam-Chang***, **Liming Huang**, **Gyan Ayral**, **Wonewoo Seo** and **Kyle Rove**, Chemistry, University of Nevada, Reno, Reno, NV

1425 **53** *Biomaterirals for Cell Transplantation*. **Tetsuji Yamaoka***, Department of Biomedical Engineering, National Cardiovascular Center Research Institute, Suita, Japan

1500 *Break*.

1520 **54** *Synthesis and Anticoagulant Function of Heparin-Containing Block Copolymers at Interfaces*. **Allyson Fry***, **Joseph McGuire** and **Karyn Bird**, Chemical Engineering, Oregon State University, Corvallis, OR

1555 **55** *Photo-Responsive Polymer Assemblies for Drug Delivery*. **Tomoko Fujiwara***, Department of Chemistry and Biochemistry, Boise State University, Boise, ID

The following poster was submitted as part of the above symposium. Please turn to page 43 for more information about the poster session. The number on the left is the poster number and also the abstract number.

220 *Identification of Proteins that Interact with the Surface of Collagen Fibrils*, **Raquel Brown*** and **Julia Thom Oxford**

The Chemistry of Advanced Nuclear Systems: Separations and Environmental

The Summit (Boise Centre on the Grove)
Monday
1:15 PM - 5:05 PM

Program Organizers: Wibe (Bert) De Jong, Pacific Northwest National Laboratory; Aurora E. Clark, Washington State University
Sponsored by: NORM 07 and the Pacific Division Chemistry Section

Please refer to the description for "The Advanced Chemistry of Advanced Nuclear Systems: Separations" on Monday morning, page 24.

Session Presider: Kenneth L. Nash

1315 **56** *Symmetric and Asymmetric Dithiophosphinic Acids for Minor Actinide Extraction*. **John R. Klaehn*[1], Dean R. Peterman[2], Mason K. Harrup[3], Richard D. Tillotson[2], Thomas A. Luther[3], Mitchell R. Greenhalgh[2], Jack D. Law[3]** and **Lee M. Daniels[4],** [1]Chemical Sciences, Idaho National Laboratory, Idaho Falls, ID; [2]Aqueous Separations and Radiochemistry Department, Idaho National Laboratory, Idaho Falls, ID; [3]Department of Chemical Sciences, Idaho National Laboratory, Idaho Falls, ID; [4]Rigaku Inc., The Woodlands, TX

1345 **57** *Trapped-Ion / Vibrational Spectroscopy of Gas-Phase Dioxouranium Complexes*. **Garold L. Gresham*[1], Gary S. Groenewold[1], Michael J. Van Stip-**

donk[2], **Jos Oomens**[3], **Michael E. McIlwain**[1] and **Wibe A. De Jong**[4], [1]Chemical Sciences, Idaho National Laboratory, Idaho Falls, ID; [2]Department of Chemistry, Wichita State University, Wichita, KS; [3]FOM Institute for Plasma Physics, Niewegein; [4]Environmental Molecular Sciences Laboratory, Pacific Northwest National Laboratory, Richland, WA

1415 **58** *Novel Dithiophosphinic Acids as Actinide Extractants, A Density Functional Theory Investigation*. **Michael T. Benson**[*1], **Adriana Dinescu**[1], **Megan L. Moser**[1] and **Dean R. Peterman**[2], [1]Chemical Sciences, Idaho National Laboratory, Idaho Falls, ID; [2]Aqueous Separations and Radiochemistry Department, Idaho National Laboratory, Idaho Falls, ID

1445 *Break*.

1505 **59** *Actinide Interaction Processes with Bacterial Surfaces: The Quest for Molecular-level Understanding*. **Heino Nitsche**[*], University of California, Berkeley, Department of Chemistry and Lawrence Berkeley National Laboratory, Nuclear Science Division, Berkeley, CA

1535 **60** *Surface Chemistry of Uranyl Silicate*. **Nathalie A. Wall**[*], Nuclear Radiation Center, Washington State University, Pullman, WA, **S.B. Clark**, Department of Chemistry, Washington State University, Pullman, WA and **Laurence C. Hull**, Idaho National Laboratory, Idaho Falls, ID

1605 **61** *Uranium, Neptunium, and Plutonium Complexes in Aqueous Hydrogen Peroxide-Carbonate Solutions: Stability and Speciation*. **G. S. Goff**, **F.L. Taw**, **S.M. Peper**, **L.F. Brodnax** and **Wolfgang H. Runde**[*], Civilian Nuclear Program Office, Los Alamos National Laboratory, Los Alamos, NM

1635 **62** *Washington State University Activation Analysis Facilities*. **James T. Elliston**[*], **Margaret A. Malloy** and **Donald E. Wall**, Nuclear Radiation Center, Washington State University, Pullman, WA

Tuesday, 19 June 2007

The Chemistry of Advanced Nuclear Systems: Modeling and Simulation

The Summit (Boise Centre on the Grove)
Tuesday
8:00 AM - 12:00 PM

Program Organizers: Wibe (Bert) De Jong, Pacific Northwest National Laboratory; Aurora E. Clark, Washington State University

Sponsored by: NORM 07 and the Pacific Division Chemistry Section

Please refer to the description for "The Advanced Chemistry of Advanced Nuclear Systems: Separations" on Monday morning, page 24.

Session Presider: Dieter Wolf

0800 **63** *Theoretical Studies of Thermochemistry, Chemical Bonding, and Electronic Excitations in Actinide Complexes*. **Enrique R. Batista**[*], Theoretical Division, Los Alamos National Laboratory, Los Alamos, NM

0830 **64** *Computational Modeling of Actinide Complexes*. **Krishnan Balasubramanian**[*], College of Science, California State University East Bay & Lawrence Livermore National Lab, Livremore, CA

0900 **65** *The Role of Surface Charge Density in Ln(III) Hydration*. **Aurora E. Clark**[*], Department of Chemistry, Washington State University, Pullman, WA

0930 **66** *First-principles Studies of Cerium Doped LaBr3 Scintillator*. **Da Gao**[*] and **Michael E. McIlwain**, Chemical Sciences, Idaho National Laboratory, Idaho Falls, ID

0950 *Break*.

1010 **67** *Interplay of Computational Modeling and Experiments in Actinide Chemistry*. **Wibe (Bert) De Jong**[*], Pacific Northwest National Laboratory, Richland, WA

1040 **68** *Structure and Reactivity Studies of Environmentally Important Actinide Complexes*. **Jason L. Sonnenberg**[*] and **H. Bernhard Schlegel**, Department of Chemistry, Wayne State University, Detroit, MI

1100 **69** *Ferrous Iron Reduction of Uranium Triscarbanato: Connecting Atomic Behavior to Field Scale Interpretations*. **Matthew C. F. Wander**[*1], **Sebastian Kerisit**[2], **Kevin M. Rosso**[2] and **Martin A. A. Schoonen**[1], [1]Department of Geosciences, Stony Brook University, Stony Brook, NY; [2]Environmental Molecular Sciences Laboratory, Pacific Northwest National Laboratory, Richland, WA

1120 **70** *Ab-initio Study of Lanthanides and Actinides: Progresses, Challenges, and Applications.* **Zhiyong Zhang***, Stanford University, Stanford, CA

The following poster was submitted as part of the above symposium. Please turn to page 43 for more information about the poster session. The number on the left is the poster number and also the abstract number.

238 *A Density Functional Study of Actinyl - Methoxide Complexes: the Structure and Bonding Properties*, **Da Gao*** and **Michael E. McIlwain**

Corrosion and Coatings Challenges in Industry

Willows (Boise Centre on the Grove)
Tuesday
8:30 AM - 11:35 AM

Program Organizer: Abdel Salam Hamdy Makhlouf, Boise State University

Sponsored by: The Pacific Division Sections on Industrial Science and Technology

Corrosion has a huge economic impact. Studies have recently confirmed that the cost due to corrosion problems amounts to 3 to 4% of the Gross Domestic Product of industrialized countries. Therefore, improving the reliability, efficiency and safety of materials used in plants and infrastructure has become a subject of great interest all over the world. The main objective of this symposium is to present the state-of-the-art for various topics in the field of corrosion and its prevention. Moreover, this symposium will enhance the interaction among the corrosion scientists and engineers from universities, scientific institutes and industry. The scientific and technical areas covered by this symposium are: 1. Corrosion in petroleum, chemical, food processing, metallurgical, power, nuclear and building industries. 2. Corrosion forms (pitting, crevice, galvanic, stress and fatigue). 3. Corrosion monitoring (destructive and nondestructive). 4. Corrosion protection by inhibitors, cathodic protection, surface modification, paints and coatings. 5. Advanced surface coatings technology (nanocomposite coatings, Sol- gel coatings, CVD- PVD, smart coatings, ...etc). 6. Case studies from industry. 7. Failure analysis due to corrosion or coatings defects. 8. Materials selection.

Session Presider: Abdel Salam Hamdy Makhlouf

0830 *Welcoming Remarks.*

0845 **71** *Modeling Realistic Microstructures: The Effects of Microstructural Anisotropy on Intergranular Stress-corrosion Cracking*. **Megan Frary***[1], **Luke Hindman**[2] and **Amit Jain**[2], [1]Materials Science and Engineering, Boise State University, Boise, ID; [2]Computer Science, Boise State University, Boise, ID

0910 **72** *Newly Developed Corrosion Resistant Nano-Composite Alloy Coatings for Steels*. **Abdel Salam Hamdy Makhlouf***, Department of Materials Science and Engineering, Boise State University, Boise, ID, **Madiha Ahmed Shoeib V**, Surface Technology and Corrosion Protection, Central Metallurgical Research and Development Institute, CMRDI, Cairo, **Hossam Hady Jr.**, Saqr Factory for Advanced Militaries Industries, Cairo and **Omar F. Abdel Salam**, Materials Science and Engineering, Faculty of Engineering, University of Cairo, Cairo

0935 **73** *Corrosion Resistant Materials for Concrete Reinforcement*. **Michael F. Hurley***, Materials Science, Boise State University, Boise, ID

1000 *Break*.

1020 **74** *Assessing the Performance of Stannate Conversion Coatings on Mg Alloys*. **Brian M. Marx***, **Abdel Salam Hamdy Makhlouf**, **Darryl P. Butt** and **David Thomsen**, Department of Materials Science and Engineering, Boise State University, Boise, ID

1045 **75** *The Impact of Crystal Orientation on Oxidation and Corrosion of Polycrystalline Metals*. **Lou Bonfrisco***, **Sharla Hopkins** and **Megan Frary**, Materials Science and Engineering, Boise State University, Boise, ID

1110 **76** *Corrosion Behavior of Some Newly Developed Mg Alloys in NaCl Solution*. **David Thomsen***, **Abdel Salam Makhlouf**, **B. Marx** and **D. P. Butt**, Department of Materials Science and Engineering, Boise State University, Boise, ID

The following two posters were submitted as part of the above symposium. Please turn to page 43 for more information about the poster session. The number on the left is the poster number and also the abstract number.

236 *Pitting Studies in Seawater Contaminated Jet Turbine Oil*, **Brandon Christoffersen***, **Brian M. Marx** and **Darryl P Butt**.

237 *Enhancing Corrosion Resistance of Stainless Steel 304 Using Laser Surface Treatment*, **I. M. Ghayad***, **M. A. Shoeib**, **T. M. Mattar**, **H. M. Hussein** and **R. A. AbuShaiba**.

Infectious Disease, Part I

Cottonwoods (Boise Centre on the Grove)
Tuesday
8:30 AM - 4:30 PM

Program Organizers: Ken Cornell, Boise State University; Juliette K. Tinker, Boise State University
Sponsored by: The Pacific Division Section on Health Sciences

Two sessions are planned. The first session will focus on presentations by investigators and students involved in research into the identification of new therapeutic targets in infectious diseases and development of new antimicrobial drugs. The second session will center on the presentation of research identifying immune responses to infectious diseases, immune system targets, and new strategies for vaccination against pathogens.

Session Presider: Ken Cornell

0830 *Welcoming Remarks.*

0845 **77** *Drug Targeting of Bacterial Communication and Nutrient Salvage Pathways*. **Ken Cornell***, **C. Isom**, **J. Bonander**, **M. Martinez**, **J. Jones** and **C. Dayan**, Department of Chemistry and Biochemistry, Boise State University, Boise, ID

0915 **78** *The Contribution of Quorum Sensing to* Pseudomonas aeruginosa *Swarming and Biofilm Formation is Nutritionally Conditional*. **Joshua D. Shrout***[1], **David Chopp**[2], **Morten Hentzer**[3], **Michael Givskov**[3] and **Matthew Parsek**[1], [1]Department of Microbiology, University of Washington, Seattle, WA; [2]Department of Enginering Science and Applied Mathematics, Northwestern University, Evanston, IL; [3]Center for Biomedical Microbiology, Technical University of Denmark, Copenhagen

0945 **79** *Antimicrobial Effects and Mechanisms of Toxicity of Metal Oxide Nanoparticles*. **Kevin Feris***[1], **Jason Bell**[1], **Madhu Kongara**[2], **Isaac Coombs**[2], **Hua Wang**[2], **Cory Hanley**[1], **Alex Punnoose**[2] and **Denise Wingett**[1], [1]Department of Biology, Boise State University, Boise, ID; [2]Department of Physics, Boise State University

1015 *Break*.

1030 **80** *Antimicrobial Nanoparticle Surface Functionalization to Prevent Biofilm Formation on Medical Devices*. **Balchandra Karandikar*** and **Bruce Gibbins**, Research and Development, AcryMed, Inc., Beaverton, OR

1100 **81** *Group A Streptococcal Myonecrosis: Increased Vimentin Expression following Skeletal Muscle Injury Mediates the "Flesh-eating Disease"*. **Amy E. Bryant***, **Stephanie M. Hamilton**, **Clifford R. Bayer** and **Dennis L. Stevens**, Infectious Diseases Section, Veterans Affairs Medical Center, Boise, ID

1130 **82** *The Leukemoid Reaction in* Clostridium sordellii *Infection: Neuraminidase Induction of Promyelocytic Cell Proliferation*. **Michael J. Aldape***, **Amy E. Bryant** and **Dennis L. Stevens**, Research Department: Infectious Disease Section, Veterans Affairs Medical Center, Boise, ID

1200 *Lunch*.

1330 **83** *Bioactivity of Herbal Medicines*. **Jayita Goswami***, Department of Biology, Boise State University, Boise, ID

1400 **84** *Virus Removal from Blood using Hollow Fiber Cartridges*. **Frank Jacobitz***[1], **Jeevan Menon**[2], **Paul Duffin**[2] and **Richard Tullis**[2], [1]Department of Engineering, University of San Diego, San Diego, CA; [2]Aethlon Medical, Inc., San Diego, CA

1430 **85** *Structural Studies of Phenylpropanoid and Monoterpene Biosynthesis Pathway Enzymes*. **ChulHee Kang***, **B. Youn**, **D.C. Hyatt**, **N.G. Lewis** and **R.B. Croteau**, School of Molecular Biosciences, Washington State University, Pullman, WA

1500 *Break*.

1515 **86** *Towards the Synthesis of Novel Borinic Acids as Potential HIV-1 Protease Inhibitors*. **Levente Fabry-Asztalos***, Chemistry, Central Washington University, Ellensburg, WA

1545 **87** *Antimalarial Agents Designed to Overcome Chloroquine Resistance*. **David H. Peyton***, **Steven J. Burgess**, **Cheryl Hodson**, **Katherine Liebman**, **Bornface Gunsaru** and **Jane Xu Kelly**, Department of Chemistry, Portland State University, Portland, OR

1615 *Concluding Remarks.*

The following seven posters were submitted as part of the above symposium. Please turn to page 43 for more information about the poster session. The number on the left is the poster number and also the abstract number.

212 *Pathogenesis beyond pX01 and pX02 – In Silico Analysis of* Bacillus Anthracis, **GongXin Yu** and **Laura Bond***.

213 *Organic Spices as Non-contact Antimicrobial Coatings*, **Jeremiah Hull***, **Ken Cornell**, and **Greg Hampikian**.

214 *New Drug Targets for Treating Lyme Disease*, **Maria Martinez***, **Cassie Bassett**, **Cassie Dayan**, **Diana Saidac**, **Nikhat Parveen** and **Ken Cornell**.

215 *Purine Auxotrophy, Giardia's Achilles' Heel?* **Jeremy Bonander*** and **Ken Cornell**.

216 *Cloning and Expression of* Entamoeba histolytica *MTA Nucleosidase*, **Robert Ormond***, **Tyrell Simpkins** and **Ken Cornell**.

217 *Methylthioribose Kinase, a Sweet Target for Antibiotic Design*. **Chelsea Isom***, **Cassie Dayan** and **Ken Cornell**.

218 *Construction of LcrV-Enterotoxin Fusions for use as Potential Mucosal Yersinia Vaccines*. **Chadwick T. Davis*** and **Juliette K. Tinker**.

Biomedical/Bio-Related Materials, Part II

Payette River (Boise Centre on the Grove)
Tuesday
9:00 AM - 3:00 PM

Program Organizer: Tomoko Fujiwara, Boise State University
Sponsored by: The Pacific Division Sections on Biological Sciences, Chemistry, and Health Sciences

Please refer to the description for "Biomedical/Bio-Related Materials, Part I" on Monday morning page 27.

Session Presider: Tomoko Fujiwara

0900 *Introductory Remarks.*

0905 **88** *Polymer-Bioceramic Composites Enhance Bone Healing*. **Kent Leach***, Department of Biomedical Engineering, University of California, Davis, Davis, CA

0940 **89** *Nanospring-based Electronic Biosensors for DNA Detection*. **Josh R. Branen***[1], **Jamie M. Jabal**[2], **Giancarlo Corti**[3], **D. Eric Aston**[4], **A. Larry Branen**[1], **James J. Nagler**[5], **M. Grant Norton**[6] and **David N. McIlroy**[3], [1]Biosensor and Nanotechnology Applications Laboratory, University of Idaho, Post Falls, ID; [2]Department of Materials Science, University of Idaho, Moscow, ID; [3]Department of Physics, University of Idaho, Moscow, ID; [4]Department of Chemical Engineering, University of Idaho, Moscow, ID; [5]Department of Biological Sciences, University of Idaho, Moscow, ID; [6]School of Mechanical and Materials Engineering, Washington State University, Pullman, WA

1015 *Break*.

1035 **90** *Utilizing the Unique Mechanical Properties of Bamboo Fiber for the Reinforcing and Toughening of Poly(3-hydrobutyrate-co-3-hydroxyvalerate)*. **Jinwen Zhang***, **Long Jiang** and **Michael P. Wolcott**, Wood Materials and Engineering Laboratory & Department of Civil and Environmental Engineering, Washington State University, Pullman, WA

1110 **91** *A Nanometer Scale Perspective on Cartilage Genesis*. **William B. Knowlton***[1], **Kaci Bloxham**[2], **Jen Cole**[2], **Zach Heuman**[2], **Lisa Warner**[3], **Sorcha Yingst**[4], **Linda Kenoyer**[2] and **Julia Thom Oxford**[4], [1]Departments of Electrical & Computer Engineering and Materials Science & Engineering, Boise State University, Boise, ID; [2]Department of Materials Science & Engineering, Boise State University, Boise, ID; [3]Departments of Materials Science & Engineering and Biology, Boise State University, Boise, ID; [4]Department of Biology, Boise State University, Boise, ID

1145 *Lunch Break*.

1315 **92** *Cell Targeting with Ferrimagnetic Protein Cage Architectures*. **Trevor Douglas***, **Masaki Uchida** and **Mark Young**, Department of Chemistry & Biochemistry, Montana State University, Bozeman, MT

1350 **93** *Intercalator-Functionalized Nucleic Acids as Emerging Tools for Targeting of Double Stranded DNA*. **T. Santhosh Kumar**[1], **Nicolai K. Andersen**[1], **Andreas S. Madsen**[1], **Jesper Wengel**[1] and **Patrick J. Hrdlicka***[2], [1]Department of Physics and Chemistry, University of Southern Denmark, Odense M; [2]Department of Chemistry, University of Idaho, Moscow, ID

1425 **94** *Probing an Enzymatic Transition State Using Atomic Force Microscopy*. **Byung I. Kim***[1], **Jenniffer Rice**[1], **Joseph Holmes**[1] and **Ken Cornell**[2], [1]Department of Physics, Boise State University, Boise, ID; [2]Department of Chemistry and Biochemistry, Boise State University, Boise, ID

What Makes a Green City – The Boise Experiment

The Kestrels (Boise Centre on the Grove)
Tuesday
9:00 AM - 12:00 PM

Program Organizers: Morty Prisament, Tetra Tech, Boise, ID; Ken Baker, Boise, ID
Sponsored by: The Pacific Division Sections on General and Interdisciplinary Studies and Ecology and Environmental Sciences

Green Planning is transforming cities across the country, from Chicago to San Francisco, as well as the smaller cities like Austin, Texas. Green design is taking hold here in Boise with green buildings taking shape downtown, and in neighboring cities like Nampa and Caldwell, which are initiating green planning policies and guidelines. Green Planning focuses upon development practices–land use planning, green design, and sustainable communities. It is more than simply a collection of techniques, but a change in approach and underlying philosophy for planning cities. Does this signal a paradigm shift? This half-day workshop will explore what makes a "green city" and cover such topics as recent trends, carbon footprint analysis, relationship to climate change, role of universities, and local developments in green planning and design. It will follow with an after-lunch tour of the Platinum LEED Platinum Banner Bank Building in Downtown Boise.

Session Presider: Morty Prisament

0900 *Introductory Remarks.*

0915 **95** *The Evolution of Green Planning – Philosophy, Trends, and Connections*. **Morty Prisament***, Energy and Water Resources Programs, Tetra Tech, Boise, ID

0945 **96** *Boise's Climate Protection Program*. **Beth Baird***, Public Works, City of Boise, Boise, ID

1015 *Break*.

1030 **97** *Boise Cool Cities Campaign*. **Jessica Ruehrwein***, Sierra Club, Boise, ID

1100 **98** *Project-Based Education*. **Kevin Van Den Wymelenberg***, Integrated Design Lab - Boise, University of Idaho, Boise, ID

1130 **99** *The Carbon Connection, Our Carbon Footprint – How to Rate a Green City?* **Victoria A. Evans***, Air Quality Research Center, University of California Davis, Davis, CA

One Hundred Fifty Years of Human Activity In Sagebrush Steppe: Ecological and Genetic Consequences

Ponderosa Pines (Boise Centre on the Grove)
Tuesday
1:15 PM - 5:20 PM

Program Organizers: Marcelo Serpe, Boise State University; Stephen J. Novak, Boise State University
Sponsored by: The Pacific Division Section on Ecology and Environmental Sciences

Due to anthropomorphic activities, the sagebrush ecosystem of the Northern Great Basin has experienced significant changes in species composition and vegetation structure. The symposium will focus on analyzing the effects of these changes on the reproduction of native species, the genetic structure of plant populations, and the dispersal of exotic invasive weeds. Practices aimed at restoring sagebrush habitats and preventing further loss of biological diversity will also be discussed.

Session Presider: Marcelo Serpe

1315 *Introductory Remarks.*

1320 **100** *Ecological Genetics of* Bromus tectorum *(Cheatgrass, Downy Brome) in Western North America*. **Cecilia Lynn Kinter***, Idaho Department of Fish and Game, Idaho Conservation Data Center, Boise, ID

1345 **101** *Germination and Seed Water Status of Native and Exotic Grasses on Biological Soil Crusts*. **Shawna Zimmerman***[1], **Roger Rosentreter**[2], and **Marcelo Serpe**[1], [1]Department of Biology, Boise State University, Boise, ID; [2]Bureau of Land Management, Boise, ID

1410 **102** *Differentiating Impacted and Least Impacted Springbrooks in Southern Idaho*. **Johnna Sandow*** and **Peter Koetsier**, Biology Department, Boise State University, Boise, ID

1435 **103** *Fertile Island Degradation Following Western Juniper Cutting*. **Chris Miwa***, Department of Forest Resources, Oregon State University, Corvallis, OR and **Ron Reuter**, Oregon State University Cascade Campus, Bend, OR

1500 *Break.*

1515 **104** *The Influence of Disturbance Events and Rehabilitation on Sagebrush Steppe Ecosystems*. **Stuart W. Murray***, High Desert Ecology, Boise, ID

1540 **105** *Sagebrush, Fire, and Restoration: New Approaches in the Great Basin*. **Robert D. Cox*** and **Nancy L. Shaw**, USDA Forest Service Rocky Mountain Research Station, Boise, ID

1605 **106** *Insect-mediated Pollination and Spatial Structuring in* Lepidium papilliferum *Populations*. **Ian C. Robertson***, **Amy C. Ulappa** and **Stephanie Billinge**, Department of Biology, Boise State University, Boise, ID

1630 **107** *Population Genetics of the Rare Polyploid,* Lepidium papilliferum *(Brassicaceae), a Southwest Idaho Endemic*. **Amy J. Stillman***, **Stephen J. Novak**, **Ian C. Robertson** and **James F. Smith**, Department of Biology, Boise State University, Boise, ID

1655 **108** *A Phylogenetic Analysis of* Lepidium papilliferum *and* L. davisii *(Brassicaceae) Reveals the Relations of these Rare Endemic Species.* **James F. Smith***[1], **Amy J. Stillman**[1], **Steven R. Larson**[2], **Culumber C. Mae**[2], **Ian C. Robertson**[1] and **Stephen J. Novak**[1], [1]Department of Biology, Boise State University, Boise, ID; [2]USDA-ARS Forage and Range Research Laboratory, Utah State University, Logan, UT

Wednesday, 20 June 2007

The Chemistry of Advanced Nuclear Systems: Waste Forms

The Summit (Boise Centre on the Grove)
Wednesday
8:00 AM - 12:00 PM

Program Organizers: Wibe (Bert) De Jong, Pacific Northwest National Laboratory, Aurora E. Clark, Washington State University
Sponsored by: NORM 07 and the Pacific Division Chemistry Section

Please refer to the description for "The Advanced Chemistry of Advanced Nuclear Systems: Separations" on Monday morning, page 24.

Session Presider: Wibe (Bert) De Jong

0800 **109** *Microstructure and Deformation Physics of Fission-reactor Materials by Multi-scale Simulation*. **Dieter Wolf***, Material Sciences Department, Idaho National Laboratory, Idaho Falls, ID

0830 **110** *Modeling Radiation Effects in Ceramics for Immobilization of Actinides*. **William J. Weber*** and **Ram Devanathan**, Fundamental Science Directorate, Pacific Northwest National Laboratory, Richland, WA

0900 **111** *Radiation Tolerance in Structurally Related Oxides*. **Blas Pedro Uberuaga***, Materials Science and Technology Division, Los Alamos National Laboratory, Los Alamos, NM

0930 **112** *Irradiation Effects in Oxide Materials*. **L. René Corrales***, Departments of Material Science and Engineering, and of Chemistry, The University of Arizona, Tucson, AZ

1000 *Break*.

1020 **113** *Molecular Dynamics Study of Diffusional Creep in Nanocrystalline UO2*. **Tapan Desai***, **Paul Millett** and **Dieter Wolf**, Material Sciences Department, Idaho National Laboratory, Idaho Falls, ID

1050 **114** *Determination of Thermodynamic Parameters for Modeling Actinide Solubility and Speciation in High Ionic Strength Aqueous Solutions*. **Donald E. Wall***, Nuclear Radiation Center, Washington State University, Pullman, WA

1120 **115** *Characterization of Actinide Containing Zirconia-Magnesia Based Inert Matrix Fuel*. **Kiel S. Holliday*** and **Ken R. Czerwinski**, Radiochemistry Group, Harry Reid Center, University of Nevada, Las Vegas, Las Vegas, NV

Environmental Issues In Idaho: Earth, Wind, and Water

Salmon River (Boise Centre on the Grove)
Wednesday
8:45 AM - 12:00 PM

Program Organizer: Sondra Miller, Boise State University
Sponsored by: The Pacific Division Sections on Ecology and Environmental Sciences and Social, Economic and Political Sciences

As the human population continues to grow throughout Idaho, we are faced with the impacts of urbanization on our natural environment. Such impacts include drinking water quantity/quality, fish/game habitat, air quality, and alternate energy. In this symposium, we will examine the effects of such activities as legacy mining operations on current fish habitat and efforts toward restoration; the effects of mining operations in other states on aquatic ecosystems in Idaho; the effects of increased urbanization on stormwater discharges to aquatic ecosystems; and alternative energy exporation currently underway in Idaho.

Session Presider: Sondra Miller

0845 *Welcoming Remarks.*

0900 **116** *Restoration of Clearwater River Subbasin Spring Chinook Salmon*. **Thomas W. H. Backman***, Department of Fisheries Resources Management, Nez Perce Tribe, Orofino, ID

0930 **117** *Mores Creek Project – Legacy Mining and Environmental Issues*. **Pam Smolczynski***, Trout Unlimited, Boise, ID

1000 *Break*.

1015 **118** *Controlling Construction Site Runoff to Minimize Sediment Pollution in Aquatic Habitat*. **Rebecca Mirsky***, Department of Construction Management, Boise State University, Boise, ID

1045 **119** *Mercury in Idaho: Earth, Wind, and Water*. **Carl A. Brown***, Idaho Department of Environmental Quality, Boise, ID

1115 **120** *Idaho's Energy Future: Is the Answer "Blowin' in the Wind"?* **John Gardner***, Mechanical & Biomedical Engineering, Boise State University, Boise, ID

New Strategies for Cancer Treatment

Douglas Firs (Boise Centre on the Grove)
Wednesday
8:45 AM - 4:45 PM

Program Organizer: Henry A. Charlier Jr., Boise State University

Sponsored by: The Pacific Division Section on Health Sciences

Cancer has recently overtaken heart disease as the leading cause of death in the U.S. for people under the age of 85 and is the second leading cause of death overall (CA Cancer J Clin 2005, 55, 10-30). Because of the impact of cancer on national health, the NCI Challenge Goal 2015 has become the vision of the National Cancer Institute, namely "Eliminating the Suffering and Death Due to Cancer". This symposium will report on the efforts of several researchers in the Pacific Northwest and how they are addressing the NCI Challenge goal 2015.

Session Presider: Henry A. Charlier Jr.

0845 **121** *Welcoming Remarks*. **Henry A. Charlier Jr.***

0900 **122** *Carbonyl Reductase and Anthracycline Chemotherapy*. **Henry A. Charlier Jr.***, Department of Chemistry and Biochemistry, Boise State University, Boise, ID

0930 **123** *Doxorubicin Cardiotoxicity and Thyroid Hormone*. **Richard D. Olson***, Research and Development, Mountain States Tumor and Medical Research Institute, VA Medical Center Boise, ID, University of Washington School of Medicine, Boise, ID

1000 *Break*.

1030 **124** *Anthracycline Chemotherapy and Age*. **Barry J. Cusack***, Division of Gerontology and Geriatric Medicine, Boise VA Medical Center, Boise, ID

1100 **125** *The Clinical Significance of Oncostatin M and Its Receptors in Breast Cancer Progression*. **Sujatha Kadaba***[1], **Karen Halsted**[2], **Kara B. Bowen**[2], **William E. Fyffe**[2], **Joseph D. Kronz**[3] and **Cheryl L. Jorcyk**[1], [1]Department of Biology, Boise State University, Boise, ID; [2]Northwest Nazarene University, Nampa, ID; [3]Mercy Medical Center, Nampa, ID

1130 **126** *Oncostatin M is a Potential Target for Inhibiting Breast Tumor Progression*. **Cheryl L. Jorcyk***, Department of Biology, Boise State University, Boise, ID

1200 *Lunch Break*.

1400 **127** *Synthesis and DNA Binding Properties of Aziridinomitosenes*. **Don L. Warner***[1], **Matt K. Haga**[1], **Mandalyn McKay**[2], **Jamie Montgomery**[1], **Richard D. Olson**[2], **Megan Penner**[1], **Andrea S. Radabaugh**[1] and **Stacia M. Rink**[3], [1]Department of Chemistry, Boise State University, Boise, ID; [2]Research and Development, VA Medical Center, Mountain States Tumor and Medical Research Institute, and Gem Pharmaceuticals, Boise, ID; [3]Department of Chemistry, Pacific Lutheran University, Tacoma, WA

1430 **128** *Glycolytic Enzyme Inhibitors as Novel Anti-cancer Drugs*. **James C.K. Lai***[1], **Vikas Bhardwaj**[1], **Nisha Rizvi**[1], **Tanushree Chatterji**[1], **Alfred O. Isaac**[1], **Maria B. Lai**[1], **Tara Johnson**[1], **Solomon W. Leung**[2], **Christopher K. Daniels**[1] and **Alok Bhushan**[1], [1]Department of Pharmaceutical Sciences, Idaho State University College of Pharmacy and Biomedical Research Institute, Idaho State University, Pocatello, ID; [2]College of Engineering and Biomedical Research Institute, Idaho State University, Pocatello, ID

1500 *Break*.

1530 **129** *Novel Approaches to Block Glioblastoma Invasion*. **Alok Bhushan***[1], **Shilpa Puli**[1], **Wajiha Tahar Ali**[1], **Launa M. J. Lynch**[1], **G. Patrick Meier**[2] and **James C.K. Lai**[1], [1]Department of Pharmaceutical Sciences, Idaho State University, Pocatello, ID; [2]Department of Chemistry, Washington State University, Pullman, WA

1600 **130** *Pathway Analysis for Insights to Gene Expression Data*. **Christopher K. Daniels***[1], **Joy L. Olbertz**[1], **Kalyan J. Gangavarapu**[1], **Donna S. Clark**[2] and **Mark W. Thomas**[3], [1]Department of Pharmaceutical Sciences, Idaho State University, Pocatello, ID; [2]Department of Animal and Veterinary Science, University of Idaho, Moscow, ID; [3]Department of Biological Sciences, Brigham Young University - Idaho, Rexburg, ID

1630 *Concluding Remarks.*

The following poster was submitted as part of the above symposium. Please turn to page 43 for more information about the poster session. The number on the left is the poster number and also the abstract number.

219 *Utilizing RNA Interference to Knockdown the Expression of Oncostatin M Receptor Beta*. **Patrick S. Aranda*** and **Cheryl L. Jorcyk**

Infectious Disease, Part II

Cottonwoods (Boise Centre on the Grove)
Wednesday
9:00 AM - 12:00 PM

Program Organizer: Ken Cornell, Boise State University
Sponsored by: The Pacific Division Section on Health Sciences

For a description, please refer to "Infectious Disease, Part I" on Tuesday morning, page 30.

Session Presider: Ken Cornell

0900 *Welcoming Remarks.*

0915 **131** *The Development of Bacterial Enterotoxin Chimeras as Potential Vaccines*. **Juliette K. Tinker***, Biology, Boise State University, Boise, ID

0945 **132** *HIV Envelope: Pursuing A Moving Target For Vaccine Design*. **Wendy Blay***[1], **Theresa Kasprzyk**[2] and **Nancy L. Haigwood**[1], [1]Viral Vaccines, Seattle Biomedical Research Institute, Seattle, WA; [2]Department of Microbiology, University of Washington, Seattle, WA

1015 *Break*.

1030 **133** *Immunoproteomic Analysis of the Protective Outer Membrane Fraction of the Rickettsial Pathogen* Anaplasma marginale. **Wendy C. Brown***[1], **Job E. Lopez**[1], **Paul A. Beare**[2] and **Robert A. Heinzen**[2], [1]Department of Veterinary Microbiology and Pathology, Washington State University, Pullman, WA; [2]Laboratory of Intracellular Parasites, Rocky Mountain Laboratories, National Institutes of Allergy and Infectious Diseases, National Institutes of Health, Hamilton, MT

1100 **134** *Loss of Antigen-Specific CD4+ T Lymphocytes During* Anaplasma marginale *Challenge in Cattle*. **Sushan Han***, Veterinary Microbiology and Pathology, Washington State University, Pullman, WA

1130 **135** *Lipid A Mimetics for Protection Against Pulmonary Plague*. **Carolyn Hovde Bohach***, **Christina L. Airhart**, **Harold N. Rohde**, **Claudia F. Deobold**, **Gregory A. Bohach** and **Scott A. Minnich**, Microbiology, University of Idaho, Moscow, ID

The Great Wilderness Compromise

The Summit (Boise Centre on the Grove)
Wednesday
1:30 PM - 5:00 PM

Program Organizer: Jon Christensen, Stanford University
Sponsored by: The Pacific Division Sections on Ecology and Environmental Sciences and Social, Economic and Political Sciences

Controversial compromise efforts are underway to find common ground to protect wilderness in many western states. One of them, the Central Idaho Economic Development and Recreation Act, would protect 318,000 acres of wilderness in the Boulder-White Clouds mountains. In exchange, some public lands could go to surrounding towns hemmed in by federal lands, and the bill would also protect existing off-road vehicle use on trails surrounding and, in some cases, cutting through the wilderness. Debate about the Boulder-White Clouds and other wilderness compromises often becomes quickly politically polarized. PBS "NOW" correspondent Jon Christensen will moderate a panel of experts, who will be asked to take a deep breath, step back, and consider the bigger picture, while calmly discussing all sides of the trade-offs involved in protecting wilderness, wildlife, and communities in the West today.

Session Presider: Jon Christensen

1330 *Introductory Remarks.*

1340 **136** *Idaho Wilderness: A Personal Political Journey*. **Cecil Andrus***, 28th Governor of Idaho, 46th U.S. Secretary of Interior, Boise, ID

1400 **137** *The Central Idaho Economic Development and Recreation Act*. **Lindsay Slater***, Chief of Staff for Rep. Mike Simpson, 2nd District, Idaho, Washington, DC

1420 **138** *The Boulder-White Clouds Wilderness*. **Craig Gehrke***, The Wilderness Society, Boise, ID

1440 *Break*.

1455 **139** *Yellowstone to Yukon and the Emergence of a Large Scale Conservation Vision*. **Gary M. Tabor***, North America Program, Wildlife Conservation Society, Bozeman, MT

1515 **140** *America's Conservation Landscape*. **J. Michael Scott***, University of Idaho, Moscow, ID

1535 *Panel Discussion.*

notes

II. WORKSHOPS

Tuesday, 19 June 2007

The Winning Equation: Access + Attitude = Success in Science

Ponderosa Pines (Boise Centre on the Grove)
Tuesday
8:30 AM - 12:00 PM

Program Organizers: Valerie Sundby, University of Washington, Lyla Crawford, University of Washington
Sponsored by: Pacific Division Section on Science Education

The Winning Equation is an interactive workshop to introduce concepts, strategies, and high/low-tech tools to fully include students with diverse learning needs, including those with disabilities, in science education. This workshop will focus on universal design concepts as a foundation and framework for increasing student achievement in science. It will also present strategies for general science curriculum access for students with diverse learning needs. Strategies include the use of technology, universal curriculum design, and collaborative learning to create a supportive and responsive learning environment for students with different strengths, needs, and backgrounds. The use of academic accommodations and the role of student self-advocacy in enhancing overall student success will also be integrated into session content. Participants will engage in small group learning activities that explore a universally designed curriculum model and a step-by-step accommodation model to fully include students with various disabilities and learning needs. Specifically, teachers will explore science activities from the regional MESA (Mathematics, Engineering, and Science Achievement) curriculum and work collaboratively to explore examples of teaching strategies and accommodations to enhance participation of students with various types of disabilities, and engage students with a variety of learning styles. Participants will be introduced to a variety of concepts and strategies that utilize mainstream and assistive technology to improve curriculum access and active participation for students in grades K-12. They will have hands-on experiences with both high and low-tech tools that can make today's curriculum accessible to all students.

Wednesday, 20 June 2007

Bio-Rad Genes in a Bottle™ Kit

Science-Nursing 205 (Boise State University)
Wednesday
8:30 AM - 10:00 AM

Sponsored by: The Pacific Division Section on Science and Technology Education

Can I see your DNA? The first step in many research applications is isolating the DNA sample. Introduce your students to molecular biology with their own DNA. In this hands-on workshop you will extract the DNA from your own cheek cells and watch it precipitate from solution as floating white strands. You will then collect and transfer the DNA strands to create a fashionable necklace. This simple procedure is used to extract DNA from many different organisms for a variety of real research applications. Bring only your imagination and take home your own DNA - in a necklace. This is another Bio-Rad lab your students will never forget! Learn key background and how to prep the lab. Do exactly what your students will do.

Bio-Rad ELISA Immuno Explorer™ Kit

Science-Nursing 205 (Boise State University)
Wednesday
10:30 AM - 12:00 PM

Sponsored by: Pacific Division Section on Science and Technology Education

Biology's magic bullet? Unleash nature's tool kit and the power of antibody specificity to explore health science and immunology. In this hands-on workshop you will perform an ELISA (enzyme-linked immunosorbent assay), a real-world antibody-based assay used to diagnose HIV/AIDS or bird flu, and to detect the molecular markers of cancer, pregnancy, and drug use. Germs spread via human contact, water, food, and the air - whether they emerge naturally or through acts of aggression. You will also learn to simulate a disease outbreak in your classroom and use ELISA to detect and track it. Designed for biology, physiology, anatomy, and health science courses. Learn key background and how to prep the lab. Do exactly what your students will do.

Bio-Rad Forensic DNA Fingerprinting™ Kit

Science-Nursing 205 (Boise State University)
Wednesday
1:30 PM - 4:00 PM

Sponsored by: Pacific Division Section on Science and Technology Education

Assume the role of a forensic scientist in this hands-on workshop. Use DNA restriction analysis and gel electrophoresis (popularly known as DNA Fingerprinting) to manipulate and analyze biological evidence found at a crime scene and to determine which of a number of suspects could have

committed the crime - based on DNA evidence. Explore the scientific, ethical, and legal implications of DNA profiling. Learn key background and how to prep the lab. Do exactly what your students will do. AP Biology Lab 6.

Thursday, 21 June 2007

Bio-Rad Crime Scene Investigator PCR Basics™ Kit

Science-Nursing 205 (Boise State University)
Thursday
9:00 AM - 11:30 AM

Sponsored by: Pacific Division Section on Science and Technology Education

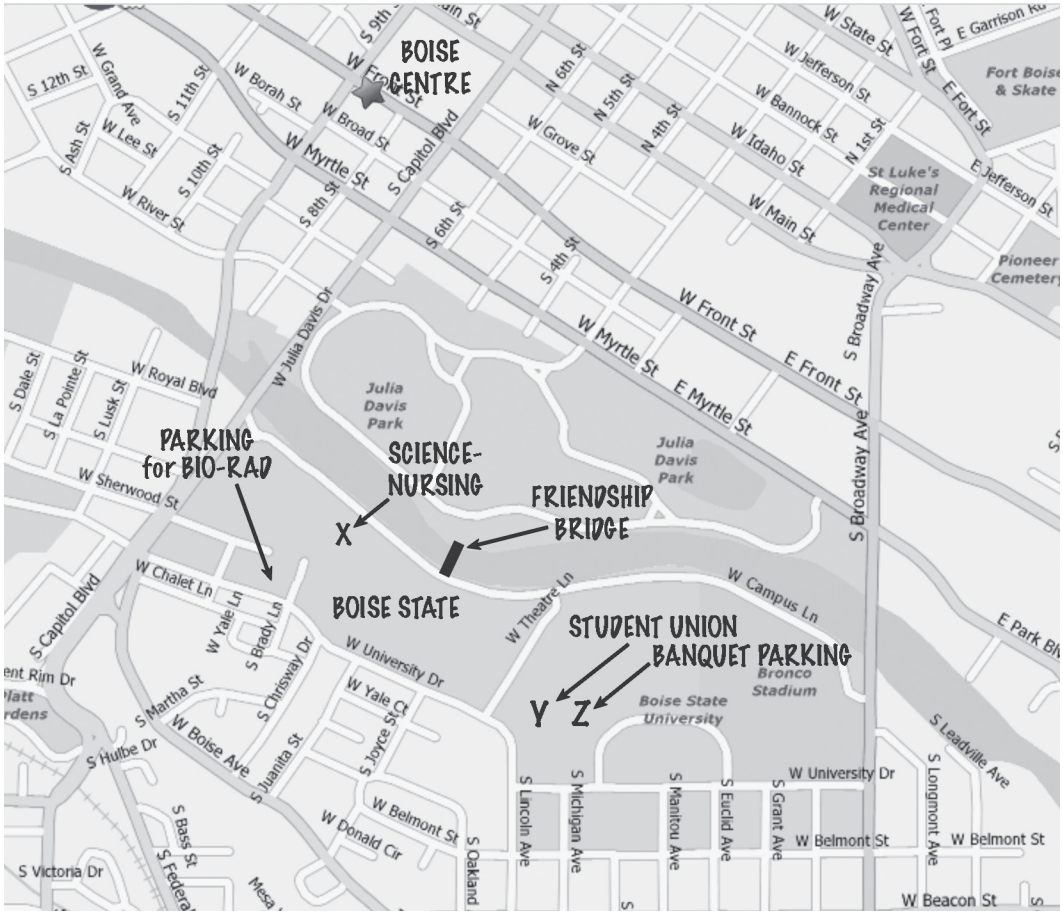
Which human DNA sequences are used in crime scene investigations, and why? In this workshop you assume the role of crime scene investigator. You will learn which human DNA sequences are used by forensic scientists and how trace amounts of DNA can be used to identify a person. You will learn to use the polymerase chain reaction (PCR) and gel electrophoresis to identify which of a number of suspects can be exonerated based on DNA evidence. This hands-on workshop teaches the basics of polymerase chain reaction (PCR), gel electrophoresis, and the statistics of chance associated with modern DNA fingerprinting. Learn key background and how to prep the lab. Do exactly what your students will do.

Bio-Rad Protein Profiler™ Kit

Science-Nursing 205 (Boise State University)
Thursday
1:00 PM - 3:30 PM

Sponsored by: Pacific Division Section on Science and Technology Education

Can molecular evidence determine evolutionary relationships? Explore fundamental principles of evolution and natural selection with this inquiry-based wet lab. In this hands-on workshop you will extract muscle proteins from closely and distantly related fish species and use protein electrophoresis to generate protein fingerprints and acquire molecular data to construct an evolutionary tree for five fish species. Learn key background and how to prep the lab. Do exactly what your students will do.



Left: Map showing Boise State University in relation to the Boise Centre. Parking for the Bio-Rad workshops is located in the parking structure indicated on the middle left. The Bio-Rad workshops take place in the Science-Nursing building, identified by the "X." Note also the locations of the Friendship Bridge, starting point for Field Trip #3, and the Student Union, location of the Division's annual student awards and banquet. The Union is identified by a large "Y" and Union parking is identified by a large "Z."

III. CONTRIBUTED PAPERS

1100 (time italicized and underlined) indicates a student presentation in competition for Awards of Excellence
* indicates the speaker from among several authors listed
63 (bolded number) indicates abstract number

Monday, 18 June 2007

Joint Session of the Anthropology and Archaeology, Earth Sciences, and Ecology and Environmental Sciences Sections

Douglas Firs (Boise Centre on the Grove)
Monday
9:00 AM - 11:30 AM

Program Organizers: J. Thomas Dutro, National Museum of Natural History; Walter Carl Hartwig, Touro University College of Osteopathic Medicine; Michael Parker, Southern Oregon University

Sponsored by: The Pacific Division Sections on Anthropology and Archaeology, Earth Sciences, and Ecology and Environmental Sciences

Session Presider: Walter Carl Hartwig

0900 *Introductory Remarks.*

0910 **141** *Snow Depth Estimation using GPS*. **Mark Jacobson***, Department of Mathematics, Montana State University - Billings, Billings, MT

0930 **142** *Geology and Hydrogeology of Boise, Idaho*. **Spencer H. Wood***, Department of Geosciences, Boise State University, Boise, ID and **Ed Squires**, Hydro Logic, Inc., Boise, ID

0950 **143** *Remote Sensing in the USDA, Forest Service: Applied Science in the Management of Natural Resources*. **Jerry D. Greer***, USDA, Forest Service, Remote Sensing Applications Center, White Bird, ID

1010 *Break.*

1030 **144** *Spatial Dynamics in Population Genetics: Heaving Toward Speciation*. **Guy A. Hoelzer***, Department of Biology, University of Nevada Reno, Reno, NV, **Rich Drewes**, Department of Computer Science and Engineering, University of Nevada Reno, Reno, NV and **Rene Doursat**, Institute for Complex Systems, Ecole Polytechnique, Paris

1050 **145** *Creating an Archive of 3D Virtualizations of the Footprint Evidence for an Unrecognized Hominoid in the Pacific and Inter-Mountain West.* **D. Jeffrey Meldrum***, Department of Biological Sciences, Idaho State University, Pocatello, ID

1110 **146** *Pronghorn Dental Age Profiles and Seasonality Data from Hogup Cave, Utah*. **Brenda L. Hill*** and **David A. Byers**, Anthropology, University of Utah, Salt Lake City, UT

Joint Session of the Chemistry, Industrial Science and Technology, and Physics Sections

Douglas Firs (Boise Centre on the Grove)
Monday
1:15 PM - 5:00 PM

Program Organizers: Frank Jacobitz, University of San Diego; Henry Oman, Consulting Engineer; Owen M. McDougal, Boise State University; Panos Photinos, Southern Oregon University

Sponsored by: The Pacific Division Sections on Chemistry, Industrial Science and Technology, and Physics

Session Presider: Frank Jacobitz

1315 *Introductory Remarks.*

1320 **147** *Worldwide Energy Efficiency Developments*. **Henry Oman***, Consulting Engineer, Normandy Park, WA

1340 **148** *Linear Free Energy Equation to Predict Free Energies of Formation of Oxides and Hydroxides of Trivalent Lanthanide, and Actinides.* **Anpalaki J. Ragavan***, Department of Civil and Environmental Engineering, University of Nevada at Reno, Reno, NV

1400 **149** *Identifying Unknown Nanocrystal Phases by Lattice-fringe Fingerprinting with Open Access Database Support*. **Peter Moeck***, Department of Physics, Nanocrystallography Group, Portland State University, Portland, OR

1420 **150** *Rapid Fluorescent Detecting Liquid Surface Curvature in Thin Well Plate*. **Lifeng Cai*** and **Miriam Gochin**, Basic Science, Touro University California, Vallejo, CA

1440 **151** *Conductance Measurements in a Shear Banding Wormlike Micellar System*. **Panos Photinos***, Department of Physics and Engineering, Southern Oregon University, Ashland, OR

1500 *Break.*

1520 **152** *Nanotechnology Opens Solar Power from Satellite in Geosynchronous Orbit*. **Henry Oman***, Consulting Engineer, Normandy Park, WA

1540 **153** *The General-Purpose Heat Source Radioisotope Thermoelectric Generator: Powering Spacecraft to the Outer Planets*. **Gary L. Bennett***, Metaspace Enterprises, Emmett, ID

1600 **154** *The Living Grand Unified Field Theory*. **Ravi Sadana***, Department of Psychiatry, Retired from: Clarke Institute, University of Toronto, Toronto, ON

1620 **155** *United States, The World's Greatest Petroleum Consumer*. **Henry Oman***, Consulting Engineer, Normandy Park, WA

1640 *Concluding Remarks.*

Tuesday, 19 June 2007

Joint Session of the Agriculture and Horticultural Sciences and Biological Sciences Sections

Douglas Firs (Boise Centre on the Grove)
Tuesday
8:10 AM - 12:00 PM

Program Organizer: Roger G. Christianson, Ph.D., Southern Oregon University
Sponsored by: The Pacific Division Sections on Agriculture and Horticultural Sciences, and Biological Sciences
Session Presider: Michael Parker

0810 *Introductory Remarks.*

0820 **156** *The effect of Soil Salinity on Bean Dry Matter and Leaf Conductance*. **Abdelfettah Berrada***, Arkansas Valley Research Center, Colorado State University, Rocky Ford, CO, **Mark A. Brick**, Soil and Crop Sciences, Colorado State University, Fort Collins, CO and **Grant E. Cardon**, Department of Plants, Soils & Biometeorology, Utah State University, Logan, UT

0840 **157** *Using Organic Mulches to Manipulate Tree Growth and Secondary Compounds in Ponderosa Pine*. **Javier Lugo-Pérez*** and **John E. Lloyd**, Departament of Plant Soil and Entomological Sciences, University of Idaho, Moscow, ID

0900 **158** *Morphological Characteristics of Western U.S. Mammals as Visualized by Light Microscopy and Scanning Electron Microscopy*. **Britten D. Sessions***, **Wilford Hess** and **Wesley Skidmore**, Department of Plant and Animal Sciences, Brigham Young University, Provo, UT

0920 **159** *Scanning Electron Microscopy of Bat Hair from Utah*. **John Sowa***, **Britten D. Sessions**, **Chanell E. Nielson**, **Wesley Skidmore** and **Wilford Hess**, Department of Plant and Animal Sciences, Brigham Young University, Provo, UT

0940 **160** *Molecular Evidence for Environmental Trigger of Mass Evolutionary Acceleration: An Experimental Model for the Cambrian Explosion*. **Aaron G. Filler***[1], **Andrew M.L. Lever**[2] and **Geoffrey P. Harrison**[2], [1]Cedars Sinai Medical Center - INM, Santa Monica, CA; [2]Medicine, Cambridge University, Addenbrooke's Hospital, Cambridge

1000 *Break.*

1020 **161** *Active Remodeling in Lymphangioleiomyomatosis as Revealed by Serial Analysis of Gene Expression*

(SAGE). **Tiffany J. Whitney**[*1], **Maureen Brandon**[1] and **Blanca Camoretti-Mercado**[2], [1]Biological Sciences, Idaho State University, Pocatello, ID; [2]Pulmonary and Critical Care Medicine, University of Chicago Medical School, Chicago, IL

1040 **162** *Breast Cancer Stimulation of Osteoclast Differentiation: The Role of Oncostatin M*. **Ken Tawara**[*], **Patrick Aranda**, **Sujatha Kadaba**, **Andrew Oler** and **Cheryl L. Jorcyk**, Boise State University, Boise, ID

1100 **163** *Oncostatin M Induces VEGF through HIF-1*. **David Chang**[*], Biology, Boise State University, Boise, ID

1120 **164** *In Vivo Anatomical Studies of the Indian Parrot (*Psittacula krameri*) Brain by MRI Microscopy*. **Nimisha Kankan**[*] and **Shubha Srivastava**, Department of Zoology, Government Degree College, Saidabad, Allahabad, Allahabad

1140 **165** *Emotional Intelligence and Vocal Learning in the Indian Parrot (*Psittacula krameri*)*. **Shubha Srivastava**[*] and **Sudhi Srivastava**, Department of Zoology, Goverment Degree Collage, Saidabad, Allahabad, Allahabad

Western Society of Soil Science

Salmon River (Boise Centre on the Grove)
Tuesday
8:15 AM - 12:00 PM

Program Organizer: Jodi Johnson-Maynard, University of Idaho

Sponsored by: Western Society of Soil Science

Session Presider: Jodi Johnson-Maynard

0815 *Introductory Remarks.*

0820 **166** *Bioassisted Remediation of Cadmium and Lead Contaminated Soil*. **Shiou Kuo**[*] and **Richard Bembenek**, Crop and Soil Sciences, Washington State University, Puyallup, WA

0840 **167** *Total and Bioavailable Chromium Along a Toposequence in San Luis Obispo, CA*. **David Guerena**[*1], **Chip Appel**[1], **Craig Stubler**[1], **Britani Harris**[1], **Arwen Ross**[1], **Ryan Tappero**[2] and **Donald L. Sparks**[2], [1]Earth and Soil Sciences Department, Cal Poly State University, San Luis Obispo, San Luis Obispo, CA; [2]Department of Plant and Soil Science, University of Delaware, Newark, DE

0900 **168** *Biogeochemistry of Surface and Subsurface Serpentine Soils on the Central Coast of California*. **Myles H. Davis**[*], **Craig P. Stubler**, **Tom A. Ruehr** and **Chip S. Appel**, Earth and Soil Sciences Department, California Polytechnic State University, San Luis Obispo, San Luis Obispo, CA

0920 **169** *An Ecosystem Approach for Restoring Severely Eroded Soils of Southern Guam*. **Mohammad H. Golabi**[*], College of Natural and Applied Sciences, University of Guam, Mangilao and **S. A. El-Swaify**, Soil Science Dept, University of Hawaii, Honolulu, HI

0940 **170** *Impact of Ponderosa Pine Management Practices on Carbon Dynamics and Soil Microbial Community*. **Amitava Chatterjee**[*1], **George F. Vance**[1], **Elise Pendall**[2], **Daniel B. Tinker**[1], **Peter D. Stahl**[1] and **Lachlan J. Ingram**[1], [1]Department of Renewable Resources, University of Wyoming, Laramie, WY; [2]Department of Botany, University of Wyoming, Laramie, WY

1000 *Break.*

1015 **171** *Dryland Crop Yields and Soil Organic Matter as Influenced by Long-term Tillage and Cropping Sequence*. **Upendra M. Sainju**[*1], **Thecan Caesar-Thonthat**[1], **Andrew Lenssen**[1], **Robert Evans**[1] and **Joseph L. Pikul**[2], [1]Northern Plains Agricultural Research Laboratory, USDA-ARS, Sidney, MT; [2]Northern Grain Insects Research Laboratory, USDA-ARS, Brookings, SD

1035 **172** *Effect of the Exotic Earthworm* Aporrectodea trapezoides *on Carbon Storage Through Formation of Soil Macroaggregates: a Microcosm Study*. **Yaniria Sánchez-de León**[*], **Katherine Smetak** and **Jodi Johnson-Maynard**, Department of Plant, Soil & Entomological Sciences, University of Idaho, Moscow, ID

1055 **173** *Earthworm Population Density and Diversity in Differently-Aged Urban Landscapes*. **K. Smetak**[1], **J.L. Johnson-Maynard**[*2] and **J.E. Lloyd**[2], [1]Plant, Soil and Entomological Sciences, University of Idaho, Moscow, ID; [2]University of Idaho, Moscow, ID

1115 **174** *Local Soil Knowledge and Crop Allocation in the Talamanca Mountain Foothills, Cabécar Indigenous Territories, Costa Rica*. **Leigh Winowiecki**[*1], **Matthew P. Whelan**[2], **Paul McDaniel**[1] and **Eduardo Somarriba**[3], [1]Plant, Soil, and Entomological Sciences, University of Idaho, Moscow, ID; [2]Duke University; [3]Agroforestry Department, CATIE, Turrialba

1135 **175** *Novel Communication for Wireless Sensor Networks using Magnetic Induction*. **Nathan D. Jack**[*] and **Krishna Shenai**, Department of Electrical and Computer Engineering, Utah State University, Logan, UT

1155 *Concluding Remarks.*

Joint Session of the General and Interdisciplinary, Health Sciences, and Science and Technology Education Sections

Willows (Boise Centre on the Grove)
Tuesday
1:30 PM - 5:00 PM

Program Organizers: Robert Louis Chianese, California State University, Northridge; Fred C.C. Peng, Taipei Veterans General Hospital; William B.N. Berry, University of California, Berkeley

Sponsored by: The Pacific Division Sections on General and Interdisciplinary Studies, Health Sciences, and Science and Technology Education

Session Presider: William B.N. Berry

1330 *Introductory Remarks.*

1335 **176** *Open Access Crystallographic Databases for Materials Science Education and Research*. **Peter Moeck***, Department of Physics, Nanocrystallography Group, Portland State University, Portland, OR

1355 **177** *Validating the Curriculum Match Method for Measuring Alignment between Course Content and Assessment Measures in College Science and Mathematics Courses*. **Dan W. Black***, Chemistry, Snow College, Ephraim, UT

1415 **178** *Teaching Nanotechnology to Liberal Arts Students*. **Mel I. Mendelson***, Mechanical Engineering, Loyola Marymount University, Los Angeles, CA

1435 **179** *Saving Science Education in Idaho: Some Lessons from the High School Standards Debate*. **Gary L. Bennett***, Metaspace Enterprises, Emmett, ID

1455 *Break*.

1515 **180** 9. *Confronting the Anti-Evolution Attack on Public Education.* **Lawrence H. Wood***, Retired Physicist, Lacey, WA

1535 **181** *A Potential Tool for Managing Complex Research Data: SemanticaPro Software*. **Kathleen M. Fisher***, Department of Biology, San Diego State University, San Diego, CA

1600 **182** *Senile Dementia and Fischer's Presbyophrenia: The Forgotten Giant's Contributions*. **Fred C.C. Peng***, Department of Neurosurgery and Neurological Institute, Taipei Veterans General Hospital, Taipei

Joint Session of the History and Philosophy of Science, Psychology, and Social, Economic and Political Sciences Sections

Douglas Firs (Boise Centre on the Grove)
Tuesday
1:30 PM - 4:00 PM

Program Organizers: Donald J. McGraw, Private Contractor; J. Kenneth Nishita, California State University, Monterey Bay; Mark Aldrich, Smith College

Sponsored by: The Pacific Division Sections on History and Philosophy of Science, Psychology, and Social, Economic and Political Sciences

Session Presider: Donald J. McGraw

1330 *Introductory Remarks.*

1340 **183** *Gained in the Translation: The Geological Career of Lou Henry Hoover, 1894-1914*. **Michele L. Aldrich***, California Academy of Sciences, Hatfield, MA, **Léo F. Laporte**, University of California Santa Cruz, Redwood City, CA and **Alan E. Leviton**, California Academy of Sciences, San Francisco, CA

1400 **184** *Less Blood More Ore: The Social Costs of Western Metal Mining, 1911-1939*. **Mark Aldrich***, Department of Economics, Smith College, Northampton, MA

1420 **185** *Measuring the Effects of Environmental Regulations: the Critical Importance of Spatially Disaggregated Air Modeling*. **Maximilan Auffhammer**, University of California, **Antonio M. Bento**, University of Maryland and **Scott E. Lowe***, Department of Economics, Boise State Univeristy, Boise, ID

1440 **186** *Human Nature and Continuing Human Existence*. **Perry S. Bezanis***, San Pedro, CA

1500 *Break*.

1520 **187** *Powering Spacecraft: the Nuclear Option*. **Gary L. Bennett***, Metaspace Enterprises, Emmett, ID

1540 **188** *Metaphysical Sciences*. **Ravi Sadana***, Department of Psychiatry, Retired from: Clarke Institute, University of Toronto, Toronto, ON

IV. CONTRIBUTED POSTERS

193 (number italicized and underlined) indicates a student presentation in competition for Awards of Excellence
*indicates the presenter from among several authors listed
207 poster number is also the abstract number

NOTE TO PRESENTERS: Boards on which to attach poster presentations will be set up in the Golden Eagle Eyrie of the Boise Centre on the Grove. 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 display space for your poster.

Posters should be set up prior to 12:00 p.m. on Monday, 18 June in order to allow attendees the opportunity to view them during lunch breaks. You must be present for at least one hour between 4:00 p.m. and 7:00 p.m. Monday afternoon/evening in order to discuss your work. Cards will be available to use in posting the time(s) you will be available. ***If you are a student in competition for an Award of Excellence, you must be present with your poster from 4:30 p.m. to 6:30 p.m. in order to give judges the opportunity to review and discuss your work with you.*** Posters should remain up until the end of the Presidential Reception that evening, about 9:30 p.m., to allow for extended viewing.

Presenters assume full responsibility for the security of their poster materials.

Monday, 18 June 2007

Golden Eagle Eyrie (Boise Centre on the Grove)
Monday
viewing: 12:00 PM – 9:30 PM
discussions: 4:00 PM – 7:00 PM
students must be present: 4:30 PM – 6:30 PM
Please refer to card on poster to
determine when presenter will be present.

Quick Directory of Sponsoring Societies and Sections and Their Posters

sponsoring section	*poster numbers*
Agriculture and Horticultural Sciences	190 – 191
Anthropology	189
Biological Sciences	192 – 207
Chemistry	238 – 243
Earth Sciences	224
Ecology and Environmental Sciences	208 – 210
Health Sciences	211 – 223
Industrial Sciences and Technology	236 – 237
Physics	249 – 251
Physics/Chemistry	244 – 248
Western Society of Soil Science	225 – 235

Anthropology and Archaeology

189 *No Impact: Anthropological and Archeological Implications of Isotopes in Rocks from the Akkadian Empire*. **Monica Guerrero***, San Diego State University, San Diego, CA and **Sabine Airieau**, Astrobiology Space Sciences Astrochemistry Institute, Berkeley, CA

Agriculture and Horticultural Sciences

190 *Residual Phosphorus Effects on Alfalfa Seed Pollination and Production*. **Bradford D. Brown*** and **James D. Barbour**, Department of Plant, Soil and Entomological Sciences, University of Idaho, Parma, ID

191 *Low Phytic Acid Barley Responses to Phosphorus Rates*. **Chad A. Jackson***[1], **Juliet M. Windes**[1], **Phil Bregitzer**[2] and **Donald Obert**[2], [1]Department of Plant, Soil, and Entomological Sciences, University of Idaho, Aberdeen, ID; [2]Small Grains and Potato Germplasm Research Unit, USDA-ARS, Aberdeen, ID

Biological Sciences

192 *Ornamentation in North American Barn Owls (*Tyto alba pratincola*): Does Spottiness Signal Quality?* **Than J. Boves*** and **James R. Belthoff**, Department of Biology and the Raptor Research Center, Boise State University, Boise, ID

193 *Costs and Benefits of Group Living in Owls*. **Justin L. Welty*** and **James R. Belthoff**, Department of Biology and The Raptor Research Center, Boise State University, Boise, ID

194 *Multi-Scale Habitat Selection by Flammulated Owls in Idaho*. **Keith P. Barnes** and **James R. Belthoff***,

Department of Biology and Raptor Research, Boise State University, Boise, ID

195 *Design Algorithms for Detection of Genomic Copy Number Variations (CNV) using the SNPlex™ Genotyping System / COPYPlex™*. **Ryan Koehler***, Bioinformatics, Applied Biosystems, Foster City, CA

196 *Molecular Mechanisms Controlling CD40L Gene Expression: Implications in Asthma*. **Ashley Masterson***, **Alma Hodzic** and **Denise Wingett**, Department of Biology, Boise State University, Boise, ID

197 *hGH-V Gene Expression and Promoter Activity under Glucose and 5-Azacytidine (5azaC) Effects*. **Marina MJ Romero-Prado***, Department of Physiology, Universidad de Guadalajara, Guadalajara, **Hugo A. Barrera-Saldaña**, Department of Biochemistry, Universidad Autonoma de Nuevo Leon, Nuevo Leon and **Jose Luis Castrillo-Diez**, Department of Molecular Biology, Universidad Autonoma de Madrid, Madrid

198 *The Role of MalQ in Carbohydrate Utilization and Gene Regulation in the Lyme Disease Spirochete*. **Elizabeth A. Morton*** and **D. Scott Samuels**, Division of Biological Sciences, The University of Montana, Missoula, MT

199 *Group A Streptococcal Myonecrosis: Vimentin Mediates "Inside-out" Infection at Sites of Non-penetrating Muscle Trauma*. **Stephanie M. Hamilton***[1], **Clifford R. Bayer**[2], **Dennis L. Stevens**[3] and **Amy E. Bryant**[3], [1]Infectious Diseases Section, Veterans Affairs Medical Center/ The University of Idaho, Boise, ID; [2]Infectious Diseases Section, Veterans Affairs Medical Center, Boise, ID; [3]Research Department: Infectious Disease Section, Veterans Affairs Medical Center, Boise, ID

200 *Evaluating Toxicity of Metal Oxide Nanoparticles and Their Potential Utilization in Treatment of Autoimmune Disease*. **Cory L. Hanley***[1], **Janet Layne**[1], **Madhu Reddy**[2], **Hua Wang**[2], **Kevin Feris**[1], **Alex Punnoose**[2] and **Denise G. Wingett**[1], [1]Department of Biology, Boise State University, Boise, ID; [2]Department of Physics, Boise State University, Boise, ID

201 *Susceptibility of Cancer Cells to ZnO Nanoparticle Toxicity - Potential Utility for Treatment of Cancer*. **Janet Layne***[1], **Cory Hanley**[1], **Kevin Feris**[1], **Alex Punnoose**[2], **Madhu Reddy**[2], **Hua Wang**[2] and **Denise G. Wingett**[1], [1]Department of Biology, Boise State University, Boise, ID; [2]Department of Physics, Boise State University, Boise, ID

202 *The Effects of Oncostatin M on Human Breast Cancer In Vivo*. **Amanda J. Bruesch*** and **Cheryl L. Jorcyk**, Biology Department, Boise State University, Boise, ID

203 *Evidence of Changes in Medial Giant Axon Membrane Electrophysiology During Nerve Regeneration following Ventral Nerve Cord Crush in Lumbricus terrestris*. **Michael Havens*** and **Katie Kuhr**, Department of Psychology, Montana State University - Billings, Billings, MT

204 *Development of a Rhodopseudomonad H_2 Producing Microbial System Driven by Agricultural Wastewater*. **Kevin Feris***[1], **Dana Moracco**[1], **Joni Barnes**[2] and **Cathy Rae**[2], [1]Department of Biology, Boise State University, Boise, ID; [2]Idaho National Laboratory, Idaho Falls, ID

205 *Developmental Expression of Collagen Type XI in Zebrafish (Danio rerio)*. **Jason S. Adams***, **Raquel Brown**, **Jeremiah Maschmann**, **Katey Irwin**, **Luke Woodbury**, **Linda Mercer** and **Julia Thom Oxford**, Biology, Boise State University, Boise, ID

206 *Characterization of the Collagen type XI Isoforms using Analytical Ultracentrifugation and Circular Dichroism Spectropolarimetry*. **Luke G. Woodbury***, **Dawn Muhlestein** and **Julia Thom Oxford**, Department of Biology, Boise State University, Boise, ID

207 *Identification of Collagen Gene Loci in* Danio rerio. **Jeremiah M. Maschmann***[1,2], **Julia Thom Oxford**[2] and **Jason S. Adams**[2], [1]Department of Chemistry and Biochemistry, Boise State University, Boise, ID, [2]Department of Biology, Boise State University, Boise, ID

Ecology and Environmental Sciences

208 *Estrogen Equivalent Concentration of Seventeen Major Para-nonylphenol Isomers Related to Commercial Mixtures in a Sediment Core Taken from Ariake Bay, Japan*. **Keiji Okuda**[1], **Takao Katase***[1], **Taketo Uchiyama**[2], **Hiroaki Saito**[2], **Mitsuko Makino**[3], **Yasuo Fujimoto**[3], **Yun-Seok Kim**[4] and **Heesoo Eun**[4], [1]College of Bioresource Sciences, Nihon University, Fujisawa; [2]College of Pharmacy, Nihon University, Funabashi; [3]College of Humanities and Sciences, Nihon University, Setagayaku; [4]National Institute for Agro-Environmental Sciences, Tsukuba, Japan

209 *Assessing Microbial Response to Nutrient Loading in Natural Stream Systems in the Dry Creek Experimental Watershed, ID*. **Pamela S. Hess***, **Mariona Nadal** and **Kevin Feris**, Department of Biology, Boise State University, Boise, ID

210 *Resilience of a Terrestrial Arthropod Community to a Catastrophic Event*. **R. Andrew Rodstrom*** and **John J. Brown**, Department of Entomology, Washington State University, Pullman, WA

Health Sciences

211 *Loss of Antigen-Specific CD4+ T Lymphocytes During* Anaplasma marginale *Challenge in Cattle*. **Sushan Han***, Veterinary Microbiology and Pathology, Washington State University, Pullman, WA

212 *Pathogenesis beyond pX01 and pX02 – In Silico Analysis of* Bacillus Anthracis. **GongXin Yu[1,2]** and **Laura Bond*[2]**, [1]Department of Computer Science, Boise State University, Boise, ID; [2]Department of Biology, Boise State University, Boise, ID

213 *Organic Spices as Non-contact Antimicrobial Coatings*. **Jeremiah Hull*[1]**, **Ken Cornell[1]**, and **Greg Hampikian[2]**, [1]Department of Chemistry and Biochemistry, Boise State University, Boise, ID; [2]Department of Biology, Boise State University, Boise, ID

214 *New Drug Targets for Treating Lyme Disease*. **Maria Martinez*[1]**, **Cassie Bassett[1]**, **Cassie Dayan[1]**, **Diana Saidac[2]**, **Nikhat Parveen[2]** and **Ken Cornell[1]**, [1]Department of Chemistry and Biochemistry, Boise State University, Boise, ID; [2]Department of Microbiology and Molecular Genetics, UMDNJ, New Jersey Medical School, Newark, NJ

215 *Purine Auxotrophy, Giardia's Achilles' Heel?* **Jeremy Bonander*** and **Ken Cornell**, Department of Chemistry and Biochemistry, Boise State University, Boise, ID

216 *Cloning and Expression of* Entamoeba histolytica *MTA Nucleosidase*. **Robert Ormond*[1]**, **Tyrell Simpkins[1]** and **Ken Cornell[2]**, [1]Department of Biology, Boise State University, Boise, ID; [2]Department of Chemistry & Biochemistry, Boise State University, Boise, ID

217 *Methylthioribose Kinase, a Sweet Target for Antibiotic Design*. **Chelsea Isom***, **Cassie Dayan** and **Ken Cornell**, Department of Chemistry and Biochemistry, Boise State University, Boise, ID

218 *Construction of LcrV-Enterotoxin Fusions for Use as Potential Mucosal Yersinia Vaccines*. **Chadwick T. Davis*** and **Juliette K. Tinker**, Biology, Boise State University, Boise, ID

219 *Utilizing RNA Interference to Knockdown the Expression of Oncostatin M Receptor Beta*. **Patrick S. Aranda*** and **Cheryl L. Jorcyk**, Department of Biology, Boise State University, Boise, ID

220 *Identification of Proteins that Interact with the Surface of Collagen Fibrils*. **Raquel Brown*** and **Julia Thom Oxford**, Biomolecular Research Center, Department of Biology, Boise State University, Boise, ID

221 *The Effect of Socioeconomic Factors on the Use of Dental Care in Pacoima , California , 2001 and 2004*. **Kim Le Huynh***, **Habiba Ismail** and **Erika Gomez**, School of Dentistry, University of California Los Angeles, Los Angeles, CA

222 *Dental Practice Characteristics and the Mix of Services*. **Courtney A. Naten***, **Damon D. Webber** and **Adel P. Newell**, Dentistry, University of California Los Angeles, Los Angeles, CA

223 *Studies on Relationship between Longevity and Geological Environment in Bama County of China*. **Zhiyong Zhang*[1]**, **He Sheng Jiang[2]**, **Min He[1]**, **Jian Qin[1]**, **Huaxiang Lu[1]**, **Zhihua Jiang[1]**, **Yuan Zou[3]**, **Yurong Qin[4]**, **Jinchao Chen[5]** and **Zhibiao Huang[6]**, [1]School of Public Health, Guangxi Medical University, Nanning, Guangxi; [2]Faculty of Animal Science & Technology, Guangxi University, Nanning, Guangxi; [3]Research Center of Mountain Areas, Guangxi Science & Technology Department, Nanning, Guangxi; [4]Faculty of Computer Sciences, Guangxi University, Nanning, Guangxi; [5]Bama Longevity Research Institute, Bama County; [6]Guangxi Center for Chemical Analysis & Measurement, Nanning, Guangxi, China

Earth Sciences

224 *Microbial Alteration in Pristine Rocks*. **Sabine Airieau*[1]**, **Yvette Piceno[2]** and **Gary Andersen[2]**, [1]ASSAI, Berkeley, CA; [2]Lawrence Berkeley National Laboratory, Berkeley, CA

Western Society of Soil Science

225 *Soil Development on a Sequence of Moraines, Eastern Sierra Nevada, CA*. **Ann M. Rossi*** and **Robert C. Graham**, Environmental Sciences Department, University of California Riverside, Riverside, CA

226 *Soil-Geomorphic Classification of an Arid Mountain Range, Mojave Desert, USA*. **Daniel R. Hirmas*** and **Robert C. Graham**, Department of Environmental Sciences, University of California, Riverside, Riverside, CA

227 *Comparison of Flood Hazard Assessments on Alluvial Fans Using FEMA, NRCS, and Surficial Geologic maps: A Case Study in Ivanpah Valley, Nevada*. **Colin R. Robins*[1]**, **Brenda J. Buck[1]**, **Douglas J. Merkler[2]**, **Michael S. Howell[1]**, **Janice L. Morton[1]**, **Amanda J. Williams[1]**, **Maureen L. Yonovitz[1]** and **P. Kyle House[3]**, [1]Department of Geoscience, University of Nevada Las Vegas, Las Vegas, NV; [2]USDA NRCS Nevada, Las Vegas, NV; [3]Nevada Bureau of Mines and Geology, University of Nevada Reno, Reno, NV

228 *Predictive Soil Maps Generated from Decision Tree Analysis and GIS Technology*. **Jeffrey S. Pace*** and **Jay S. Noller**, Department of Crop and Soil Science, Oregon State University, Corvallis, OR

229 *Predictive Mapping in the Fremont National Forest, Oregon*. **Melanie R. Malone*** and **Jay S. Noller**, Department of Crop and Soil Science, Oregon State University, Corvallis, OR

230 *Using Decision Tree Analysis to Generate Rule Sets for Predictive Soils Mapping*. **Sarah J. Hash*** and **Jay S. Noller**, Department of Crop and Soil Science, Oregon State University, Corvallis, OR

231 *Impact of Soil Mineral Assemblage and Acidity on Organic Carbon Cycling in a Range of Ponderosa Pine Forests*. **Katherine A. Heckman**[1], **Amy Welty-Bernard**[2], **Craig Rasmussen***[1], **Egbert Schwartz**[2] and **Jon Chorover**[1], [1]Soil, Water, and Environmental Science, University of Arizona, Tucson, AZ; [2]Northern Arizona University

232 *Evaluation of Ponderosa Pine Management Practices Based on Economic Profitability and Opportunity of Receiving Carbon Credits*. **Amitava Chatterjee***[1], **George F. Vance**[1], **Siân Mooney**[2], **Daniel B. Tinker**[1], **James Arnold**[3], **Peter D. Stahl**[1] and **Bill Haggenson**[3], [1]Department of Renewable Resources, University of Wyoming, Laramie, WY; [2]Department of Economics, Boise State University, Boise, ID: [3]Wyoming State Forestry Division, Cheyenne, WY

233 *Soil Quality Characteristics in High Elevation Riparian Wet Meadows in the Sierra Nevada: Relationships to Hydrologic Functionality*. **Laura J. Jungst***[1], **Hayley R. Olsen**[1], **Jay B. Norton**[1], **Urszula Norton**[2], **William R. Horwath**[2] and **Kenneth W. Tate**[3], [1]Department of Renewable Resources, University of Wyoming, Laramie, WY; [2]Department of Land, Air and Water Resources, University of California Davis, Davis, CA; [3]Department of Plant Sciences, University of California Davis, Davis, CA

234 *Soil Morphology and Organic Matter Beneath Cheatgrass-, Sagebrush-, and Bunchgrass-Dominated Shrub-Steppe Vegetation*. **Jay B. Norton***[1], **Thomas A. Monaco**[2], **Tom A. Jones**[2] and **Robert R. Blank**[3], [1]Department of Renewable Resources, University of Wyoming, Laramie, WY; [2]Forage and Range Research Laboratory, USDA-ARS, Logan, UT; [3]Exotic and Invasive Weeds Research Unit, USDA-ARS, Reno, NV

235 *Influence of Plant Nutrition and Chemical Treatments on* Phymatotrichoposis omnivora *in Cotton*. **John E. Matocha***, Texas Agricultural Experiment Station, Texas A&M University Systems, Corpus Christi, TX and **James C. Wilborn**, Texas Agricultural Experiment Sation, Texas A&M University Systems, Corpus Christi, TX

Industrial Sciences and Technology

236 *Pitting Studies in Seawater Contaminated Jet Turbine Oil*. **Brandon Christoffersen***, **Brian M. Marx** and **Darryl P. Butt**, Materials Science and Engineering, Boise State University, Boise, ID

237 *Enhancing Corrosion Resistance of Stainless Steel 304 Using Laser Surface Treatment*. **I. M. Ghayad***[1], **M. A. Shoeib**[1], **T. M. Mattar**[1], **H. M. Hussein**[1] and **R. A. AbuShaiba**[2], [1]Surface Protection, Central Metallurgical Research and Development Institute, Cairo; [2]Chemistry, Faculty of Science, AlAzhar University, Cairo

Chemistry

238 *A Density Functional Study of Actinyl - Methoxide Complexes: the Structure and Bonding Properties*. **Da Gao*** and **Michael E. McIlwain**, Chemical Sciences, Idaho National Laboratory, Idaho Falls, ID

239 *The Effects of Trifluoperazine on Calsequestrin Structure and Protein Aggregation*. **Dawn Muhlestein***[1], **T.S. Broyles**[2], **James Cole**[3], **Julia Thom Oxford**[1] and **Susan E. Shadle**[2], [1]Department of Biology, Boise State University, Boise, ID; [2]Department of Chemistry, Boise State University, Boise, ID; [3]Department of Molecular and Cell Biology, University of Connecticut, Storrs, CT

240 *Dichlorophene Inhibition of Human Carbonyl Reductase*. **Christopher K. Ewing*** and **Henry A. Charlier Jr.**, Department of Chemistry and Biochemistry, Boise State University, Boise, ID

241 *Binary and Ternary Complexes Involving Small Molecules and Carbonyl Reductase*. **Matthew T. Mayer*** and **Henry A. Charlier Jr.**, Department of Chemistry and Biochemistry, Boise State University, Boise, ID

242 *The Three C's of Renewable Biomass Briquettes*. **Blake E. Stanhouse***, **Dana Moracco** and **Owen McDougal**, Department of Chemistry and Biochemistry, Boise State University, Boise, ID

243 *OSpec Web: An Online Educational Resource to Facilitate the Instruction of Organic Spectroscopy*. **Matthew Turner***, **Ryan Morton** and **Owen McDougal**, Department of Chemistry and Biochemistry, Boise State University, Boise, ID

Physics/Chemistry

244 *Polymer Nanocomposite Based Chemiresistive NOx Sensor*. **Divakara A.B.S. Meka**[*1], **Linda A. George**[2] and **Shalini Prasad**[1], [1]Department of Electrical and Computer engineering, Portland State University, Portland, OR; [2]CSE/Env. Sciences and Resources, Portland State University, Portland, OR

245 *Correction of the Amplification Factor in SAW Sensor's Semi-Empirical Response Equation by Perturbation Theory*. **Zhixiong Cha**[*], Department of Civil & Environmental Engineering, University of Utah, Salt Lake City, UT

246 *Iridium Oxide Nanowire Monitors for Protein Detection*. **Vinu L. Venkatraman**[*1], **Ravikiran K Reddy**[1], **Fengyan Zhang**[2], **Victor Hsu**[2], **Bruce Ulrich**[2] and **Shalini Prasad**[1], [1]Department of Electrical and Computer Engineering, Portland State University, Portland, OR; [2]Sharp Labs of America, Inc

247 *Development of a Magnetic-Shape-Memory-Based Micro-Accelerometer*. **Chris Pohl**[*1], **Michael Hagler**[1], **Volodymir Chernenko**[2], **Makato Ohtsuka**[3] and **Peter Müllner**[1], [1]Department of Materials Science and Engineering, Boise State University, Boise, ID; [2]Institute of Magnetism, Kyiv; [3]Tohoku University, Sendai, Japan

248 *Development of Metallic Periodic Structures for Surface Plasmon Polariton Sensor*. **Cory Sparks**[*], **Lincoln Bollschweiler** and **Wan Kuang**, Department of Materials Science and Engineering, Boise State University, Boise, ID

Physics

249 *Computational Methods in Discovering the Nature of Gas Hydrates*. **Klaus Johannsen**, Parallab, Bergen Center for Computational Science, University of Bergen, Bergen and **Alla Sapronova**[*], Physics Department, Boise State University, Boise, ID

250 *Ferroelectric Films: Molecular Model of Switching*. **Alla Sapronova**[*], Physics Department, Boise State University, Boise, ID, **Vladimir Bystrov**, University of Aveiro, CICECO, Aveiro and **Ekatherine Paramonova**, Department of Prospective Information Technologies, Institute of Mathematical Problems of Biology RAS, Pushchino, Moscow Region

251 *Medical Application of Microwaves*. **Galina Ovchinnikova**, Physics Department, Moscow State University, Moscow and **Alla Sapronova**[*], Physics Department, Boise State University, Boise, ID

ABSTRACTS

Abstracts are grouped by program.
Not all presenters submitted an abstract.

Sunday Evening Plenary Lecture

1. *How Green Is Idaho?* **Jon Christensen** (Stanford University, Palo Alto, CA, 650-759-6534, jonchristensen@stanford.edu).

PBS "NOW" correspondent Jon Christensen will screen his short documentary on controversial new approaches to protecting wilderness in the West being tested in the Boulder/White Cloud Mountains of central Idaho. He'll discuss the politics that brought together conservative Republican Congressman Mike Simpson and environmentalist Rick Johnson in an effort to find common ground on wilderness protection in the reddest state in America, the high-profile debate that brought singer/songwriter Carole King into the fray, and the beautiful remote high country at stake. Christensen will also field questions about bringing a complex story involving people, politics, the environment, and science, from way out west to the TV screens in 1.2 million households across the country.

Monday Noon Public Lecture

2. *From Vegas to Boise: A Theme of Collaborative Research*, **Mark Rudin** (Boise State University, Boise, ID, 208-426-5732, markrudin@boisestate.edu).

Lake Mead, USA serves as an excellent field laboratory for studying a number of environmental processes, including the distribution and rate of sediment deposition, the bioavailability of anthropogenic contaminants in water and sediment columns, and the impact of naturally-occurring events such as fires and floods on lake ecosystems. Attempts at understanding this body of water, critical to the viability of over 20 million people, requires expertise and experience across a substantial number of disciplines. A research team comprised of representatives from academia and several federal agencies collected lakefloor side-scan sonar and seismic reflection measurements, along with sediment cores, in various parts of Lake Mead to begin our understanding of sedimentation processes in this dynamic reservoir. Preliminary results of the work are presented along with lessons learned in assembling this truly interdisciplinary team. The principal investigator on this project will also discuss how and why this spirit of collaborative research exists today at Boise State University.

Monday Evening Plenary Lecture

3. *Science: The Publics' Need (and Right) to Know*, **Shirley Malcom** (American Association for the Advancement of Science, Washington, DC, 202-326-6680, smalcom@aaas.org).

Science and technology are critical to the Nation's economy, security, health status and quality of life as well as to global sustainability. As individuals make decisions for themselves and their families, knowledge of and comfort with science and technology are crucial. Increasingly, policy issues involve topics informed by and linked to science and technology, thus, underscoring our needs as citizens, to have broader engagement with science and technology.

In addition to supporting the public need to know, our role as "investors" in research and development in science and technology gives us a right to know.

This presentation will attempt to define what this requires of the scientific community and to explore the steps that need to be taken to ensure that there is access to the knowledge, concepts and ideas of science.

Tuesday Noon Public Lecture

4. *Geology and Fauna of Four Galapagos Islands 2006*, **Kathleen M. Fisher** (San Diego State University, San Diego, CA, 619-594-6961, kfisher@sciences.sdsu.edu).

The Galapagos Islands in Ecuador lie on the equator about 600 miles off the coast. Formed as the Pacific plate passes over a thermal hot spot, the newest islands are found in the west. A 10 km Sierra Negra Caldera was created in 2005 on Isla Isabella along with a large fissure zone, Volcan Chico. Buffeting by five major ocean currents moderates equatorial temperatures. About 97% of land on the 19 Galapagos islands is said to be protected, but this is questioned. We spent a month visiting four islands, each with human settlements and fascinating life forms. Local fishing boats each appear to have adopted their own 'pets', seals and sea lions who haul out to sun themselves, clamber around the boats, and accept tidbits from owners. The pinipeds love to surf the waves, sun themselves on beaches, and sleep on benches in town. The tiny Galapagos penguin flies through the water at breakneck speed to catch its breakfast. It prefers to sit on rocky shores rather than with people. Fish are abundant. Blue-footed boobies and penguins grab their grub by crash-diving head-first into the water, often resulting in blindness in old age. As two species of Galapagos tortoises are now extinct, each inhabited island maintains a tortoise nursery. The prolific, multicolored marine iguanas are everywhere. They have a 'desalination plant' in their heads that allows them to drink salt water. Darwin's finches on the inhabited islands have learned to keep their distance from people. Many pictures will be shown with discussion of biology/evolution. All of these species are at risk with threats posed by invading species and climate change.

Tuesday Evening AAAS, Pacific Division Presidential Lecture

5. *Sustainability: Thinking and Designing a New World*, **Carl A. Maida** (University of California, Los Angeles, Los Angeles, CA, 805-492-5613, cmaida@ucla.edu).

The concept of sustainability holds that the social, economic and environmental factors within human communities must be viewed interactively and systematically. The Brundtland Report (1987) defines sustainable development as meeting the needs of the present without compromising the ability of future generations to meet their own needs. Disasters are a challenge to sustainability, as they are unpredictable and non-linear in nature. When disaster strikes, the contours of a locality take on a new shape to its people. A locale's geography, and its history—features of everyday life that are so taken for granted that they are virtually invisible—suddenly acquire a new reality. Rec-

ognized anew as the foundations of rural or urban living, a disaster reveals these strengths, weaknesses, and interconnections. Human behavior in disaster, as well as any form of human action, cannot be understood solely from the objective properties of an environment without reference to its meaning for the people in the setting. Severe natural disasters disrupt the sense of a secure and familiar world; confusion results when the familiar disintegrates; displacement occurs when the individual's sense of spatial identity is undermined. Disaster survivors frequently work together out of the shared experience of catastrophe and a sense of communal loss. "Holistic Disaster Recovery" is a social practice that uses a consensus-building, participatory process to apply sustainability principles in the recovery community. The process ensures that a locality systematically consider sustainability principles in each decision about reconstruction and redevelopment, and requires ecological design practices. For communities pursuing a sustainable "culture of response," a new way of thinking–whole systems thinking–will be necessary to ensure disaster resilience.

Wednesday Noon Public Lecture

6. *The Early Years of Tree-Ring Science*, **Donald J. McGraw** (Private Contractor, Chula Vista, CA, 619-216-4650, granttree@yahoo.com).

The science of tree-ring dating, or dendrochronology, depends in its central theoretical constructs upon the Giant Sequoia and the Ponderosa Pine. How the sequoia came to be used by Andrew Ellicott Douglass (1867-1962)—the founder of dendrochronology--and what vital information and how it provided such information is the first of three topics for this public lecture. Douglass' primary student, Edmund Schulman (1908-1958) at Douglass' Laboratory of Tree-Ring Research at the University of Arizona, carried on the science from 1953 using the Bristlecone Pine as it was invaluable in building long chronologies for dendroclimatological studies. His sudden death in 1958 came about just as he was alerting the world to the value of this species. This early history is the second focus of this talk. Finally, the calibration of Willard Libby's (1908-1980) then fairly newly-established dating technique of carbon 14 (^{14}C), or radiocarbon dating, comprises the third and final focus of this public lecture.

This talk is taken from Dr. McGraw's two books on the history of dendrochronology: Andrew Ellicott Douglass and the Big Trees: The Role of the Giant Sequoia in the Development of Dendrochronology (2001), and Edmund Schulman and the 'Living Ruins': Bristlecone Pines, Tree Rings, and Radiocarbon Dating (2007).

It is expected that copies of each book will be available for this AAAS/Pacific Division meeting for interested attendees.

Sensors and Sensor Technology

7. *Development of Biomolecular Nanostructure Sensor Arrays*, **William B. Knowlton**[1], **David Araujo**[2], **Patrick Price**[2], **Jason Brotherton**[2], **Kendra Coonse**[2], **Richard G. Southwick III**[2], **Amy J. Moll**[3] and **Julia Thom Oxford**[4] [1](Boise State University, Boise, ID, 208-426-5705, bknowlton@boisestate.edu); [2](Boise State University, Boise, ID); [3](Boise State University, Boise, ID, amoll@boisestate.edu); [4](Boise State University, Boise, ID, joxford@boisestate.edu).

The self assembly mechanism of biomolecular monomers into nanometer scale fibrils provides the opportunity to investigate their possible use as biomolecular nanowires. Silicon process technology, both typical and novel, is used to fabricate the sensors on the nanometer scale. The presentation will review the progress towards biomolecular nanowire sensors.

8. *Electrophoretic Flow Cell System for Biological Sensing*, **Vindhya Kunduru** (Portland State University, Portland, OR, 503-725-3814, vindhya.es@gmail.com) and **Shalini Prasad** (Portland State University, Portland, OR, 503-725-3814, sprasad@pdx.edu).

We demonstrate a technique to detect protein biomarkers contained in vulnerable coronary plaque using a platform based microelectrode array. One of the applications of clinical proteomics is the development of protein sensor platform technologies for rapid bedside detection of disease biomarkers. The detection scheme is based on the property of high specificity binding between antibody – antigen similar to most immuno assay techniques. Rapid clinical diagnosis can be achieved by detecting the amount of protein composed in blood by analyzing the protein's electrical signature. Polystyrene beads which act as transportation agents for the immobile proteins (antigen) are electrically aligned to form conductive paths between the chosen electrodes by application of homogenous electric fields. The principle of electrophoresis is employed to produce calculated electrokinetic movement amongst the Anti-CRP (antibody) functionalized polystyrene beads. The electrophoretic movement of antibody functionalized polystyrene beads results in the formation of "Microbridges" between the two electrodes of interest which aid in the amplification of the antigen- antibody binding event. Sensitive electrical equipment is utilized for capturing the amplified signal from the "Microbridge" which essentially behaves as a conducting path between the two electrodes. The technique circumvents the disadvantages of conventional protein detection methods by being rapid, non invasive, label free, repeatable and inexpensive. The same principle of detection can be applied for any receptor – ligand based systems since the technique is based only on the volume of the analyte of interest. Detection of the inflammatory coronary disease biomarker CRP is achieved at concentration levels spanning over the lower microgram/ml to higher order nanogram/ml ranges.

9. *Novel Waveguide Structures for Bioassays with Broad Applications to Analytical Instrumentation*, **Heather Edberg** (Pacific Northwest National Laboratory, Richland, WA, 509-376-8051, heather.edberg@pnl.gov), **Richard Ozanich** (Pacific Northwest National Laboratory, Richland, WA, 509-375-4586, richard.ozanich@pnl.gov), **R. Shane Addleman** (Pacific Northwest National Laboratory, Richland, WA, 509-375-6824, raymond.addleman@pnl.gov), **Michael Wojcik** (Pacific Northwest National Laboratory, Richland, WA, 509-372-6867, michael.wojcik@pnl.gov), **Summer Ziegler** (Pacific Northwest National Laboratory, Richland, WA, 509-376-8722, summer.ziegler@pnl.gov) and **Kathryn Antolick** (Pacific Northwest National Laboratory, Richland, WA, 509-376-1134, kathryn.antolick@pnl.gov).

Many current fluorescent bioassay systems employ optical fibers for excitation/illumination of the fluorescent reporter and fiber collection of the emitted fluorescence, limiting the number of photons that can be collected. By collecting a larger portion of the fluorescent signal, the detection limits of the on-column bioassay can be reduced. Conversion of the bioassay flow cell to a liquid core waveguide for sensitive on-column detection of fluorescence-based bioassay signals will be covered. The current flow cell is constructed from FEP Teflon with a refractive index of 1.35. For waveguide conditions to exist, the refractive index of the flow cell contents must be greater than the

flow cell. This presentation explores the modification of the refractive index of the flow cell through fabrication of the flow cell from a lower refractive index material.

10. *Field Portable Electrochemical Sensor for Uranium and other Actinides in Aqueous Samples*, **Dale D. Russell** (Boise State University, Boise, ID, 208-426-3975, drussell@boisestate.edu) and **Noah Minskoff** (Boise State University, Boise, ID, 208-426-3975, noahminskoff@gmail.com).

A rugged, solid state field portable sensor for water-borne actinide species has been demonstrated with 10 part-per-trillion detection limit for UO_2^{2+} ion. A semiconductive polymer is prepared with selective binding sites, calix-6-arene (C[6]A). These chelating rings have high formation constants with actinide ions having the form MO_2^{2+} or MO^{2+}, where M is the actinide metal. The binding site specificity for actinide ions largely excludes chemical interferences such as other heavy metal ions, and preconcentrates the actinide species on the polymer. When actinide ions bind into the polymer, they can be detected by the redox properties of the actinide metal itself, or by changes in the electronic or electrochemical properties of the polymer. Two detection modes have been demonstrated. In one mode, a cyclic voltammogram is recorded in which the potential of electron transfer is correlated to the identity of the actinide species present, and the current of the peak(s) correlates to concentration (s). In the second mode, the actinide-binding polymer is coated onto the gate of a field effect transistor (FET). In operation, as actinide ions bind to the polymer, the gate potential changes thus changing the source-drain current correspondingly. Both detection systems are housed in a single package for hand-held or autonomous deployment. The power requirement is very low (~ 9 volts), and signal transmission is possible for remote applications or long term in-situ deployment. The entire sensor weighs less than a kilogram, including power supply, control electronics, data collection and signal transmission systems.

11. *Nanomonitors: Electrical Immunoassay*, **Ravikiran K. Reddy** (Portland State University, Portland, OR, 503-725-3814, ravikk@pdx.edu) and **Shalini Prasad** (Portland State University, Portland, OR, 5037253223, prasads@ece.pdx.edu).

The best predictor of post operative outcome for cardio-vascular surgery is the presence of preoperative ischemia, which is caused by vulnerable coronary plaque rupture. The goal of this research project is the non-invasive identification of protein biomarkers for vulnerable coronary plaque rupture that results in poor post-surgical outcomes. In the perioperative state, this condition is characterized by inflammation and thrombosis. The heterogeneity of this disease makes early detection inconclusive based on the identification of a single protein biomarker. The traditional assay detection technique for this disease state is limited by single protein biomarker detection, complexity, and turnaround time. Our technique addresses these gaps in the current technology. We have created a nanowell detection methodology by scaling down the size of the microwells to nanowells, using pl volumes and improving the sensitivity by adopting the tested biochemical approach. The most significant advantage is the ability to detect multiple disease markers using one single device.We have demonstrated the effectiveness of nanoporous alumina based electrical biosensors in identification of two biomarkers, associated with this disease-C-Reactive Protein and Myeloperoxidase. We have successfully demonstrated a label free technique with improved speed of detection, with reagent minimization and comparable sensitivity to the Enzyme Linked Immunosorbent Assay (ELISA) with multiplexed detection capability. The principle of operation of these biosensors is based on the detection of the change in the electro chemical signal at the electrode, based on the modulation of the electric double layer at the interface of the electrode and the binding site, associated with the formation of the antibody-antigen binding complex. Using this approach we have achieved detection sensitivity of up to 1ng/ml.

12. *Reservoir Characterization of Pulsed Vapor Generators Developed at the Idaho National Laboratory*, **Carla Miller** (Idaho National Laboratory, Idaho Falls, ID, 208-526-9009, carla.miller@inl.gov), **Timothy Kaser** (Idaho National Laboratory, Idaho Falls, ID, 208-526-9025, timothy.kaser@inl.gov) and **Jessica Rodriquez** (University of Idaho, Moscow, ID).

Computer controlled explosive vapor generators for 2,4,6-trinitrotoluene (TNT), cyclo-1,3,5-trimethylene-2,4,6-trinitramine (RDX) and pentaerythritol tetranitrate (PETN) were developed, built and calibrated at the Idaho National Laboratory beginning in 1991. The original design was patented in 1995 (U.S. patent 5,452,600). Since that time, the vapor generators have gone through multiple changes in an attempt to improve their reproducibility and ease of use. The reservoir is the component that has undergone the most changes. Tests were performed to characterize the current reservoir design in an attempt to improve consistency in calibration coefficients between heads containing the same analyte and to automate the reservoir loading process.

13. *Developing an In-Situ Sensor for Monitoring Oil Quality*, **B. Marx** (Boise State University, Boise, ID, 208-426-5376, BrianMarx@boisestate.edu), **Michael F. Hurley** (Boise State University, Boise, ID, 208 426 9375, mfh3f@virginia.edu), **D.P. Butt** (Boise State University, Boise, ID, 208-426-1054, darrylbutt@boisestate.edu) and **Matthew Luke** (Boise State University, Boise, ID, 208-426-1113, mattluke@boisestate.edu).

In order to meet the objectives of an oil quality, corrosion sensor for a prognostic engine health monitoring system, a two component sensor was considered. The first component was comprised of two electrodes and was used for making Electrochemical Impedance Spectroscopic (EIS) measurements for monitoring oil quality. Because the EIS technique is capable of resolving small changes in the electronic properties of a system, such as degradation and/or contamination, it is being exploited as a technique for monitoring oil quality. EIS tests were run on oils containing various additives and on oils contaminated with water. The data was analyzed using equivalent circuit modeling and the results obtained from two equivalent circuit models are compared. Both models provided good fits to the data and yielded information possibly pertaining to the characteristic time constants and relaxation frequencies associated with the additives and water molecules present in the oil.

14. *Detection of Interleukin-6 Based on Dye-Doped Silica Nanoparticle Label/Protein Microarray*, **Hong Wu**[1], **Qisheng Huo**[2], **Guodong Liu**[2], **Jun Wang**[2], **Susan Varnum**[2], **Zimin Nie**[2], **Jun Liu**[2] and **Yuehe Lin**[3] [1](Pacific Northwest National Laboratory, Richland, WA, 509-376-1117, Hong.Wu@Pnl.Gov); [2](Pacific Northwest National Laboratory, Richland, WA); [3](Pacific Northwest National Laboratory, Richland, WA, 01-509-376-0529, yuehe.lin@pnl.gov).

The fluorescent labelling has been widely used in biological analysis. We report a dye encapsulated silica nanoparticle with the advantages of high fluorescence intensity, photostability and biocompat-

ibility as label for protein microarray fluorescence immunoassay. The Rubpy dye labeled nanoparticle was characterized by transmission electron microscopy (TEM) and fluorescence spectroscopy. It was found that the sizes of the nanoparticles are uniform with diameter of 50 nm and there are approximately 9,000 dyes per silica nanoparticle based on calculation. The highly bright nanoparticles improve the detection sensitivity with the limit of detection of biomarker IL-6 down to 0.1 ng/mL. The calibration curve ranges from 0.1 ng/mL to 10 ng/mL. The capability of detection IL-6 in spiked human plasma sample provides the great opportunity for clinical diagnosis and prognosis of IL-6 related diseases.

15. *Disposable Electrochemical Immunosensor Diagnosis Device Based on Nanoparticle Probe and Immunochromatographic Strip*, **Ying-Ying Lin**[1], **Guodong Liu**[2], **Jun Wang**[2], **Yuehe Lin**[3], **Hong Wu**[4], **Chien Wai**[5] and **Ai-Cheng Lee**[2] [1](University of Idaho, Moscow, ID, 208-310-6497, yingyinglin@vandals.uidaho.edu); [2](Pacific Northwest National Laboratory, Richland, WA); [3](Pacific Northwest National Laboratory, Richland, WA, 509-376-0529, yuehe.lin@pnl.gov); [4](Pacific Northwest National Laboratory, Richland, WA, 509-376-1117, Hong.Wu@Pnl.Gov); [5](University of Idaho, Moscow, ID, 208-885-6787, cwai@uidaho.edu).

A disposable electrochemical immunosensor diagnosis device which is based on immunochromatographic strip technique and quantum dot (QD, CdS@ZnS) label based electrochemical immunoassay has been developed. The device takes advantages of both high-speed and low-cost of the conventional immunochromatographic strip test and high-sensitivity of nanoparticle based electrochemical immunoassay. A sandwich immunoreaction was performed on the immunochromatographic strip. Captured QD labels in the test zone were determined by high sensitive stripping voltammetric to measure the dissolved metallic component (cadmium) with a disposable screen printed electrode, which is embedded underneath the membrane on the test zone. By coupling with a portable electrochemical analyzer, this device shows great promising for in-field and point-of-care quantitative testing on disease related protein biomarkers. The parameters (e.g. voltammetric measurement of QD labels, antibody immobilization, the loading amount of QD-antibody, and immunoreaction time) that govern the sensitivity and reproducibility of the device were optimized. Protein biomarkers such as interleukin (IL)-6 and prostate-specific antigen (PSA) were tested on this new device by using its corresponding antibodies. The voltammetric response of optimized device is highly linear over the range of 0.1 to 10 ng mL-1 IgG, 0.1 to 5 ng mL-1 IL-6, and 0.05 to 4 ng mL-1 PSA. All immunoreaction can be finished in 7 min. The detection limit was improved to 10 pg mL-1 using optimized immunoreaction time, e.g. 10 min for PSA. The new disposable electrochemical diagnosis device thus provides a more user-friendly, rapid, clinically accurate, less expensive and quantitative tool for protein and biomarker detection.

16. *Direct Deposition of Noble Metal Nanoparticles Onto Nanosprings and Nanowires*, **Timothy Cantrell** (University of Idaho, Moscow, ID, 208-882-8863, timothy.cantrell@vandals.uidaho.edu), **Pamela J. Shapiro** (University of Idaho, Moscow, ID, 208-885-5785, shapiro@uidaho.edu) and **David N. McIlroy** (University of Idaho, Moscow, ID, 208-885-6809, dmcilroy@uidaho.edu).

Silver and gold metal nanoparticles have displayed interesting optical and electronic properties. Their size and properties has potential for application as components in nanometer scale devices. Potential applications include catalysis, electrical conductivity based sensors, and novel material design. In the following presentation the preparation and deposition of nanoparticulate gold and silver onto various nanometer scale substrates will be discussed.

Gold can be directly reduced by hydrazine to form gold nanoparticles on Gallium Nitride (GaN) nanowires. These gold nanoparticles influence the conductivity of the GaN nanowires and are anchor points for functional group attachment. Silver nanoparticles have been deposited on SiO_2 nanosprings via the reduction of $AgNO_3$ in aqueous dimethylformamide. The variables that influence this will be discussed.

17. *Biofunctionalization of Nanopatterned Silica from the Diatom* Cyclotella sp., **Debra Gale** (Oregon State University, Corvallis, OR, 541-231-0101, galede@engr.orst.edu), **Gregory L. Rorrer** (Oregon State University, Corvallis, OR, 541-737-3370, rorrergl@engr.orst.edu) and **Timothy Gutu** (Portland State University, Portland, OR).

The conjugation of proteins, peptides and other biomolecules to silica substrates, a process called biofunctionalization, is an emerging technology that has an array of applications ranging from drug delivery systems to biosensors. Biogenic silica derived from diatoms is an attractive substrate for these applications because its surface is populated with SiOH groups which are amenable to amine functionalization. Furthermore, a diatom frustule may serve as a template to pattern biomolecules onto a silica surface at the nanoscale and microscale. In this study, silica frustules of the centric marine diatom *Cyclotella sp.* were biologically functionalized by a two-step process. In the first step, *Cyclotella sp.* biosilica frustules were covalently functionalized with 3-aminopropyl trimethoxysilane. The presence of amine groups on the frustule surface were validated with the fluorescent probe fluorescamine. In the second step, the amine-functionalized diatom biosilica was biotinylated. Biotinylation was confirmed by binding of the amine-biotin complex with Avidin that was fluorescently labeled with FITC. This allowed for direct observation of the microscale patterning of biomolecules on the diatom frustule by epi-fluorescence microscopy. This two-step process for functionalization of diatom biosilica affords a new way to ornately pattern biological molecules onto a template with high reproducibility at the nano and microscales. The ability to organize a nanopattern of proteins is an essential step in the development of biosensor technology.

The Chemistry of Advanced Nuclear Systems: Separations

18. *Challenges for Actinide Separations in Advanced Nuclear Fuel Cycles*, **Ken Nash** (Washington State University, Pullman, WA, knash@wsu.edu).

The basic framework for uranium and plutonium separation and recycle as we know it today (the PUREX process) was established 50 years ago. During these five decades of deployment, a great deal of both scientific and engineering insight has been gained. PUREX in fact marked a vast improvement over the processes it displaced in terms of both the volume of wastes generated and in overall separation efficiency. Nevertheless, PUREX processing (and by association solvent extraction in general) has gained a reputation as a “dirty” option for processing spent nuclear fuels. This judgment is certainly debatable, as TBP and the PUREX process were designed under political pressure to accomplish a particular goal and operated to achieve that goal, all other considerations (like waste management) being of

secondary importance. Continuous operations, tunability of process efficiency and more than 50 years of industrial-scale experience are all arguments favoring solvent extraction processing of nuclear fuels in the 21st Century. Further, the emphasis during the past two decades on remediation of the waste management problems left behind by weapons Pu production has improved our collective understanding of separation systems for spent fuel management. We should have learned further that it is essential to integrate sound waste management practices into spent fuel processing. We must also recognize the essential fact that scientific innovation must continue for such an industry to remain viable. In this presentation, selected features of the current state of the actinide separations art and prospects for the future will be discussed.

19. *Selective Extraction of Americium and Curium in Acidic Media by Symmetric and Asymmetric Dithiophosphinic Acids*, **Dean R. Peterman** (Idaho National Laboratory, Idaho Falls, ID, 208-533-4104, dean.peterman@inl.gov), **Mitchell R. Greenhalgh** (Idaho National Laboratory, Idaho Falls, ID, mitchell.greenhalgh@inl.gov), **John R. Klaehn** (Idaho National Laboratory, Idaho Falls, ID, 208-526-5238, john.klaehn@inl.gov), **Mason K. Harrup** (Idaho National Laboratory, Idaho Falls, ID, 208-526-1356, mason.harrup@inl.gov), **Richard D. Tillotson** (Idaho National Laboratory, Idaho Falls, ID, 208-533-4094, tillrd@inel.gov), **Thomas A. Luther** (Idaho National Laboratory, Idaho Falls, ID, thomas.luther@inl.gov) and **Jack D. Law** (Idaho National Laboratory, Idaho Falls, ID, 208-526-3382, Jack.Law@inl.gov).

The selective extraction of the minor actinides (Am(III) and Cm(III)) from the lanthanides is an important part of advanced reprocessing of spent nuclear fuel. This separation is difficult to accomplish due to the similarities in the chemical properties of the trivalent actinides and lanthanides. Research efforts at the Idaho National Laboratory have resulted in the recent development of an innovative synthetic pathway yielding new regiospecific dithiophosphinic acid (DPAH) extractants. The synthesis improves DPAH designs that can address the issues concerning minor actinide separation and extractant stability. Several new symmetric and asymmetric DPAH extractants have been prepared. The use of these extractants for the separation of minor actinides from lanthanides will be discussed. In addition, the variation in the extent of Am(III) extraction by a related series of DPAH isomers will be presented.

20. *Identifying Americium Speciation for Advanced Separations*, **Leigh R. Martin**[1], **Bruce J. Mincher**[2] and **Nicholas C. Schmitt**[2] [1](Idaho National Laboratory, Idaho Falls, ID, 208-526-8414, Leigh.Martin@inl.gov); [2](Idaho National Laboratory, Idaho Falls, ID).

The separation of Am from Cm and the lanthanides is still one of the most challenging separations facing analytical chemistry, as well as any proposed advanced fuel cycle. Despite significant advances in soft donor extractants for the separation of the trivalent actinides the required separation factors have yet to be reliably demonstrated. Americium displays a wide variety of redox chemistry which could be utilized to develop improved separations systems. To implement this approach, we have to fully understand the chemistry of these different oxidation states in solution. One way is to study the optical absorbance spectra of these species. Although the optical absorbance spectra of all americium species are relatively well established, due to the sensitivity limitations of this technique low millimolar solutions of Am are usually required. These concentrations represent a significant radiological hazard and as such, have limited these techniques for use in studying the chemistry of Am. With the application of a Liquid Waveguide Capillary Cell we have been able to study the chemistry of these oxidized species of Am with lower concentrations and smaller sample volumes. The benefits and limitations of this approach to studying the optical absorbance spectra of Am species will be discussed.

21. *Phase Transfer Kinetics of Trivalent Actinides and Lanthanides in Phosphorus Reagent Extraction Systems*, **Mikael Nilsson** (Washington State University, Pullman, WA, 509-335-7131, mikaeln@wsu.edu) and **Ken Nash** (Washington State University, Pullman, WA, knash@wsu.edu).

With a steady increase in energy demand and the consensus to reduce greenhouse gases, nuclear power production has regained interest as a good source of power. Plans to close the nuclear fuel cycle to reduce waste volumes and storage times will require chemical treatment of the spent nuclear fuel. One of the necessary steps for successful operation of a closed fuel cycle is the separation of trivalent actinides from lanthanides, both present in the spent nuclear fuel. Because the chemical behavior of these elements are so similar their mutual separation is a challenging task. Over the years of research on this subject several chemicals and extraction systems have been identified that will yield a separation factor suitable for industrial applications. Even though processes have been found, there are still many unknown parameters that need to be investigated, to support their deployment at industrial scale. The work presented here focuses on the TALSPEAK process, a system based on a phosphoric acid extracting agent in combination with an aqueous hold back reagent. The phase transfer kinetics in a 2-phase system have been investigated using a non-stirred extraction cell. The presence of a carboxylic acid, such as lactic acid, has been reported to improve kinetics and so it was investigated whether this would have an effect in a diffusion controlled environment. The transfer of the lactic acid itself between the two phases have also been investigated. This information would be valuable for process purposes as well as basic chemical understanding.

22. *Separation of Uranium/Technetium for the UREX Process*, **Julie Du Mazaubrun**[1], **Frederic Poineau**[2], **Ken Czerwinski**[2], **Gordon Jarvinen**[3] and **Doris Ford**[4] [1](University of Nevada Las Vegas, Las Vegas, NV, 702-895-2804, Jdumazaubrun@aol.com); [2](University of Nevada Las Vegas, Las Vegas, NV); [3](Los Alamos National Laboratory, gjarvinen@lanl.gov); [4](Los Alamos National Laboratory).

US fuel cycle program was designed to treat spent fuel solvent extraction process that would separate uranium and technetium in the first step by an ion exchange process. The presented research deals with the separation of uranium from technetium by a combination of two different resins. The goals of the study are: evaluate the technetium separation, develop a process to recover the technetium and synthesize waste forms. This separation was performed using treated Reillex HP and untreated Reillex HP anion exchange resins. Preliminary experiments have shown that the Reillex has a suitable technetium absorption capacity while relatively poor elution properties. To improve elution properties, Reillex was treated. Results indicate that the Reillex soaked for 6 hours in concentrated nitric acid at 85 °C (R6) exhibit optimal elution properties. Using the R6 resin, dynamics experiments were performed. An optimal value of 1M NH4OH and a 4 mL/min flow rate were obtained for elution. Experiments were performed on a 150 mL scale using a solution containing [U] ~ 50g/L and [Tc] ~ 60 mg/L. Considering the great absorption capacity of the Reillex and good elution properties of the R6, the final experiment con-

sists of an initial column charged with the R6 and a second containing the Reillex. In this set-up, most of the technetium is sorbed on the R6 resin and the remaining fraction trapped on the untreated Reillex. This process allows producing separate streams. These streams were used to prepare waste forms; solid uranium and metallic technetium.

23. *Separation Potential of Cloud Point Extraction of Lanthanide Salts*, **Melissa A. Ensor** (Washington State University, Pullman, WA, 509-335-3757, mensor@wsu.edu) and **Ken Nash** (Washington State University, Pullman, WA, knash@wsu.edu).

Cloud point extraction (CPE) has gained increasing attention as a method for the preconcentration of metal ions since it was first introduced in 1973. This environmentally friendly separation process uses a surfactant to selectively concentrate metal-ligand complexes into a smaller volume, surfactant-rich phase (SRP). Both phases are predominantly aqueous, hence the complications associated with the use of organic solvents can be minimized. The surfactant-rich phase is made to partition from the colloidal mixture of polymer and water by means of a simple temperature shift and centrifugation, hence the technique has a significant simplicity of operation. While CPE has been applied successfully to transition metals, only scattered interest has been shown in its application to the lanthanide family. A new method for the extraction of Eu(III) using Triton X-114 and 1-phenyl-3-methyl-4-benzoyl-2-pyrazolin-5-one (PMBP) will be detailed. The effects of $NO3^-$, Cl^-, $ClO4^-$, and (CH3)4NCl salts as a function of their concentrations on the extraction efficiency with Eu(III) will be discussed. IR and NMR measurements of the SRP with these salts provide insights into how the structure of the SRP is changed relative to that of purely aqueous systems. One primary objective of this investigation is to better understand the mechanism of the formation of the SRP and the driving forces attendant to lanthanide partitioning between the phases. It has been noted in these studies that PMBP can successfully extract and preconcentrate Eu (III) into the SRP and the extraction efficiency can be maximized using salt additives (salting out).

24. *Effect of Acetohydroxamic Acid on Distribution of Pu(IV) in 30% TBP*, **Alena Paulenova** (Oregon State University, Corvallis, OR, 541-737-7070, alena.paulenova@oregonstate.edu) and **Peter Tkac** (Oregon State University, Corvallis, OR, 541-737-7053, peter.tkac@oregonstate.edu).

The effect of acetohydroxamic acid (AHA) on speciation of tetravalent plutonium has been investigated in chemical matrices relevant to UREX+ extraction process. The extraction experiments were focused on effect of HNO3, total nitrate and AHA concentration on extraction of Pu(IV) by tributyl phosphate. Significantly decreased extraction yields of plutonium confirm a strong affinity of AHA to tetravalent plutonium even under strong acidic conditions of the aqueous nitric acid/nitrate matrix. Kinetics of plutonium redox reactions and complexation with AHA are the most important factors affecting the extraction performance of the process. Spectrophotometric speciation experiments performed with both the aqueous and organic extraction phase confirmed penetration of hydroxamate species of plutonium in the organic phase and formation of neutral solvates of tributyl phosphate with ternary hydroxamate-nitrate complexes of metal.

25. *Development of a Two-phase Calorimetric Method for the Studies of Thermodynamics of Solvent Extraction*, **Peter Zalupski** (Washington State University, Pullman, WA, 509-335-3757, pzalupski@wsu.edu) and **Ken Nash** (Washington State University, Pullman, WA, knash@wsu.edu).

Solvent extraction chemistry plays a fundamental role in the proposed chemical treatment of nuclear waste prior to disposal. The development of efficient separation schemes based on liquid-liquid metal distributions has relied heavily on studies of thermochemistry of metal extraction. Calorimetric measurements offer an opportunity for a careful determination of heats of extraction; however, the inherent complexity of a two-phase system has been an obstacle to the application of conventional calorimetry to solvent extraction systems. Efficient phase contact without excessive generation of heat proved troublesome, making the van't Hoff analysis (temperature dependence of extraction coefficient) a method of choice for most thermodynamic studies of such systems. In this report, a method for calorimetric investigation of the heats of metal distribution in a two-phase system will be presented. The extraction of lanthanide metal ions from nitrate media by bis(2-ethylhexyl) phosphoric acid (HDEHP) was chosen as a model example to develop the two-phase calorimetric method. The enthalpy of extraction of europium(III), derived from its quantitative transfer to the organic phase, was compared with that obtained from the temperature dependence of the extraction constant. The process of the collection of thermodynamic parameters for the extraction of the complete lanthanide series by HDEHP, as well as the applicable correction factors, will be discussed with emphasis on utilizing this method for routine analyses of thermochemistry of liquid-liquid distribution systems.

Soilscapes of the Western U.S.: Perspectives on Change

26. *Benchmark Soilscapes to Predict Effects of Climatic Change in the Western USA*, **Anthony O'Geen** (University of California, Davis, CA, 530-752-2155, atogeen@ucdavis.edu).

The effects of climate change on soils are not well known, although it is widely recognized that soil properties vary greatly and function differently as a result of the climate conditions in which they are found. Understanding the ecosystem services soils provide in the context of climate change is imperative for planning and policy development by stakeholders in agriculture and natural resources. Our goal is to investigate the resiliency of soils (and near surface processes regulated by soil) to climate change in a manner that meets the needs of the National Cooperative Soil Survey, while addressing critical natural resource issues in the western U.S. To predict the impacts of climate change we will establish a framework of benchmark soilscapes as long term monitoring sites across the western U.S. in the form of two regional bioclimatic sequences, one established in transported materials and the other in residuum. This study will focus on four major soil forming processes: 1) primary mineral weathering and secondary mineral formation, 2) organic matter accumulation, 3) leaching and 4) organism effects on soil. This study will track the effects of moisture and temperature on near surface processes closely governed by the following pedogenic processes: 1) primary mineral weathering and secondary mineral formation, 2) organic matter accumulation, 3) effects of organisms in soil and 4) leaching. The following experiments will be set up to characterize these processes along the climosequence and empirically derive the impacts of climate change.

27. *Soils of the Mazama Tephra-blanketed Landscapes in Oregon: A Benchmark Soilscape for Global Change Research,* **Jay S. Noller** (Oregon State University, Corvallis, OR, 541-737-6187, Jay.Nol-

ler@oregonstate.edu).

Highly productive forests and fertile dryland cropping systems of the Pacific Northwest region (Washington, Oregon, Idaho) are rooted in continentally unique soils formed in volcanic materials. Soils that develop in volcanic ash (Andisols) have unique physical and chemical properties, and the rarefied composition of their weathering products has implications for global change issues of carbon cycle and climate. Accordingly, understanding the evolution of these soils is key to understanding the implications of land use and forest management decisions in the Pacific Northwest, and to understanding the region's importance in the global carbon cycle. Whereas, we are informed of basic nature of pedogenesis and related transformations of volcanic ash soils in other regions of the world, there remains insufficient knowledge of such ecologically productive soil landscapes in the Pacific Northwest which comprise much of the area where Andisols are found in North America. The overall goal of this study is to identify and quantify pedogenic processes in soils along a climatic gradient in the Pacific Northwest. To meet this goal, reference sites will be established, including instrumentation and observation shafts, to record, sample and monitor the chemical, physical, and biological properties in soils developed in the extensive Mazama tephra-blanketed landscape of Oregon and adjoining areas.

28. *Vegetation Influences on Soil Organic Carbon Dynamics in an Arid, Hyperthermic Ecosystem*, **David A. White II** (University of Arizona, Tucson, AZ, 520-909-7501, dwhite@email.arizona.edu) and **Craig Rasmussen** (University of Arizona, Tucson, AZ, 520-621-7223, crasmuss@ag.arizona.edu).

Few studies have examined soil organic carbon (SOC) dynamics in arid, hyperthermic ecosystems and the potential role these ecosystems play in global warming. Study objectives were to quantify the impact of vegetation and aggregate stability on SOC dynamics in an arid, hyperthermic ecosystem. We employed an ultrasonic dispersion technique to determine aggregate stability. Aggregate stability indices show greater energy required to disperse mesquite aggregates relative to creosote and grass soils due to higher amounts of SOC. Laboratory incubations were performed to determine SOC dynamics, pools and mean residence time (MRT) for soils under mesquite, creosote and mixed grasses. Incubation results indicate significant variation in respired CO_2 under mesquite, creosote and grasses [135, 169, 203 mg C (g soil C)$^{-1}$, respectively]. Labile pool sizes were [31.0, 49.1, and 50.7 mg C (g soil C)$^{-1}$] and MRT (7 days) for mesquite, creosote and grass, respectively. Creosote contained the largest resistant pool followed by mesquite and grass [87.5, 55.8, 54.7 mg C (g soil C)$^{-1}$, respectively]. Resistant pool MRT's were different among vegetation types ranging from 122 days for creosote and 59.5 days for grass. Incubation results indicate the main control of SOC dynamics, pool size and MRT appear to be input and quality of plant litter, with minimal role for aggregate stability. Our results demonstrated significant variation in SOC dynamics between vegetation types in a hyperthermic ecosystem with potential feedbacks to SOC storage of atmospheric CO_2.

29. *Organic Soil Formation on Lava Flows at Craters of the Moon National Monument and Preserve*, **Karen L. Vaughan** (University of Idaho, Moscow, ID, 208-885-7505, karen.vaughan@vandals.uidaho.edu), **Paul McDaniel** (University of Idaho, Moscow, ID, paulm@uidaho.edu) and **Anita Falen** (University of Idaho, Moscow, ID, afalen@uidaho.edu).

Organic soils forming in cracks of Holocene lava flows at Craters of the Moon National Monument and Preserve provide important ecological habitat for plants and animals in this semi-arid environment. These pioneer organic soils are not typical Histosols since they lack saturated conditions for much of the year. Instead, these soils are Folists which implies that the addition of organic matter from parent vegetation exceeds decomposition without the influence of abundant water. Folists were sampled and characterized on lava flows ranging from 2,000 to 12,000 yrs BP. Sapric, hemic, and fibric material combine to form these shallow organic soils over basalt. Aerial soil cover ranges from 0 to 25% of the lava with greater coverage occurring on ropy-pahoehoe rather than rough-a'a lava. The taxonomic classification and rate of formation of Folists on lava flows is investigated in this study. Craters of the Moon offers a unique setting in which to document the formation of soil along a chronosequence of dated lava flows. This research characterizes organic soils forming on lava flows as well as identifies the processes leading to the formation of Folists in south-central Idaho.

30. *Predictive Mapping and Landscape Analysis using Geographic Information Systems and Classification Trees*, **Sheila Slevin** (Oregon State University, Corvallis, OR, 541-737-4507, sheila.slevin@oregonstate.edu) and **Jay S. Noller** (Oregon State University, Corvallis, OR, 541-737-6187, jay.noller@oregonstate.edu).

Geographic information systems, geospatial datasets, and classification tree software have been used to digitally map soils and soil properties, vegetation, and habitat. We are developing a model using these techniques to prepare a predictive map of Landtype Associations (LTAs) for the Fremont National Forest in Southern Oregon. LTAs are landscape-scale map units defined by distinctive combinations of landscape elements, including current and potential natural vegetation, soils, geology, and geomorphology. In particular, we are evaluating whether computer-based, predictive mapping techniques can be used to predict where unique combinations of these landscape elements will occur. Our initial tests suggest that models that work for predicting individual landscape elements, such as soils or vegetation, based on environmental variables are not as effective in predicting compound map units such as LTAs. We are continuing to assess the environmental variables used in this analysis, and whether the geospatial datasets and their derivatives are reasonably accurate proxies for these variables.

31. *Soil Development in a Forested Debris Flow Chronosequence in Southern California*, **Judith K. Turk** (University of California, Riverside, CA, 951-827-3711, judith.turk@email.ucr.edu) and **Robert C. Graham** (University of California, Riverside, CA, 951-827-3751, graham@mail.ucr.edu).

Soil properties that develop rapidly in young soils are relevant to considerations of global nutrient cycling, ecosystem functions, and interpretations of geomorphic histories of dynamic landscapes. This study evaluated the rates at which soil morphological and physical properties develop and the rates at which of carbon and nitrogen accumulate in coniferous forest soils in southern California. Soil development was considered using a chronosequence approach, in which debris flow deposits ranging from <1 to 244 years old represented stages of soil formation through time. Morphological development of the organic horizons predominated, including formation of matted F horizons and mostly-decomposed H horizons. The upper mineral soils also underwent pedogenic change, including melanization, rubification, and decreased bulk density. Organic carbon accumulated in the soils at a rate of 26.6 g m^{-2} yr^{-1} and total nitrogen accumulated at 1.0 g m^{-2} yr^{-1}. The influence of buried soils on carbon storage was

considered by comparing carbon stored in soils with and without buried organic horizons and by evaluating decomposition rates in experimentally buried litter. Although buried litter decomposed more rapidly than litter at the surface, that loss is not reflected in the size of the carbon pool in soils with buried organic horizons. Several important processes occur in the early years of soil development, including development of the humus forms profile, alteration of physical properties in the upper part of the mineral soils, and accumulation of carbon and nitrogen.

32. *Data Mining and Its Application to Soil-landscapes in the Great Basin*, **Abdelhamid A. Elnaggar** (Oregon State University, Corvallis, OR, 541-737-4519, abdelhamid.elnaggar@oregonstate.edu) and **Jay S. Noller** (Oregon State University, Corvallis, OR, 541-737-6187, jay.noller@oregonstate.edu).

Decision tree analysis, one of the most widely used inductive machine-learning methods, is used to retrieve the expert knowledge embedded in the soil-landscape model used by the Harney County, Oregon soil survey (ca. 1980-2003). The extracted model was extrapolated to develop a preliminary soil map for adjacent area in Malheur County. Field data were used to test the prediction accuracy of the generated map. Also it was trained to develop a second model to produce another soil map for the study area in Malheur County. Spatial environmental data of geology, vegetation, precipitation, terrain attributes, landforms, solar insolation and landsat TM data at a resolution of 30 m were used to predict soil map units. Model efficiency was tested by making a comparison between the predicted and the present soil map for the reference area, resulting in overall accuracy of 92%. Prediction accuracy for the preliminary soil map of the unmapped area extrapolated based on the soil-landscape model of the reference area was very low. Few SMUs were predicted with significant accuracy, mostly those shallow SMUs that have either a lithic contact with the bedrock or developed on a duripan. On the other hand, the developed soil map based on field data was predicted with very high accuracy. The overall accuracy of that map was about 97%. Decision tree proved to be a powerful tool in retrieving the spatial relations between SMU and the environmental variables. Further, it would provide a means to objectively inventory soils in the Great Basin that are most sensitive to climate change.

33. *The Critical Zone Exploration Network Sonoran Desert Environmental Gradient as a Benchmark Soilscape in Southern Arizona*, **Craig Rasmussen**[1], **Michael Crimmins**[2], **Tom Meixner**[2], **Jon Chorover**[2] and **Egbert Schwartz**[3] [1](University of Arizona, Tucson, AZ, (520) 621-7223, crasmuss@ag.arizona.edu); [2](University of Arizona, Tucson, AZ); [3](Northern Arizona University).

As part of the Critical Zone Exploration Network (CZEN) we have established a long-term research node that spans a typical Great Basin Sonoran Desert Environmental Gradient (SDEG). The primary objectives of the SDEG are to (i) characterize how temporally variable climate forcing impacts soil physical, chemical and biological processes, and the flux of chemical species from soils to surface waters, and (ii) build predictive models of mineral weathering response to climate and climate change. Particular attention is given to the bimodal precipitation regime and the impact of warm versus cold precipitation on biogeochemical processes. The SDEG spans the Chiminea Creek watershed (800-2650m in elevation) along the southwest slope of the Rincon Mountains in Saguaro National Park (SNP). The Rincon consists of a metamorphic core complex dominated by granitic parent materials, and encompasses a steep environmental gradient. Mean annual air temperature decreases (20-10ºC), and mean annual precipitation increases (30-85cm) with elevation, with concomitant shifts in vegetation from mixed desert-scrub (<1200m) to grass and oak woodlands (1200-1700m) to pinyon-juniper woodland (1700-2000m) and ponderosa pine and fir forest (>2000m). We have established long-term climate and soil moisture and temperature monitoring stations that capture high temporal resolution climate variability in each the dominant vegetative communities. Pedon characterization and constitutive mass balance data for each site indicate shifts in the degree of soil formation, soil forming processes and long-term (~103 yrs) mineral weathering. Future studies will couple the observed long-term pedogenic data with short-term modeling of soil-water flux, mineral weathering and stream water chemistry.

34. *Development of a Forensic GIS Database*, **Patricia R. Menchaca** (University of California, Riverside, Riverside, CA, 951-827-3711, pmenc001@student.ucr.edu), **Robert C. Graham** (University of California, Riverside, Riverside, CA, 951-827-3751, robert.graham@ucr.edu) and **Marianne Stam** (California Department of Justice, Riverside, CA, 951-361-5009, marianne.stam@doj.ca.gov).

The unincorporated areas of Romoland and Winchester in Riverside County, California experience high levels of drug-related and homicide-related criminal activity. This study is being conducted to create a Geographic Information Systems (GIS) database to assist in future criminal investigations in the area. A database of soil properties is needed to link soil evidence to probable source locations or link suspects to a crime scene. Discriminant analysis is being applied to variables such as soil color, magnetic susceptibility, and trace minerals to differentiate geologic and soil units. A GIS map database is currently under construction to exhibit spatial variability. It is comprised of multiple layers including the geologic map units and their attributes. Attributes such as color, trace minerals, magnetic susceptibility, particle size, and heavy mineral separations will contribute individual GIS layers. This study will serve as a pilot project that can guide the development of a greater state-wide or regional system.

35. *Linking Arid Land Surface Characteristics to Soil Hydrologic and Ecosystem Functions in Mojave Desert Landscapes*, **R.C. Graham** (University of California, Riverside, Riverside, CA, 951-827-3751, robert.graham@ucr.edu).

Desert lands comprise more than 6.5 million ha in southern California and are increasingly impacted by housing developments, utility corridors, recreation, waste disposal, and military activities. This increased land use poses significant environmental challenges, including hazardous dust, runoff and erosion, degradation of habitats, and invasion of exotic species. Most of these issues are directly related to soil surface conditions. Our overarching hypothesis is that the physical characteristics of the land surface, such as desert pavement, the amount of bare soil, and the structure and texture of A horizons, closely control key soil processes related to ecosystem function in the Mojave Desert. We are investigating the links between land surface characteristics and soil hydrologic and ecosystem functions within the desert mountain-piedmont-playa geomorphic context. The results of this study will help with the development of map unit descriptions and land use interpretations in ongoing and planned soil surveys in the Mojave Desert. They will also be useful in guiding site-specific land management decisions.

New Humanities and Science Convergences III: The Greening of the Disciplines

36. *Introductory Remarks*, **Robert Louis Chianese** (California State University, Northridge, Northridge, CA, 818-677-3431, robert.chianese@csun.edu).

37. *Marco Polo's Visit to Hangzhou, China: A Humanties/GPS Visualization/Convergence*, **James C. Manley** (California State Polytechnic University, Pomona, California, Pomona, CA, 909-869-3573, jcmanley@csupomona.edu).

New GPS and GIS technology has made it possible to visualize early geographical descriptions with regard to topographical plausibility. Such is the case with the descriptions from Marco Polo's "Travels" of his visit to the palace of the deposed Southern Sung emperor, located on what is now Phoenix Hill in modern Hangzhou, China. Through the use of historical maps superimposed on high-resolution digital maps, it is possible to address the question of what "Marco Polo" may have seen on his 13th Century visit.

38. *A.R.T. as the Savior of Science and Technology*, **Scott MacFarlane** (Independent scholar, Mount Vernon, WA, 360-840-4590, scottmacfarlane@hotmail.com).

The Hippie Narrative (2007) examines the key works of literature from this era through a constructivist paradigm of Author/ Reader/ Text (A.R.T.). The hippie phenomenon evolved from rebellious attempts to deconstruct "the establishment"—including the excesses of modern science and technology. Such tumult gave way to the exploration of alternative approaches for living more harmoniously on the planet. The greening of the sciences owes its origins to this countercultural sensibility—to the constructivism of the hippies. Postmodern literary theory owes its origins to a similar youthful unrest in France in 1968. However, postmodernism never progressed from a deconstructivist mode of critique based on reader/text. The authorial construction of text as an integral part of the literary process was discounted. This is akin to the users of technology ignoring the role of scientists in its creation and continued evolution. A postmodern ennui harbors the dangerous idea that mankind is at the systemic mercy of technology, and that "the machine" is beyond human control and now controls us. However, "the greening of the disciplines" holds that contemporary mankind can engage technology and author new science in ways that serve our long term ecological wellbeing without succumbing solely to the modern exigencies of economic growth or political power. A.R.T. as the salvation of science and technology implies that humans not abdicate an authorial role on this last whole earth, and that we rein in our modern behavior so it serves the global ecological paradigm. We are the authors of our own "narrative."

39. *Collaborating on the Wings of a Butterfly: An Interdisciplinary Effort to Understand and Restore a Threatened Species,* **Jon Christensen** (Stanford University, Palo Alto, CA, 650-759-6534, jonchristensen@stanford.edu).

An interdisciplinary team of scientists and humanists has been studying the feasibility of reintroducing the Bay checkerspot butterfly to the Jasper Ridge Biological Preserve on the campus of Stanford University where it went extinct in 1998. The demise of the Bay checkerspot has been seen as a tragic conclusion of the historical transformation of California's native grasslands, and increasing variability of weather due to global warming. A re-examination of this dominant narrative—using newly digitized historical botanical records, historic accounts of botanists and geologists, spatial analysis of the relationship of plants and serpentine soils, historic livestock numbers, and climate—has raised important questions about this history and current conservation strategies. Introducing humanistic questions, methods, and sources into the interdisciplinary scientific process has led the scientists to reformulate their questions, which in turn, has changed the historical questions we ask as humanists, in an iterative, collaborative fashion, which has mutually shaped the biggest questions the group is addressing. Chief among there is whether the history that has been told about California's grasslands and the butterfly may have foreclosed possibilities and contributed to the demise of a species that has come to symbolize much of what has been lost in California. And is there any way to recover the possibilities through environmental history? These questions have important implications for the feasibility of reintroducing the Bay checkerspot to its local habitat as well as wider conservation efforts in California grasslands and beyond.

40. *A Century of Misbelief: Milk Sickness in the American Midwest, 1828-1928*, **Barbara Yablon Maida** (University of California, Los Angeles, Los Angeles, CA, 310-825-1071, bymaida@ucla.edu).

One hundred years after the first experimental studies were conducted in rural Illinois and Ohio, urban scientists isolated a chemical component of white snakeroot (Eupatorium rugosum), a common woodlands plant of North America. White snakeroot induced symptoms of milk sickness, an often-fatal malady of the Midwestern states, documented in humans and cattle since the eighteenth century. Tying a single plant source to the poisoning or death of thousands of Midwest and Upper South settlers had proceeded erratically, and in the face of professional skepticism. Between 1828, when a white woman of limited medical training learned the identity of the plant from a Native American, and 1928, when a formally trained, male researcher isolated tremetol, an alcohol in the plant, the scientific and medical communities exhibited a consistent disregard for both hearsay evidence and empirical experiment conducted out of institutional range. Individual and collective factors of white snakeroot ecology do not justify the disbelief of and disregard for substantial evidence by the medical community of the time. Two centuries after Abraham Lincoln's mother succumbed to this toxin, new patterns of settlement breach the wildland/urban interface, setting up more potential interactions between plants and humans. The case points to an earlier disparity between professional and lay knowledge, with regard to the nature of disease and its etiology. We now acknowledge that herbalists and Native American women understood white snakeroot poison; addressing such issues as land use, soil profiles and plant genetics may serve to bridge gaps in the historical scientific database.

41. *Micron Scale Examinations of Two Illustrative Environments: Where Reality is the Ultimate Abstraction,* **Roy W. Johnson** (University of Illinois, Boise, ID, 208-859-1269, royjohnson@cableone.net).

Art has assumed important roles over the course of human history, not the least of which is the visual portrayal of the world around us. Only in the recent history of art have the finished products of the artistic process depicted abstractions. By definition, then, art becomes the antithesis of science. With the emergence of advanced imaging technology as an important instrument in basic research, abstraction no longer needs to be claimed under the dominion of art alone. At these spatial scales, and without context, our world transforms into ultimate abstraction. Choosing micron scale imaging as the medium to

visually reveal the vast and impelling complexity of our natural environment enriches our perceptions of the micro-cosmos with an almost tangible awareness. Observing and reflecting on this universe under our feet fosters a fresh appreciation for the impact humans may be making on their immediate environment: impacts on things we cannot see and did not even know exist. And similar to how images of celestial phenomena facilitated by NASA's Hubble Space Telescope allow us breathtaking insights into the limitlessness of space, seeing these remarkable examples illustrates one of the scientist's primary dilemmas: making meaningful observations and interpretations within the randomness and disorder of the fabric of life around us. Explaining our world requires exceptional effort and is benefited by an integrated approach. The realization that such profound and eloquent abstraction is universal illuminates the potential interrelationship between art and science and cultivates appreciation between artists and scientists for each other's work.

*current address: 910 Warm Springs Avenue, Boise, Idaho 83712

42. *The New Humanities Field Trip: Sensing/Aesthetics/Mythology/Ecology*, **Robert Louis Chianese** (California State University, Northridge, Northridge, CA, 818-677-3431, robert.chianese@csun.edu)

The New Humanities Field Trip is neither a science adventure into identifying flora and fauna nor an humanities excursion to museums or cultural sites. Rather it stages field experiences that re-connect participants to the natural world through exercises in both sensory and aesthetic response as well as mythological and eco-logical understanding.

Sense-experiencing a local place begins with an overview of its geology, climate, biology, and cultural history. Participants then envision the landscape as amplitude and frequency rhythms, which inspire drumming on instruments brought for that purpose. Physical sampling of non-toxic objects follows. An active imagination exercise invites participants to penetrate deep beneath land surfaces to the molten mantle, grounding one mentally in place.

Participants then practice "tracker vision," holding the head and eye still while surveying a panoramic scene with the "mind's eye" in order to discover hidden motion and then the emergence of previously unnoticed forms and patterns. This provokes an aesthetic vision of interrelated objects and spaces, which coalesce into organized fields. This leads to apprehension of the expressive form and aesthetic "architecture" of the scene, a product of both external objects and subjective visioning.

Recounting of local native and historical lore and mythology locates the site in human social experience, with additional attention to archetypal aspects of both its physical and cultural features. Ecological envisioning of both natural and cultural dimensions of the site reveals the interrelatedness of "nature" and "culture," provoking preservationist impulses and incorporating viewer and scene into a dynamic whole.

43. *ORGANIZING KNOWLEDGE: Armadillo, Armoire, Amoeba and Aretology*, **Fred Massarik** (UCLA Anderson School of Management, Los Angeles, CA, 323-469-4976, fred.massarik@anderson.ucla.edu).

In an era of electronic media, incessant e-mail, an aversion to 'spam' (not necessarily the edible kind), acceptance of Blackberry (also not of the edible kind)… and an overwhelming volume of academic publication; - this is the right time to inquire "what is knowledge?" and "how is it developed and distributed?" And AAAS, with its broad compass is just the right venue to ask these questions.

In 1962, with the eyes of a far-ranging economist, Fritz Machlup (by no means the first, but indeed one of the most important) did pose these queries. His statement (in THE PRODUCTION AND DISTRIBUTION OF KNOWLEDGE IN THE UNITED STATES) opens the complex discourse with disarming simplicity: "… we may designate as 'knowledge' anything that is known by somebody, and as 'production of knowledge' any activity by which someone learns of something he has not known before even if others have", p. 7).*

It is the purpose of this presentation to recommence dialogue revolving around these questions, providing a series of metaphors, and variously lamenting and endorsing current trends. (It is my hope that this dialogue will continue beyond the present session, presumably electronically).

The metaphors… each preceded by the word KNOWLEDGE: The Armadillo… well-protected by hard boundary and shell; The Armoire… neatly categorized on visible shelves; The Amoeba… from a solid core reaching out to variable environments, and Aretology… a segment of ethics, particularly addressing virtue. Let's talk about it!

*Princeton N.J.: Princeton University Press, 1962 (typographic in quote slightly modified for present purpose).

44. *Sustainability and the Re-Greening of Anthropology*, **Carl A. Maida** (University of California, Los Angeles, Los Angeles, CA, 805-492-5613, cmaida@ucla.edu).

The concept of sustainability holds that the social, economic, and environmental factors within human communities must be viewed interactively and systematically. The pursuit of sustainable development is a local practice because every community has different needs and quality of life concerns. Sustainable development cannot be understood apart from a community, its ethos, and its ways of life. Cultural processes (norms, values, expectations) operate as precedents to guide human adaptation, as in the case of a community facing development choices. With global change, localities throughout the world have undergone ecological crises, such as resource depletion, changes in land use, and biodiversity loss. Despite efforts to maintain internal control of their economies, many localities become enmeshed in global markets and, as a result, experience increased pressures to change their styles of work and land tenure practices, and to specialize in order to remain competitive. Delocalization results when people become less affected with local concerns, especially in decisions about the management of common resources, and in their stance towards their neighbors who have been marginalized by consequences of global change. Through its encounter with these displacements, the new ecological anthropology has come to view the community as embedded within larger systems at the regional, national, and international levels, and to study the impact of a multitiered and globalizing world on the locality. This new paradigm recognizes the importance of cultural mediations in ecological processes at a time when local ethnoecologies are being transformed by development, biodiversity conservation, environmentalism, and the influence of NGOs.

45. *MCCE IGERT: An Experiment in International Interdisciplinary Graduate Education*, **Adam Freeburg[1], Sara Breslow[2], Julie Combs[2], Emma Flores[2], Steve Harrell[2], Tom Hinckley[2], Joanne Ho[2], Joyce LeCompte-Mastenbrooke[2], Eric Nassau[2], Alicia Robbins[2], Haldre Rogers[2], Patrick Shamberger[2]** and **Lauren Urgenson[2]** [1](University of Washington, Seattle, WA, 206-632-3187, freebs@u.washington.edu); [2](University of Washington, Seattle, WA).

The major goal of the University of Washington's IGERT, "Mul-

tinational Collaborations on Challenges to the Environment", is to train graduate students to address the complex challenges of environmental problems that cross national, cultural, disciplinary, and institutional boundaries. This academic year the third and final incoming cohort consisted of nine doctoral students from across the University. The program began with an intensive eight-day field course exploring environmental problems shared by the western U.S. and Canada. This was followed by a year-long seminar focusing on the following four questions: (1) How do disciplines and their practitioners vary according to epistemology and workplace culture? (2) What does it take to do effective cross-disciplinary research, what models for interdisciplinary collaboration are currently available, and what models do we envision? (3) How do cultural, disciplinary, and institutional identities influence our perceptions of the environment, and (4) What constitutes effective and ethical multinational research in an unequal world? These experiential and classroom experiences culminated in two short-term international team studies: (1) the management of invasive species in New Zealand and (2) human-land use history in a national park in China. Our interdisciplinary and place-based approach offers a multifaceted model for graduate education, in which students are encouraged to cross national and academic boundaries and engage directly with the diversity of people and institutions who share the responsibility for identifying and solving environmental problems. This presentation will offer a preliminary assessment of how this IGERT experiment transformed our perspectives on environmental research.

46. *Ethnographic Futures Research: A Method to Facilitate Visioning, Consensus and Organizational Success*, **Bill Gillis** (Washington State University, Spokane, WA, 509-358-7685, bgillis@wsu.edu), **Matthew Mitchell** (Washington State University, Spokane, WA, 509-358-7685, matthew_mitchell@wsu.edu) and **Robert Textor** (Washington State University, Spokane, WA, 503-223-6370, robertbtextor@comcast.net).

Washington State University's Center to Bridge the Digital Divide recognizes information and communication technologies as powerful tools enabling communities, institutions and ordinary people to pursue desired futures not otherwise available to them. The Center focuses on empowering people with the ability to apply technology with imagination and in ways that build community and create opportunity. Crucial to this process is engaging leaders and members of a group in a collaborative visioning process. For this purpose, the Center uses a method known as "Ethnographic Futures Research (EFR), which is an adaptation of conventional ethnography to the needs and constraints of futures research. In this paper, we will explain the rationale and procedure of EFR, and give examples of its recent successful use in Washington, Oregon, and California.

Biomedical/Bio-Related Materials, Part I

47. *Polymeric Delivery Systems for Genes: Beneficial Effect of Lipophilic Substitutions on Cationic Polymers*, **Hasan Uludag** (University of Alberta, Edmonton, AB, Canada, 780-492-0988, hasan.uludag@ualberta.ca).

Cationic polymers are increasingly utilized to overcome the delivery challenges facing DNA therapeutics. Molecular control of the polymeric structural features is vital when one needs to control the intracellular fate of DNA therapeutics. These efforts are largely based on engineering the promising polymeric materials to impart additional beneficial properties to the materials. Along these lines, two cationic polymers, polyethylenimine (PEI) and poly-L-Lysine (PLL) have been engineered in our laboratory. Both polymers were readily taken up by the cells, and can be located in the cell nucleus without the need for further engineering. However, the ability of PEI to transport a DNA cargo into the cells was superior to that of PLL. In both cases, the DNA payload is rarely seen in the cell nucleus. Adding hydrophobic lipid groups to the polymers significantly improved the delivery of DNA payload by PLL, and to a lesser extent in PEI. Attempts to improve the delivery by grafting integrin-binding arginine-glycine-aspartic acid (RGD) peptides to PEI did not lead to a measurable increase in effectiveness. The polymeric carriers were also versatile in the DNA delivery, since they were effective in delivery of DNA molecules of different conformations (circular vs. linear) and sizes. In human skin fibroblasts, and rat bone marrow cells, the engineered polymeric carriers were equivalent or superior to commercially available lipid formulations and were not as effective as the adenoviral delivery systems. Our collective studies are providing promising polymers for gene delivery, while highlighting the significant challenges that needs to be overcome.

48. *Bioinspired Phospholipid Polymers for Biomedical Devices*, **Kazuhiko Ishihara** (The University of Tokyo, Tokyo, Japan, +81-3-5841-7124, ishihara@mpc.t.u-tokyo.ac.jp).

The preparation of polymer surfaces covered with a phosphorylcholine group and active ester groups on the surface were carried out to conjugate specific biomolecules including proteins and DNAs. We have already reported that the polymer surfaces covered with phosphorylcholine groups are inert biologically; that is, when they contact blood, they do not adsorb plasma proteins. Recently, polymer substrates having directional antenna molecules such as enzymes and antibodies are expected to be novel diagnostic agents and targeting drug carriers to target specific cells and organs. However, attention has not been paid to conventional polymer for the preparation of a suitable interface, which is the most important factor for antenna molecules to show their performance such as selectivity and reactivity. We hypothesized that the polymer surfaces covered with phosphorylcholine groups will provide a suitable platform to conjugate with specific biomolecules. Thus, if these biomolecules are located at an inert surface, they have good bioselectivity, specific reactivity, and so on. In this study, novel phospholipid polymers were synthesized. The active ester group in the side chain can react with a specific biomolecule via condensation with an amino group of the biomolecule. Two kinds of enzymes were co-immobilized on the surface of the phospholipids polymer to achieve enzymatic reactions continuously. We will discuss the detection of specific biomolecules by the continuous enzymatic reactions on the polymer surfaces just like as natural cell membrane.

49. *Antiviral Drug Delivery Systems for the Prevention of HIV Transmission*, **Patrick F. Kiser** (University of Utah, Salt Lake City, UT, 801-587-3681, patrick.kiser@utah.edu).

There is great need in the developing world for engineered drug delivery systems that prevent the male to female sexual transmission of HIV. To this end we are exploring the use of bioresponsive drug delivery systems, which we tailor to the physiological and mechanical requirements essential for vaginal drug delivery. These polymeric constructs are designed to incorporate controlled release characteristics, allow for enhanced tissue coating, reduced viral transport and allow for triggered release of anti-HIV drugs by interaction with semen. For example, we have triggered the release of antiviral agents by utilizing the change in vaginal pH that occurs after coitus or by

seminal enzymes in the ejaculate. In this way, we believe the antiviral agents' biodistribution and bioavailability can be modulated to increase potency and allow for burst release of free HIV inhibitors at the initial onslaught of viral exposure. The design parameters, synthesis and characterization of a few of these microbicide delivery systems will be discussed.

50. *Molecular Interactions within the Extracellular Matrix of Cartilage*, **Julia Thom Oxford** (Boise State University, Boise, ID, 208-326-2395, joxford@boisestate.edu), **Raquel Brown** (Boise State University, Boise, ID, 208-426-2544, rbrown@boisestate.edu) and **Noriko Hazeki-Taylor** (Boise State University, Boise, ID, 208-426-2395, NorikoHazekiTaylor@boisestate.edu).

The structural integrity of biological materials is in part, dependent upon the strength of interactions between the molecular constituents of the tissue. Although the molecular composition of many biological materials is known, the interactions between individual molecules within the tissue are less well understood. Thrombospondin-1 is a multidomain matricellular glycoprotein that mediates cell–cell and cell–matrix interactions. Collagen type XI is a quantitatively minor collagen that is found at the surface of heterotypic collagen fibrils of cartilage and known to play a role in the regulation of fibrillogenesis. Molecular interactions between the surface of heterotypic type II/IX/XI collagen fibrils and noncollagenous constituents of the extracellular matrix have been determined by a combination of affinity chromatography and tandem mass spectrometry. Thrombospondin-1 and related fragments were among those proteins identified. Studies indicate the possibility that molecules previously identified as mediators of collagen fibrillogenesis may work in concert to accomplish their common function. Additionally, thrombospondin-collagen XI interactions may contribute to cell-matrix interactions and matrix-matrix interactions that provide structural integrity to the tissue. The overlap or similarities in the phenotypes that result from mutations in either thrombospondin-1 or collagen alpha 1(XI) may reflect a physical interaction at the molecular level. Results of our studies may provide a better understanding of the molecular architecture of the extracellular matrix and indicate mechanistic details in the cooperative function within the regulation of assembly of higher-ordered structures.

51. *Fully Degradable Functionalized Polymers: A Versatile Approach Using Ring-Opening Polymerization of Cyclic Carbonates,* **James L. Hedrick** (IBM Research, San Jose, CA, 408-927-1632, hedrick@almaden.ibm.com).

Advanced applications in biomedicine will require well-defined macromolecules capable of generating nanostructured materials with distinctive properties and capabilities with respect to the delivery of biologically active cargo. The ability to prepare complex polymers with controlled functionality and architecture continues to be a significant challenge. Our own research has focused on organocatalytic ROP of cyclic esters and related monomers, which was primarily motivated as a means to avoid metal contaminants to allow use of the polymers in biological applications, but has since proven to be broadly effective. We have reported several classes of ROP organocatalysts, including N-heterocyclic carbenes, bifunctional thiourea-amines, and amidine or guanidine superbases, with user-selectable degrees of activity and selectivity. With this toolbox of catalysts in hand, both solution and bulk polymerization conditions were established to afford polymers with precise molecular weight, narrow molecular weight distributions, end group fidelity and no side reactions. However, a task that is difficult to achieve with cyclic esters is the incorporation of pendant functional groups, preferably into easily accessible monomers. Cyclic carbonate monomers offer an alternate path to introducing functionality into easily degraded polymers, and aliphatic polycarbonates are a class of biocompatible and biodegradable materials. Monomers resembling trimethylene carbonate (TMC) with substituents at the 5-position, para to the carbonyl group, are distant from the propagating functionalities and should interfere less with polymerization. Functional carbonate monomers can be easily prepared on laboratory scale by ring closure of 1, 3-diols using triphosgene. This talk will present the organocatalyzed ROP of substituted analogs of TMC, the effect of subsituents on polymerization kinetics, and attempts to build block and random carbonate copolymers.

52. *Organic Materials via Molecular Self-Organization into Liquid-Crystalline Phase or Crystal Phase*, **Suk-Wah Tam-Chang**[1], **Liming Huang**[2], **Gyan Ayral**[2], **Wonewoo Seo**[3] and **Kyle Rove**[3] [1](University of Nevada, Reno, Reno, NV, 775-784-6661, tchang@unr.edu); [2](University of Nevada, Reno, Reno, NV, 775-327-5337); [3](University of Nevada, Reno, Reno, NV).

Liquid crystals play important roles in biological systems. Common examples of liquid-crystalline biological systems include DNA in concentrated solutions and lipid bilayers. In the past few decades, liquid crystals have also found useful applications as functional materials. Inspired by the formation of liquid-crystalline phase by DNA, we design and synthesize ionic organic compounds that self-organize to give chromonic liquid crystals and crystals with direction-dependent properties. Organic materials have potential applications as optical and electronic materials, in light emitting devices, and in microelectronic fields. The properties of organic materials and the performance of devices based on these materials are strongly influenced by the interactions among the components (molecules or ions) and the packing of the components in the materials. For example, ordered arrangement of organic molecules may result in materials that show more intense absorption of light or higher electrical conductivity in one direction. Such materials are useful as polarizers (which are important components of liquid crystal displays) or semiconducting materials in electronic devices. Using a polymer template with micrometer-scale features to direct the ordered arrangement of these compounds, patterned structures with micrometer-scale local order and direction-dependent optical properties were fabricated.

53. *Biomaterirals for Cell Transplantation*, **Tetsuji Yamaoka** (National Cardiovascular Center Research Institute, Suita, Japan, +81-6-6833-5012, yamtet@ri.ncvc.go.jp).

The clinical use of the regenerative medicine has been attracting great attention in this decade, which is, however, limited by both of scientific and regulatory aspects. Among the various protocols in the regenerative medicine, autologous cell transplantation is the most safe and highly anticipated system for curing various diseases including myocardial infarction, arteriosclerosis obliterans, and Parkinson's disease. Mesenchymal stem cells (MSCs) are the most widely studied cell source and usually isolated by use of their adhering nature onto tissue culture polystyrene dishes. However, the isolated cells consist of many subpopulations. For an effective use of these systems, significant problems such as the heterogeneity of the prepared cells and poor efficiency in embedding cells to the site of action must be solved. Moreover, due to the difficulty to follow up the fate of transplanted cell in a non-invasive manner, the mechanisms of the interaction between therapeutic efficacy and function of the cells are unclear. Our recent research accomplishments involve (1) a novel cell

purification system based on the density of the cell surface marker proteins (2) bio-resorbable injectable scaffold for cell transplantation composed of poly(ethylene glycol) and poly(lactic acid), and (3) in vivo non-invasive cell tracking system using novel MRI (magnetic resonance imaging) contrast agent. In this study, we combined these new technologies into one system to improve the problems of autologous cell transplantation.

54. *Synthesis and Anticoagulant Function of Heparin-Containing Block Copolymers at Interfaces*, **Allyson Fry** (Oregon State University, Corvallis, OR, 541-737-9819, frya@onid.orst.edu), **Joseph McGuire** (Oregon State University, Corvallis, OR, 541-737-6306, mcguirej@engr.orst.edu) and **Karyn Bird** (Oregon State University, Corvallis, OR, 541-737-8283, karyn.bird@oregonstate.edu).

A number of case studies suggest that biomaterial surfaces with grafted heparin show a diminished thrombogenic response, but results with such heparinized surfaces have been far from uniformly favorable. An important origin of the ineffectiveness of heparin coatings may be that the spatial and structural character of heparin at interfaces is not properly managed The main objective in our research is to synthesize heparin-containing copolymer constructs that can be immobilized at interfaces such that heparin molecular mobility and solvent accessibility are preserved. For this purpose, thiol groups were introduced to unfractionated heparin by reaction of carboxyl groups in its iduronic residues. Thiolated heparin derivatives were then linked to pyridyl disulfide-activated, poly[ethylene oxide]- poly[propylene oxide]-poly[ethylene oxide] (PEO-PPO-PEO) triblock polymers which had previously been coated onto the surfaces of polystyrene (1 µm) microspheres via their PPO center blocks. While the surface attachment of heparin in this manner significantly increased the anticoagulant activity of the microsphere suspensions as determined by the activated partial thromboplastin time assay, this result was not fully reproducible, due in all likelihood to the heparin having been modified at multiple sites along the length of the molecule as opposed to only at one end. In this regard we have altered our approach to include an end-aminated heparin starting material. Thiol modification of the NH2 group on this heparin derivative will be achieved using a commercially available, NHS-ester crosslinker. Materials with (untethered) covalently grafted heparin will also be synthesized for controlled comparison of function.

55. *Photo-Responsive Polymer Assemblies for Drug Delivery*, **Tomoko Fujiwara** (Boise State University, Boise, ID, 208-426-2393, tomokofujiwara@boisestate.edu).

Spiropyrans are a class of photochromic compounds whose molecular structure is alterable upon exposure to UV/ visible light or changes in temperature. Two typical forms are a colorless spiro (Sp) form and a colored merocyanine (MC) form. The polar MC form exists as a zwitterion in polar solution and has more complicated isomers based on the cis-trans isomerization of the conjugated bonds such as TTC (Trans-Transoid-Cis), CTC, CTT, and TTT. Furthermore, the planer MC structure tends to associate into stacking structures so called J-aggregates and H-aggregates by ionic interaction. We are particularly interested in remarkable changes in polarity and structure (especially, planarity) between Sp and MC forms of spiropyran. To effectively utilize these properties, we have designed a functional polymer initiated from a newly developed spiropyran dimer (BIPSD). This photo-switchable polymer has great potential for site recognition of specific biomolecules and as a sensor of organic/inorganic compounds. The polar face of the MC form strongly attracts ionic species which can be released through visible light irradiation upon transformation into the non-polar Sp form. The aggregates of this BIPSD-polymer is attractive since MC-to-Sp conversion destroys the planarity of the molecules, which disallows maintenance of the self-assembly structure. The preparation of BIPSD and the preliminary results of photochromic studies will be discussed.

The Chemistry of Advanced Nuclear Systems: Separations and Environmental

56. *Symmetric and Asymmetric Dithiophosphinic Acids for Minor Actinide Extraction*, **John R. Klaehn** (Idaho National Laboratory, Idaho Falls, ID, 208-526-5238, john.klaehn@inl.gov), **Dean R. Peterman** (Idaho National Laboratory, Idaho Falls, ID, 208-533-4104, dean.peterman@inl.gov), **Mason K. Harrup** (Idaho National Laboratory, Idaho Falls, ID, 208-526-1356, mason.harrup@inl.gov), **Richard D. Tillotson** (Idaho National Laboratory, Idaho Falls, ID, 208-533-4094, tillrd@inel.gov), **Thomas A. Luther** (Idaho National Laboratory, Idaho Falls, ID, thomas.luther@inl.gov), **Mitchell R. Greenhalgh** (Idaho National Laboratory, Idaho Falls, ID, mitchell.greenhalgh@inl.gov), **Jack D. Law** (Idaho National Laboratory, Idaho Falls, ID, 208-526-3382, Jack.Law@inl.gov) and **Lee M. Daniels** (Rigaku Inc., The Woodlands, TX, 281-363-1033, ldaniels@Rigaku.com).

A new synthetic pathway has been used to provide an accessible route for both symmetric and asymmetric (dithiophosphinic acid) DPAH derivatives (two different substituents on phosphorus). Several DPAH derivatives have been isolated using this synthetic pathway which provides the control of regiochemistry and/or stereochemistry. The synthesis allows better DPAH designs that can address the issues about the separation between trivalent actinides and lanthanides. Some of the DPAH products showed remarkable stability. For example, bis(o-trifluoromethylphenyl)dithiophosphinic acid (1) showed very little degradation when contacted with water and nitric acid for prolonged periods. One astonishing finding is that (1) selectively extracts trivalent actinides from lanthanides at higher acidities with separation factors of over 90,000 at low pH. The synthesis and characterization along with some stability testing and Ln(III)/An(III) extraction results will be presented.

57. *Trapped-Ion / Vibrational Spectroscopy of Gas-Phase Dioxouranium Complexes*, **Garold L. Gresham** (Idaho National Laboratory, Idaho Falls, ID, 208-526-6684, garold.gresham@inl.gov), **Gary S. Groenewold** (Idaho National Laboratory, Idaho Falls, ID, 208-526-2803, gary.groenewold@inl.gov), **Michael J. Van Stipdonk** (Wichita State University, Wichita, KS, 316-978-7381, mike.vanstipdonk@wichita.edu), **Jos Oomens** (FOM Institute for Plasma Physics, Niewegein, Netherlands), **Michael E. McIlwain** (Idaho National Laboratory, Idaho Falls, ID, 208-526-8130, michael.mcilwain@inl.gov) and **Wibe A. De Jong** (Pacific Northwest National Laboratory, Richland, WA, 509-376-5490, wibe.dejong@pnnl.gov).

The structure and reactivity of the dioxouranium cation complexes is important because the nature of coordination dictates ultimate disposition in industrial processes, the environment and biological systems. In solution, the strength of ligand coordination is difficult to quantitatively measure because of solvent effects, varying participation of uranium f-orbitals, and multiple anion bonding modes. We have investigated intrinsic uranyl-anion interactions using

wavelength-selective infrared multiple photon dissociation (IRMPD) of discrete complexes isolated in a trapped-ion mass spectrometer. Using this technique discrete metal species can be formed and isolated in explicitly defined solvation states resulting in an IRMPD spectra that bear close resemblance to vibrational spectra generated using more conventional means. Uranyl $[UO_2]^{2+}$ complexes provide an ideal system for IRMPD study because the asymmetric stretch (ν3) frequency of the linear O=U=O moiety is decreased by equatorial coordination with electron donating ligands, which causes repulsion of the axial oxo ligands. Previous studies of uranyl-acetone showed that ν3 was decreased by a) increasing the number of equatorial ligands, or b) increasing ligand nucleophilicity. Substitution of a halide to the equatorial coordination sphere caused a further decrease in ν3, with a concomitant increase in the acetone C=O frequency. Formal reduction of uranyl was evaluated by measuring $[UO_2(ROH)_n]^+$ where ROH = H_2O, MeOH, EtOH and n-PrOH: ν3 was further red-shifted, consistent with greater electron density at the metal center. The IRMPD values for the dioxouranium complexes were compared with density functional theory values, which showed that the computational accuracy was within 20 cm^{-1} of most measurements.

58. *Novel Dithiophosphinic Acids as Actinide Extractants, A Density Functional Theory Investigation*, **Michael T. Benson** (Idaho National Laboratory, Idaho Falls, ID, 208-526-1316, michael.benson@inl.gov), **Adriana Dinescu** (Idaho National Laboratory, Idaho Falls, ID, 208-526-9739, Adriana.Dinescu@inl.gov), **Megan L. Moser** (Idaho National Laboratory, Idaho Falls, ID) and **Dean R. Peterman** (Idaho National Laboratory, Idaho Falls, ID, 208-533-4104, dean.peterman@inl.gov).

The minor actinides (MA) Am, Cm, and other transplutonium elements represent significant, long-term hazards found in spent nuclear fuel (SNF). Unfortunately, the MA and lanthanide ions are most stable in the trivalent oxidation state and, as a result, have essentially identical chemical behavior. Ligands with soft donor atoms, such as dithiophosphinic acids, have worked as actinide extractants, although with limited efficiency. In this work, density functional theory has been used to model a series of novel dithiophosphinic acids, in terms of structure and pKa. Initial studies on the ML3 complexes (where M=Cm3+) will also be discussed, in terms of complex geometry and ligand binding enthalpies. Experimentally, several of the acids have shown significant improvements in separation efficiency and extractant stability relative to commercially available extractants, such as Cyanex 301.

59. *Actinide Interaction Processes with Bacterial Surfaces: The Quest for Molecular-level Understanding*, **Heino Nitsche** (University of California, Berkeley, Department of Chemistry and Lawrence Berkeley National Laboratory, Nuclear Science Division, Berkeley, CA, 510-486-5615, hnitsche@lbl.gov).

Microorganisms play an important role in the immobilization and mobilization of actinides in aquifers and subsurface environments. This talk will present several detailed examples of the interaction of aerobic soil bacteria with uranium and plutonium. Details of the nature of the bacterial functional groups involved in the interfacial actinide interaction process will be reported. Based on time-resolved laser-induced fluorescence spectroscopy (TRLFS) and synchrotron X-ray absorption spectroscopy (XANES and EXAFS) studies, molecular-level mechanistic details of the different interaction processes will be discussed. Complexation studies on bacterial surface model compounds with curium will be reported. Areas of this emerging field in actinide research will be outlined where additional information and integrated interdisciplinary research is required.

60. *Surface Chemistry of Uranyl Silicate*, **Nathalie A. Wall** (Washington State University, Pullman, WA, 509-335-8917, nawall@wsu.edu), **S.B. Clark** (Washington State University, Pullman, WA, 509-335-1411, s_clark@wsu.edu) and **Laurence C. Hull** (Idaho National Laboratory, Idaho Falls, ID, 208 526-1922, Laurence.Hull@inl.gov).

On a geologic timescale, the U(VI) silicates such as uranophane, sklodowskite, and Na-Boltwoodite ($Ca[(UO_2)(SiO_3OH)]_2{\cdot}5H_2O$, $Mg[(UO_2)(SiO_3OH)]_2{\cdot}6H_2O$, and $Na(H_3O)[(UO_2)SiO_4]$, respectively) are expected solids that form upon corrosion of spent nuclear fuel. Experimental and computational data are needed to predict the surface chemistries of these compounds. We modeled the surface reactions from experimentally—determined surface areas, zeta potentials and potentiometric titrations. We paid a particular attention to the measurements of solid dissolution during the titrations. The surface areas are best determined in solution using methylene blue sorption, because the solid structures tend to collapsed upon dehydration, which is used during BET measurements. Zeta potentials are negative for the entire pH scale, with a sharp decrease for pH > 5. Dissolution begins to occur at pH < 5.5. The modeling was carried out using PHREEQC and the nonlinear parameter estimating code PEST.

61. *Uranium, Neptunium, and Plutonium Complexes in Aqueous Hydrogen Peroxide-Carbonate Solutions: Stability and Speciation*, **G. S. Goff**[1], **F.L. Taw**[1], **S.M. Peper**[1], **L.F. Brodnax**[1] and **Wolfgang H. Runde**[2] [1](Los Alamos National Laboratory, Los Alamos, NM); [2](Los Alamos National Laboratory, Los Alamos, NM, 505-667-3350, runde@lanl.gov).

For decades, peroxide has been used to adjust the oxidation state of plutonium and to precipitate plutonium under acidic conditions. Currently, it is unknown whether Pu will behave the same way at high pH in the presence of competing complexing ligands, i.e. CO3-2, OH-. In particular, carbonate forms very stable complexes with the actinides and may inhibit plutonium recovery utilizing peroxide. Recent experiments have shown that in carbonate solutions, U(VI) is oxidized upon the addition of hydrogen peroxide, while both Np(VI) and Pu(V,VI) are reduced. In the mixed peroxide-carbonate solutions, these actinides form stable mixed peroxy-carbonato complexes. For example, U(VI) forms complexes of the form UO2(O2)x(CO3)y2-2x-2y (x/y = 1/2, 2/1, and 3/0), and the monoperoxo-biscarbonato anion UO2(O2)(CO3)24- has been crystallized. We have also crystallized a ternary Pu(IV) peroxo-carbonate complex that exhibits a dimeric structure with bridging peroxo ligands. Crystals were characterized by single crystal x-ray diffraction studies. We have characterized these solution complexes by a variety of methods including UV-VIS, 13C NMR, and Raman spectroscopy. These complexes have been studied over a range of peroxide and carbonate concentrations in order to determine fundamental thermodynamic data to be used in determining solution speciation.

62. *Washington State University Activation Analysis Facilities*, **James T. Elliston** (Washington State University, Pullman, WA, 509-335-8316, elliston@wsu.edu), **Margaret A. Malloy** (Washington State University, Pullman, WA, 509-335-5032, mollymalloy@wsu.edu) and **Donald E. Wall** (Washington State University, Pullman, WA, 509-335-8641, Donald_wall@wsu.edu).

Neutron activation analysis (NAA) has been performed at Washington State University since the early 1960's. A significant number of research projects that require quantification of trace elements have used and continue to use NAA despite the availability of other trace element techniques. The WSU neutron source is a 1 MW TRIGA conversion reactor with the core at the bottom of a 70,000 gallon, 30 foot deep pool. Available thermal neutron fluxes are on the order of 3×10^{12} cm^{-2} s^{-1} in water cooled positions. The reactor has four positions dedicated to NAA; each of these four positions is mechanized to rotate sample assemblies during irradiation to correct for lateral flux inhomogeneity. Should epithermal NAA be required a Cd lined tube can be used to replace one of the four thermal tubes (typically in conjunction with boron nitride vials to further filter neutrons that have been thermalized by the small water volume inside the Cd tube). The core also has 8 fixed positions for the irradiation of iridium doped ceramic beads, which are used in petroleum and natural gas well logging. There is also a movable irradiation position that can be lowered to the core for specialized irradiations such as silicon disks that are used in quality control/quality assurance of digital camera charged-coupled device production. Spectral analysis for NAA at WSU is carried out by gamma-ray spectrometry using high purity germanium (HPGe) or lithium drifted germanium (GeLi) detectors coupled to personal computer-based Genie™ 2000 (Canberra) data acquisition and analysis software.

The Chemistry of Advanced Nuclear Systems: Modeling and Simulation

63. *Theoretical Studies of Thermochemistry, Chemical Bonding, and Electronic Excitations in Actinide Complexes,* **Enrique R. Batista** (Los Alamos National Laboratory, Los Alamos, NM, 505-667-8177, erb@lanl.gov).

In this talk we will discuss the performance of density functional theory in combination with relativistic effective core potentials for simulation of actinide systems. A detailed study of the chemical bonding of the first linear uranium-imido analog of the uranyl ion will be presented. A molecular orbital analysis shows that the U-N bond is a covalent triple bond. The metal center and the ligands form two sigma and four pi bond between the f-electrons of the uranium and the p electrons of the ligands. We will also present studies of the mixed species uranium oxo-imido compound and compare them to uranyl. Second we will discuss the nature of electronic excitations in uranyl carbonate complexes and compare our calculations to experimental observations.

64. *Computational Modeling of Actinide Complexes*, **Krishnan Balasubramanian** (California State University East Bay & Lawrence Livermore National Lab, Livermore, CA, 925-422-4984, balu@csueastbay.edu).

No text available.

65. *The Role of Surface Charge Density in Ln(III) Hydration*, **Aurora E. Clark** (Washington State University, Pullman, WA, 509-335-3362, auclark@wsu.edu).

The aqueous chemistry of Ln(III), particularly in the primary and secondary hydration spheres, has energetic and entropic consequences for the separation of these elements using solvent extraction techniques. A common tenet in ion solution chemistry is that the surface charge density of the ion influences both the binding energies of solvent in the primary solvation sphere, as well as the solvent order at longer scales. While there have been extensive theoretical studies of the primary, and to some extent secondary, hydration spheres of individual f-elements under different solvent conditions, a systematic investigation into the energetic and entropic affects of surface charge density has not been performed. Here we will present a detailed computational analysis of the aqueous solution chemistry of Ln(III) ions across the lanthanide period.

66. *First-principles Studies of Cerium Doped LaBr3 Scintillator*, **Da Gao** (Idaho National Laboratory, Idaho Falls, ID, 208-526-3691, da.gao@inl.gov) and **Michael E. McIlwain** (Idaho National Laboratory, Idaho Falls, ID, 208-526-8130, Michael.McIlwain@inl.gov).

There has been recent revived interest in a scintillation mechanism that appears capable of producing scintillation materials that are both fast and luminous, and they are currently being considered for sensor applications in nuclear plant. In order to better understand LaBr3:Ce, which is a promising material in scintillator development for gamma ray detection, the electronic structures of Cerium doped LaBr3 Scintillators have been investigated by systematic first-principles quantum mechanics calculations, in which the density functional theory plane-wave pseudo potential method has been employed. The effect of Ce-doping content on the band structure, density of states, electron density difference, optical properties, and structural stability of LaBr3:Ce scintillator has been thoroughly studied in the present work. In addition, different theoretical levels of approximations for the exchange-correlation energy, such as generalized-gradient approximation (GGA including PBE, RPBE and PW91) and local-density approximation (LDA), have been examined. Finally, the spin polarization effect has been addressed via a comparison between the spin polarized calculation and the non spin polarized calculation.

67. *Interplay of Computational Modeling and Experiments in Actinide Chemistry*, **Wibe (Bert) De Jong** (Pacific Northwest National Laboratory, Richland, WA, 509-376-5490, Wibe.DeJong@pnl.gov).

Results will be presented in Computational chemistry emphasizing the significant contributions to actinide chemistry in understanding and interpretation of experimental data, the prediction of chemical and physical properties of heavy transition metal, lanthanide and actinide complexes. Sensitive experimental measurements are combined with the interpretative power of ab initio theory to measure and understand structural and bonding parameters in complexes containing actinides, and to test the accuracy of the available computational methodologies.

68. *Structure and Reactivity Studies of Environmentally Important Actinide Complexes*, **Jason L. Sonnenberg** (Wayne State University, Detroit, MI, 313-577-2546, molecule@wayne.edu) and **H. Bernhard Schlegel** (Wayne State University, Detroit, MI, 313-577-2562, hbs@chem.wayne.edu).

In the field of actinide environmental chemistry, nine-coordinate complexes adopting ideal or nearly ideal tricapped, trigonal-prismatic geometries are common. Relativistic density functional theory provides a radiation-free tool for investigating such complexes, in silico. The formation of a Pu(IV) siderophore complex from [Pu(H2O)9]3+ and free desferrioxamine E is presented along with possible reaction mechanisms. The general nature of nine-coordinate actinide complexes is also discussed.

69. *Ferrous Iron Reduction of Uranium Triscarbanato: Connecting Atomic Behavior to Field Scale Interpretations*, **Matthew C. F. Wander** (Stony Brook University, Stony Brook, NY, 917-539-7117, mwander@notes.cc.sunysb.edu), **Sebastian Kerisit** (Pacific Northwest National Laboratory, Richland, WA), **Kevin M. Rosso** (Pacific Northwest National Laboratory, Richland, WA, 509-376-7762, kevin.rosso@pnl.gov) and **Martin A. A. Schoonen** (Stony Brook University, Stony Brook, NY, martin.schoonen@stonybrook.edu).

Iron rich environments inhibit the mobility of uranium while carbonate rich waters are known to enhance uranium mobility. This work focuses on density functional theory calculations of aqueous reactions between ferrous iron and uranium tris-carbanato. Utilizing Marcus Theory and its extension to proton coupled electron transfer reactions, we studied both the thermodynamics as well as the kinetics of U(V)1 and U(IV) production and its stability in ferrous iron rich waters. In particular, we determined the effects of the hybridization change and proton transfers in the U(V) to U(IV) transition. We examine our results in light of field scale observations which show a correlation between ferrous iron and immobilized U(IV) in a carbonate rich aquifer2.

(1) Wander, M. C. F.; Kerisit, S.; Rosso, K. M.; Schoonen, M. A. A. Journal of Physical Chemistry A 2006, 110, 9691. (2) Davis, J. A.; Curtis, G. P.; Wilkins, M. J.; Kohler, M.; Fox, P.; Naftz, D. L.; Lloyd, J. R. Physics and Chemistry of the Earth 2006, 31, 548.

70. *Ab-initio Study of Lanthanides and Actinides: Progresses, Challenges, and Applications*, **Zhiyong Zhang** (Stanford University, Stanford, CA, 650-723-0420, zyzhang@stanford.edu).

The characterization and prediction of properties of heavy element materials through simulations have been the ultimate goal of computational studies and are particularly important due to the radioactive nature of these materials. Great progresses have been made in the past and the applications of ab-initio methods are becoming prevalent. Ab initio simulation of heavy element materials presents several major difficulties due to the strong relativistic effects, especially the spin-orbit interactions. I will discuss some aspects of the capabilities, outstanding issues, and promising new developments for Density Functional Theory, Configuration Interaction, and Quantum Monte Carlo methods in application for systems with heavy elements. I will also present our recent results on the study of electronic structures of actinide molecules and the separation of actinides from lanthanide in nuclear waste material.

Corrosion and Coatings Challenges in Industry

71. *Modeling Realistic Microstructures: The Effects of Microstructural Anisotropy on Intergranular Stress-corrosion Cracking*, **Megan Frary**[1], **Luke Hindman**[2] and **Amit Jain**[2] [1](Boise State University, Boise, ID, 208-426-1061, meganfrary@boisestate.edu); [2](Boise State University, Boise, ID).

The properties of materials depend directly on the underlying structure of the material, especially at the grain boundaries. Grain boundaries are known to influence the strength, ductility, creep resistance, impact resistance, and corrosion behavior in metals and ceramics. In turn, the effects of the grain boundaries are strongly dependent on their structure. Therefore, models of intergranular phenomena must be founded on an accurate representation of the microstructure, including information on the distribution of grain boundary types. We are developing both 2D and 3D models for microstructures which account for grain size and shape distribution, crystallographic texture, and grain boundary character. Using percolation theory, the connectivity of boundaries susceptible to intergranular stress-corrosion cracking can be determined and related to the properties of the material. In the future, these models could be used to predict the microstructural characteristics which result in the most corrosion-resistant structures.

72. *Newly Developed Corrosion Resistant Nano-Composite Alloy Coatings for Steels*, **Abdel Salam Hamdy Makhlouf** (Boise State University, Boise, ID, 208-426-5375, AbdelSalamHamdy@boisestate.edu), **Madiha Ahmed Shoeib V** (Central Metallurgical Research and Development Institute, CMRDI, Cairo, Egypt, 00202 5010642, mshoeib@yahoo.com), **Hossam Hady Jr.** (Saqr Factory for Advanced Militaries Industries, Cairo, Egypt, hosamhady@yahoo.com) and **Omar F. Abdel Salam** (Faculty of Engineering, University of Cairo, Cairo, Egypt).

The electroless deposition of Ni–P–W and Ni-P-nano scattered alumina alloy composite coatings onto low carbon steel substrates was studied. The effect of kinetic parameters, namely: temperatures (60–80°C), pHs (6-9), nickel sulfate concentration (10-40 g/l), sodium hypophosphate concentration (15 to 30 g/l), sodium citrate (50-80 g/l) and deposition time (20 to 60 minutes) on the average metal deposition rates were investigated. The coating performance was evaluated based on the corrosion and wear resistance, surface appearance and micro-hardness. The effect of heat treatment on the coating performance was also studied. The optimum conditions under which such coatings can provide good corrosion protection to the substrate were determined after two weeks of immersion in 3.5% NaCl solution. Electrochemical impedance spectroscopy (EIS) and polarization measurements have been used to evaluate the coating performance before and after heat treatment. The Ni–P–W coatings showed the highest hardness, corrosion and wear resistance compared with Ni-P-alumina and Ni–P. XRD analysis revealed formation of a protective tungsten phosphide phase in the Ni–P–W composite coatings. Heat treatment has an adverse effect on the corrosion protection performance of tungsten and alumina composite coatings. The surface resistance decreased sharply after heat treatment.

73. *Corrosion Resistant Materials for Concrete Reinforcement*, **Michael F. Hurley** (Boise State University, Boise, ID, 208-426-9375, mfh3f@virginia.edu).

The life of a concrete structure exposed to deicing compounds or seawater is often limited by chloride induced corrosion of the steel reinforcement. The high cost of maintaining these structures has prompted some states to consider more costly corrosion resistant reinforcing bar to achieve a corrosion-free lifetime design goal of at least 100 years. Key material attributes that impact the corrosion initiation and propagation periods were studied using laboratory electrochemical methods. Threshold chloride concentrations for corrosion initiation were determined for solid 316LN (UNS 31653) stainless steel, 316L (UNS 31603) stainless steel clad over carbon steel, 2101 LDX (UNS S32101), MMFX-2, and carbon steel rebar (ordinary ASTM A 615M) in saturated calcium hydroxide + sodium chloride solutions. Surface preparation, test method, aging time, and presence of cladding defects all affected the threshold chloride concentration obtained. Model results of chloride diffusion in concrete confirmed that pickled 316LN (Cl-/OH- > 20) may increase the time until chloride-induced

corrosion initiation to 100 years or more. Once initiated, active radial pit growth was found to be ohmically controlled for all materials but repassivation occurred more readily in the case of 316LN and 2101 stainless steels. The discovery of ohmically controlled propagation enabled transformation of propagation rates from simulated concrete pore solution to less conductive concrete by accounting for resistance changes in the surrounding medium. The results suggest that corrosion resistant materials offer a significant extension to the corrosion propagation stage over carbon steel, even in very aggressive conditions because small, localized anodes develop.

74. *Assessing the Performance of Stannate Conversion Coatings on Mg Alloys*, **Brian M. Marx** (Boise State University, Boise, ID, 208-426-5376, brianmarx@boisestate.edu), **Abdel Salam Hamdy Makhlouf** (Boise State University, Boise, ID, AbdelSalamHamdy@boisestate.edu), **Darryl P. Butt** (Boise State University, Boise, ID, 208-426-1054, darrylbutt@boisestate.edu) and **David Thomsen** (Boise State University, Boise, ID, 208-426-5375, DavidThomsen@mail.boisestate.edu).

Although Mg alloys display good mechanical properties and have low densities, their applications are limited due to magnesium's poor corrosion resistance. Conversion coatings can be used to improve the corrosion performance of Mg alloys, thereby increasing their applications. This work studies the effects of surface pre-treatments, prior to applying stannate conversion coatings, and stannate concentration on Mg AZ91D alloys. Linear polarization, cyclic voltommetry, electrochemical impedance spectroscopy, SEM-EDS, and XRD analysis was performed to assess the corrosion performance/protection of the stannate conversion coatings. The results indicate that lower Sn concentrations and alkaline surface pre-treatments enhance the corrosion performance of these Mg alloys in 3.5% NaCl solution.

75. *The Impact of Crystal Orientation on Oxidation and Corrosion of Polycrystalline Metals*, **Lou Bonfrisco** (Boise State University, Boise, ID, 208-426-5375, loubonfrisco@gmail.com), **Sharla Hopkins** (Boise State University, Boise, ID, sharlahopkins@mail.boisestate.edu) and **Megan Frary** (Boise State University, Boise, ID, meganfrary@boisestate.edu).

The understanding of oxidation and corrosion behavior in the aerospace, power generation, and nuclear energy industries has the potential to enhance the properties and performance of a diverse subset of products. Engineering materials at the microstructural level could increase their resistance to corrosion in harsh environments, such as in space, nuclear containment systems or varying atmospheric conditions. As corrosion and oxidation are generally considered to be surface phenomena, the microstructure of the surface may affect the rate at which these processes occur. Most studies that have investigated the role of surface orientation on oxidation or corrosion have focused on one or a few orientations. In the present work, we explore the continuum in surface orientations and determine the effects of orientation on the oxidation and corrosion behavior of metals over all surface orientations. The orientations of the grains on the metal surface are mapped using electron backscatter diffraction (EBSD). The topography and relative thickness of the oxide layer are then characterized using optical profilometry (OP) or atomic force microscopy (AFM). By correlating the results from EBSD and OP or AFM, the relative oxide thickness can be determined for each orientation in the specimen. We find that the oxide depth is correlated to the angular deviation away from the <111> surface orientation. Knowledge of the oxidation and corrosion behavior as a function of surface orientation will provide valuable insight on role of microstructures in material properties and could lead to the development of microstructures that are more resistant to these phenomena.

76. *Corrosion Behavior of Some Newly Developed Mg Alloys in NaCl Solution*, **David Thomsen** (Boise State University, Boise, ID, 208-426-5375, DavidThomsen@mail.boisestate.edu), **Abdel Salam Makhlouf** (Boise State University, Boise, ID, abdelsalamhamdy@boisestate.edu), **B. Marx** (Boise State University, Boise, ID, BrianMarx@boisestate.edu) and **D. P. Butt** (Boise State University, Boise, ID, DarrylButt@boisestate.edu).

There is a growing interest in Mg alloys in many industrial applications due to their high-strength, light-weight properties. However, Mg alloys show high corrosion susceptibility in chloride containing solutions. Because the Open Circuit Potential (OCP) of Mg in aqueous environments is below the H2 gas formation potential (i.e. hydrogen gas can form on Mg surfaces), therefore this work focuses on quantifying the amount of hydrogen generated on a Mg alloy surface and correlating this with the accumulated corrosion damage. Hydrogen was collected and measured on AZ91D, AZ91E alloys before and after applying stannate conversion coatings. The alloys were immersed in 3.5% NaCl solutions and the hydrogen gas that formed at the surface was collected as a function of time for 9 days. The rate of hydrogen evolution collected after 9 days from the AZ91D was 0.0133 ml/cm^3-hr, which was less then that collected from the AZ91E (0.0141 ml/cm^3-hr), but higher than the rate from the AZ91D and AZ91E coated with stannate conversion coatings. Based on the rate of hydrogen evolution, the stoichiometry of the hydrogen reduction reaction and the Mg oxidation reaction, corrosion rates and corrosion currents (ICorr) were calculated. These calculations assumed that all of the charge consumed in the hydrogen evolution reaction was generated via the oxidation of Mg. The results indicate that the AZ91D offers better corrosion performance than the AZ91E alloy and the stannate conversion coating improves the corrosion performance of both alloys.

Infectious Disease, Part I

77. *Drug Targeting of Bacterial Communication and Nutrient Salvage Pathways*, **Ken Cornell** (Boise State University, Boise, ID, 208-426-5429, kencornell@boisestate.edu), **C. Isom** (Boise State University, Boise, ID, 208-371-8857, chelseaisom@gmail.com), **J. Bonander** (Boise State University, Boise, ID, 208-559-6122, jeremybonander@mail.boisestate.edu), **M. Martinez** (Boise State University, Boise, ID, 208-899-6838, MariaMartinez5@boisestate.edu), **J. Jones** (Boise State University, Boise, ID, 208-860-3826, jones_111282@yahoo.com) and **C. Dayan** (Boise State University, Boise, ID, 208-869-5627, cassiedayan@msn.com).

The continued rise of antibiotic resistant pathogens necessitates the development of new drugs targeting microbe specific processes. We have studied two unique enzymes in the methionine salvage pathway: 5' methylthioadenosine / S-adenosylhomocysteine nucleosidase (MTN) and 5 methylthioribose kinase (MTRK) as targets for antibiotic design. The contribution of this pathway to methionine and purine salvage, and its involvement in the production of bacterial quorum sensing signals, suggest that drug interventions could work by a number of mechanisms including nutrient starvation and interference with autoinducer dependent events such as biofilm formation. The genes for MTN and MTRK have been cloned and overexpressed from a variety of pathogens, including *Escherichia coli*, *Klebsiella pneu-*

moniae, *Salmonella typhimurium*, and *Borrelia burgdorferi*. Current studies are examining a number of compounds to characterize their inhibitory activity against the recombinant enzymes. Preliminary indications are that interruption of the pathway leads to significant effects on microbial growth and autoinducer type II dependent events.

78. *The Contribution of Quorum Sensing to* Pseudomonas aeruginosa *Swarming and Biofilm Formation is Nutritionally Conditional*, **Joshua D. Shrout**[1], **David Chopp**[2], **Morten Hentzer**[3], **Michael Givskov**[3] and **Matthew Parsek**[4] [1](University of Washington, Seattle, WA, 2065433147, jdshrout@u.washington.edu) [2](Northwestern University, Evanston, IL); [3](Technical University of Denmark, Copenhagen, Denmark); [4](University of Washington, Seattle, WA).

The importance of cell-cell signaling to formation of bacterial biofilms is unclear. There are separate reports showing that *Pseudomonas aeruginosa* cell signaling (i.e., quorum sensing) has either no impact upon biofilm formation or significant phenotypic differences by quorum sensing mutants compared to wild-type. In this study, the influence of quorum sensing on *P. aeruginosa* biofilm formation was found to be dependent upon the nutritional environment. Quorum sensing mutant strains showed a pronounced defect in early steps of biofilm formation when grown with succinate as the carbon source, while growth on either glutamate or glucose yielded biofilms having the same structure as wild-type. Time-lapse microscopy and mathematical simulations both suggested that the biofilm defect exhibited by succinate-grown quorum sensing mutant strains was related to surface motility. Surface motility patterns observed early in biofilm formation were then linked to swarming motility. Quorum sensing mutant strains were defective for swarming on succinate, yet they swarmed the same as wild-type when glutamate or glucose was the carbon source. A surface sensing component to swarm motility was also observed as quorum sensing-controlled production of rhamnolipid varied with small changes to the agar concentration used for swarm plate assays. These data led to a model proposing that the juncture at which *P. aeruginosa* initiates flat or structured biofilms depends, in part, upon whether environmental conditions promote swarming motility. These data suggest that the nutritional environment can supersede swarming motility's requirement for quorum sensing and this can manifest itself at early stages of biofilm development.

79. *Antimicrobial Effects and Mechanisms of Toxicity of Metal Oxide Nanoparticles*, **Kevin Feris**[1], **Jason Bell**[2], **Madhu Kongara**[3], **Isaac Coombs**[3], **Hua Wang**[4], **Cory Hanley**[3], **Alex Punnoose**[4] and **Denise Wingett**[5] [1](Boise State University, Boise, ID, 208-426-5498, kevinferis@boisestate.edu); [2](Boise State University, Boise, ID, 208-426-5498, JasonBell1@mail.boisestate.edu); [3](Boise State University, Boise, ID); [4](Boise State University); [5](Boise State University, Boise, ID, 2084262921, denisewingett@boisestate.edu).

Recent indications of nanoscale (<100 nm) metal oxide toxicity and their increased presence in the environment suggests that an understanding of that toxicity is urgently needed. We have conducted a suite of experiments exploring the levels and mechanisms of toxicity of a suite of metal oxide nanoparticles (ZnO, SnO2, and TiO2) on three model microorganisms: *Escherichia coli*, *Staphylococcus aureus*, and four strains of *Pseudomonas aeruginosa* (A+B+, A+B-, A-B+, and A-B-). Our data indicate each species has a unique level of resistance to metal oxide nanoparticles and that this resistance is due, in part, to electrostatic interactions at the cell surface, such that the presence of charged and uncharged o-oligosaacharides present in the lipopolysaccharide outer membrane (LPS) of gram negative cells influences NP toxicity to these organisms. Current studies are exploring the role of reactive oxygen species (ROS) and subsequent oxidative damage to cellular structures as a possible mechanism of toxicity for these particles. These studies provide evidence that these novel nanomaterials have the potential to be developed into valuable antimicrobials. Future studies by our group include targeted cell killing and induction of biofilm dispersion by active nanostructures.

80. *Antimicrobial Nanoparticle Surface Functionalization to Prevent Biofilm Formation on Medical Devices*, **Balchandra Karandikar** (AcryMed, Inc., Beaverton, OR, 503-639-0846, bkarandikar@acrymed.com) and **Bruce Gibbins** (AcryMed, Inc., Beaverton, OR).

Background and Objective: Surgical site infections (SSI) impart a heavy financial burden, costing U.S. hospitals in excess of $1.5 billion in additional medical treatment. The surfaces of medical devices do not normally have any inherent resistance to microbial colonization. The use of a novel process that causes the formation of nanoparticles of silver on the surface of medical devices has long been needed to prevent indwelling devices from being a source of recurrent infections. Technology and Method of Application: A wet immersion process is used where medical devices are submerged in an aqueous mixture of ionic silver and stabilizers. Catalyst addition initiates the formation of nanoparticles of silver that grow and bind tightly to the surface. Results. The catheter portion of the device was treated to a range of 6-10 µg Ag/cm2 in the form of mono-dispersed 10 nm diameter nanoparticles. Microbial challenge testing showed the catheters possessed equivalent antimicrobial activity on both the external and luminal surfaces. Treated catheters showed 3 log reduction of bacterial counts after 10 days of saline elution. Testing against 6 strains each of 6 types of clinical isolates showed that the treated surfaces prevented biofilm formation. A biodistribution study in mice showed the majority of silver stayed either on the catheter or local skin site and that none accumulated in tissues. Conclusion. Nanoparticles serve as an ideal reservoir for sustained release of sufficient silver to prevent biofilm formation. This technology platform has been successfully cleared to market and is being commercialized.

81. *Group A Streptococcal Myonecrosis: Increased Vimentin Expression following Skeletal Muscle Injury Mediates the "Flesh-eating Disease"*, **Amy E. Bryant** (Veterans Affairs Medical Center, Boise, ID, 208-422-1599, amy.bryant@mindspring.com); **Stephanie M. Hamilton** (Veterans Affairs Medical Center, Boise, ID, 208-422-1599, juststeph_1@yahoo.com); **Clifford R. Bayer** (Veterans Affairs Medical Center, Boise, ID, 208-422-1599, cliff.bayer@va.gov) and **Dennis L. Stevens** (Veterans Affairs Medical Center, Boise, ID, 208-422-1599, dlsteven@mindspring.com).

Invasive group A streptococcal (GAS) necrotizing fasciitis and myonecrosis are rapidly progressing, life-threatening infections that have re-emerged worldwide. Mortality remains 30-70% despite appropriate antibiotics and intensive care measures. Major surgery is required in over 50% of cases and frequently includes amputation of multiple limbs.

Half of all GAS myonecrosis cases have no known portal of entry, yet, for unknown reasons, infection becomes established precisely at the site of a prior, non-penetrating minor traumatic injury such as a bruise or muscle strain. Without an obvious portal of entry to provide clinical clues, physicians often miss the diagnosis completely, raising the mortality in this "no portal" myonecrosis group to 85%.

We hypothesized that GAS establishes infection at the site of

muscle trauma by binding surface molecules that are upregulated on injured skeletal muscle cells. Indeed, we have isolated and identified vimentin as the major skeletal muscle GAS-binding protein. Further, vimentin expression was upregulated on injured skeletal muscle cells in vitro and was expressed in muscle specimens from a human case of GAS myonecrosis. In a mouse model of eccentric contraction-induced muscle injury plus GAS bacteremia, vimentin upregulation was associated with increased numbers of GAS in the injured muscle.

These findings provide a molecular mechanism to explain the development of severe GAS soft tissue infections at the site of prior minor muscle trauma. This understanding may provide a rationale for novel preventative or therapeutic strategies for patients with this devastating infection.

82. *The Leukemoid Reaction in* Clostridium sordellii *Infection: Neuraminidase Induction of Promyelocytic Cell Proliferation*, **Michael J. Aldape** (Veterans Affairs Medical Center, Boise, ID 208-422-1599, maldape32@hotmail.com), **Amy E. Bryant** (Veterans Affairs Medical Center, Boise, ID, 208-422-1599, amy.bryant@mindspring.com) and **Dennis L. Stevens** (Veterans Affairs Medical Center, Boise, ID, 208-422-1599, dlsteven@mindspring.com).

Life-threatening *Clostridium sordellii* infections have recently been reported in women undergoing therapeutic abortion (RU 486), in natural childbirth and in injection drug users. Mortality remains high largely because the onset of refractory shock and organ failure is often so rapid that death precedes diagnosis. A leukocytosis, termed the leukemoid reaction (LR), is pathognomonic for *C. sordellii* infection and refers to extremely high circulating white blood cell counts (> 70-100,000 cells/ µL whole blood) found in patients with this infection. The mechanisms driving the LR are entirely unknown. We hypothesized that *C. sordellii* produces a factor that either 1) directly stimulates granulocytic progenitors to proliferate, 2) stimulates increased release of granulocytes and precursors from the bone marrow, or 3) both. To investigate the first of these possibilities, *C. sordellii* (ATCC #9714) culture supernatant was concentrated and fractionated by isoelectric focusing and size exclusion chromatography. Collected fractions were used to stimulate promyelocytic HL-60 proliferation as measured by flow cytometry. Granulocyte/macrophage colony stimulating factor (GM-CSF) was used as a positive proliferation control. Results demonstrated that one fraction (pI 5.0, molecular weight 40 kDa) reproducibly stimulated significant increases in HL-60 cell numbers comparable to the GM-CSF control. Tandem electrospray ionization mass spectroscopy (ESI-MS) identified this protein as neuraminidase (NanS). Additionally, co-stimulation of HL-60 cells with both NanS and GM-CSF resulted in amplified proliferation that dramatically increased HL-60 cell numbers by 40% over that of either agonist alone. We conclude that NanS contributes to the characteristic LR in *C. sordellii* infection. Understanding the underlying mechanisms of this unique clinical feature may provide better diagnostic tools and novel therapeutic strategies to limit the morbidity and mortality associated with this devastating infection.

83. *Bioactivity of Herbal Medicines*, **Jayita Goswami** (Boise State University, Boise, ID, 208-426-2522, joiet567@yahoo.com).

The use of traditional Chinese and Indian herbal medicines has become increasingly popular in many medical contexts, particularly among patients with cancer and refractive infectious diseases. Intensive research is also ongoing to study the application of traditional medicines in treatment of cancer cells and as antibiotics. Several recent papers report that the effects of treatment with traditional medicines span a wide spectrum of clinical modalities: reduction of therapeutic toxicity, improvement of cancer-related symptoms, improvements in the immune system and even direct anti-cancer effects by inducing apoptosis or differentiation. It has also been reported that certain herbal medicines inhibit angiogenesis and reverse multi-drug resistance of cancer cells. The treatment with traditional herbal medicines are based on ancient medical tenets founded on centuries of experience, and documented through oral and written texts, proper clinical trials and dosage studies have not been completed. 60% of all chemotherapeutic agents used in the treatment of breast cancer are derived from natural substances. We have shown that a number of spice extracts are effective antimicrobial agents, and have begun to study their effects against cancer cells as well. For our present research, the effects of Turmeric, Eucalyptus oil, Thuja and select extracts of Indian and Chinese herbs are being examined against cultured breast cancer cells and a panel of bacterial species. Our studies complement recent papers that show plant extracts of Scutellaria barbatae, Scutellaria baicalensis, Mylabris phalerlata, and curcumin show antitumor effects against a broad range of cancer types.

Conclusion: This talk discusses recent studies using traditional medicines to combat infectious agents and cancer cells, and presents the results of our work on the effects of several Asian herbal extracts.

84. *Virus Removal from Blood using Hollow Fiber Cartridges*, **Frank Jacobitz**[1], **Jeevan Menon**[2], **Paul Duffin**[2] and **Richard Tullis**[2], [1](University of San Diego, San Diego, CA, 619-260-7820, jacobitz@sandiego.edu); [2](Aethlon Medical, Inc., San Diego, CA, 858-459-7800).

Aethlon Medical is developing a hollow-fiber hemodialysis device designed to remove viruses and toxins from blood. Possible target viruses include HIV and pox-viruses. The filter could reduce virus and viral toxin concentration in the patient's blood, delaying illness so the patient's immune system can fight off the virus. In order to optimize the design of such a filter, the fluid mechanics of the device is both modeled analytically and investigated experimentally. Polysulfone hollow-fiber dialysis cartridges were used. The cartridges are charged with water as a model fluid for blood and fluorescent latex beads are used in the experiments as a model for viruses. In the experiments, properties of the flow through the cartridge are determined through pressure and volume flow rate measurements of water. The removal of latex beads, which are captured in the porous walls of the fibers, was measured spectrophotometrically. Experimentally derived coefficients derived from these experiments are used in the analytical model of the flow and removal predictions from the model are compared to those obtained from the experiments.

85. *Structural Studies of Phenylpropanoid and Monoterpene Biosynthesis Pathway Enzymes*, **ChulHee Kang**[1], **B. Youn**[2], **D.C. Hyatt**[2], **N.G. Lewis**[2] and **R.B. Croteau**[2], [1](Washington State University, Pullman, WA, 509-335-1409, chkang@wsu.edu); [2](Washington State University, Pullman, WA).

Plant secondary metabolites, such as phenylpropanoids and terpenoids mediate diverse processes ranging from pathogen defense to pollinator attraction, with useful applications as anti-cancer drugs, pesticides, flavorings, and anti-fungal drugs. For these reasons, there is considerable interest in making these compounds more generally available by defining and exploiting their biosynthetic pathways. These approaches are seriously hampered by a lack of detailed information on the enzymes involved, thus there has been limited success

in obtaining those compounds in significant amount. Our goal is to understand the principles governing the biosynthesis of these useful plant secondary metabolites. For the phenylpropanoid biosynthetic pathway, we investigated the mechanistic (regiospecificity and enantiospecificity) basis of the pathway enzymes, such as pinoresinol-lariciresinol reductase, secoisolariciresinol dehydrogenase and double bond reductase as well as of various monolignol pathway enzymes (e.g., cinnamyl alcohol dehydrogenase, arylpropenal double bond reductase, cinnamoyl CoA reductase, etc.). Additionally, by solving the crystal structure of (4S)-limonene synthase from Mentha spicata, a divalent metal ion-dependent monoterpene cyclase that catalyzes the coupled isomerization and cyclization of geranyl diphosphate, we described the initial stage of monoterpene biosynthesis pathway in atomic level (e.g., changes in diphosphate - metal ion coordination and the substrate binding conformation in the course of the multistep reaction). The information gained from these studies will be very useful for exploring the regulation of lignan, isoflavonoid and tepenoid biosynthesis for ecological plant protection, and for the industrial-scale synthesis of these pharmacologically active substances.

86. *Towards the Synthesis of Novel Borinic Acids as Potential HIV-1 Protease Inhibitors*, **Levente Fabry-Asztalos** (Central Washington University, Ellensburg, WA, 509-963-2887, fabryl@cwu.edu).

Drug discovery for HIV/AIDS has resulted in many life-saving therapies, making a great impact on modern medicine. Even though new therapies are available many drugs are highly susceptible to resistance development, have poor bioavailability, and cause several side effects. Therefore, there is an urgent need for the development of new types of inhibitory compounds, with better resistance profiles, better bioavailability, higher affinity, and lower toxicity. We are synthesizing novel borinic acids that were designed as compounds with potential dual-mode, both competitive and associative, of HIV-1 protease inhibitory action. Recent studies showed that boron-modified inhibitors have a higher affinity for the protease than their corresponding non-boronated analogs. Furthermore, the boron-modified structures were inhibitory to an HIV-1 protease variant that is resistant to several HIV-1 protease inhibitors. A library of both straight chain and cyclic borinic acids are being synthesized. The cyclic borinic acids are 1,3-azaborines, which due to their structural rigidity are expected to be better inhibitors than the straight chain compounds.

87. *Antimalarial Agents Designed to Overcome Chloroquine Resistance*, **David H. Peyton** (Portland State University, Portland, OR, 503-725-3875, peytond@pdx.edu), **Steven J. Burgess** (Portland State University, Portland, OR, 503-275-3874, sburgess@pdx.edu), **Cheryl Hodson** (Portland State University, Portland, OR, 503-275-3874, cherylh@pdx.edu), **Katherine Liebman** (Portland State University, Portland, OR, 503-275-3874, kliebman@pdx.edu), **Bornface Gunsaru** (Portland State University, Portland, OR, 503-275-3874, bgunsaru@yahoo.com) and **Jane Xu Kelly** (Portland State University, Portland, OR, 503-220-8262 x 54131, kellyja@ohsu.edu).

Malaria is a devastating parasitic disease that infects 300 - 500 million people, mainly in sub-Saharan Africa. WHO estimates about 2 million deaths result from malaria each year, with 2 of 3 being infants, children, or expectant mothers. The most severe form of the disease is caused by *Plasmodium falciparum*, but several other species of the parasite are found. The economic impact of the disease is enormous. Classical drugs such as chloroquine (CQ), which was the main line of defense against malaria for many years, are having their usefulness reduced dramatically by the emergence of drug-resistant strains of the parasites.

It has been known for some time that certain drugs, called "reversal agents" (RAs) can reverse the drug resistance to chloroquine. These are unrelated to chloroquine, and often have little intrinsic antimalarial activity of their own. In order to reverse drug resistance of malaria to CQ, reversal agents may require large doses, with associated side effects and costs.

We discovered that by covalently bonding an RA to CQ, drug resistance could be overcome at a surprisingly low dose. In fact, the dose for the new class of compounds to control drug-resistant malaria is lower than the dose of CQ normally required for drug-sensitive malaria. One example of the new class of drugs has been tested in animals and provided a total cure with no observable side effects.

Biomedical/Bio-Related Materials, Part II

88. *Polymer-Bioceramic Composites Enhance Bone Healing*, **Kent Leach** (University of California, Davis, Davis, CA, 530-754-9149, jkleach@ucdavis.edu).

Bioceramics have been successfully employed as biomaterials to fill or even promote the repair of bone defects as these materials are highly osteoconductive and potentially osteogenic. Our recent efforts have focused on the role of two bioceramics, specifically hydroxyapatite and bioactive glass, and their potential impact on various aspects of bone repair. We have developed a novel technique for preparing three-dimensional porous synthetic scaffolds which present an osteoconductive surface through deposition of a biomineral coating. Compared to earlier methods, our approach generates substrates which are superior in the efficiency of macromolecule incorporation while still achieving localized and sustained delivery of growth factors. Furthermore, these scaffolds demonstrate comparable osteogenic potential to existing techniques when characterizing the *in vitro* osteodifferentiation of human progenitor cells. We have also investigated the potential of low concentrations of bioactive glass to induce bone healing by stimulating local angiogenesis. A concentration of bioactive glass determined to elicit the greatest angiogenic response *in vitro* was placed on a collagen sponge and implanted into a previously irradiated rodent critical-sized bone defect. Compared to the contralateral collagen control, we observed increases in neovascularization within the bone defect at 2 weeks using immunohistochemistry for von Willebrand factor, as well as significant increases in bone volume fraction at 12 weeks using microCT. The results of these studies suggest that hybrid biomaterials formed of bioceramics and synthetic or natural polymers are an attractive strategy to promote bone repair and offer a relatively simple and inexpensive method to positively impact the healing process.

89. *Nanospring-based Electronic Biosensors for DNA Detection*, **Josh R. Branen** (University of Idaho, Post Falls, ID, 208-262-2011, jbranen@uidaho.edu), **Jamie M. Jabal** (University of Idaho, Moscow, ID, 208-885-6953, jamie@uidaho.edu), **Giancarlo Corti** (University of Idaho, Moscow, ID, 208-885-6809, cort4258@uidaho.edu), **D. Eric Aston** (University of Idaho, Moscow, ID, 208-885-6953, aston@uidaho.edu), **A. Larry Branen** (University of Idaho, Post Falls, ID, 208-262-2010, lbranen@uidaho.edu), **James J. Nagler** (University of Idaho, Moscow, ID, 208-885-4382, jamesn@uidaho.edu), **M. Grant Norton** (Washington State University, Pullman, WA, 509-335-4207, norton@mme.wsu.edu) and **David N. McIlroy** (University of Idaho, Moscow, ID, 208-885-6809,

dmcilroy@uidaho.edu).

Specific and quantitative detection biomolecules is essential to timely diagnoses and accurate treatment decisions. Electronic biosensors show great promise for allowing biological detection platforms to be used in a point-of-care setting. The next generation of electronic biosensors will take advantage of the unique properties of nanomaterials to enhance these devices. A major hurdle in the development of nano-based electronic biosensors is integrating nanomaterials with standard electrical components in a process that is scalable and economic. We have developed a process for growing silica nanosprings in predetermined patterns using standard lithography. These nanospring mats are integrated into a microelectronic circuit as the detection component in the biosensor. Important characteristics of nanosprings include an extremely large surface area per volume that can be easily functionalized for biological detection and reporting. We have designed two nanobiosensors for the sequence-specific detection of DNA. The first consists of a nanospring mat spanning two gold electrodes. The mat surface is functionalized with probe DNA molecules. Hybridization between target DNA and probe surface will cause a change in the conductance of the mat that will be measured using DC and AC (electrochemical impedance spectroscopy) techniques. Initial investigations will be presented exploring the device characteristics dry, in solution and following probe immobilization. A second biosensor device consists of a three gold electrode design. Two electrodes are used to set and maintain the voltage of the solution while the third electrode is covered with a mat of nanosprings. Device design and detection approaches will be discussed.

90. *Utilizing the Unique Mechanical Properties of Bamboo Fiber for the Reinforcing and Toughening of Poly(3-hydrobutyrate-co-3-hydroxyvalerate),* **Jinwen Zhang** (Washington State University, Pullman, WA, 509-335-8723, jwzhang@wsu.edu), **Long Jiang** (Washington State University, Pullman, WA, 509-335-6362, jianglong@wsu.edu) and **Michael P. Wolcott** (Washington State University, Pullman, WA, 509-335-6392, wolcott@wsu.edu).

There is a growing interest in melt-compounding of short natural fiber biocomposites because it allows the manufacturing of extruded and injection-molded products. However, most studies in the literature showed only an increase in modulus but decreases in tensile strength and toughness of thus prepared biocomposites. In this study, composites of bamboo pulp fiber (BPF) and Poly(3-hydroxybutyrate-co-3-hydroxyvalerate) containing 8 mol% 3-hydroxyvalerate (PHBV8) were melt compounded and injection-molded into standard tensile and flexural test specimens. Adding BPF in PHBV resulted in significant improvements of tensile, flexural properties and impact strength. With 10 wt% BPF, notched impact strength was tripled, and flexural modulus and tensile strength were 2.5GPa and 30 MPa, respectively. The impact strength continuously increased with fiber content ranging from 0 to 40 wt%. Adding coupling agent or compatibilizer increased tensile strength and modulus, but reduced the impact strength. Effects of nucleating agents and crystallization of the PHBV on properties of the composites were also studied. Single fiber tensile tests indicate that the Young's modulus of BPF is ca. 7.3 GPa. The large increases in tensile and impact toughness were attributed to the more surfaces created owing to the pullout of the fillers. In contrast to many other forms of natural fibers, BPF exhibits large elongation (~ 21.6%) with a relatively low yield stress and strain (~ 117 MPa and 1.9%, respectively). The apparently unique ability of BF to toughen PHB may also result in the fact that the yield strain of BF and neat PHBV are nearly coincident.

91. *A Nanometer Scale Perspective on Cartilage Genesis*, **William B. Knowlton**[1], **Kaci Bloxham**[2], **Jen Cole**[2], **Zach Heuman**[2], **Lisa Warner**[2], **Sorcha Yingst**[2], **Linda Kenoyer**[2] and **Julia Thom Oxford**[3], [1](Boise State University, Boise, ID, 208-426-5705, bknowlton@boisestate.edu); [2](Boise State University, Boise, ID); [3](Boise State University, Boise, ID, joxford@boisestate.edu).

Atomic force microscopy (AFM) is used to investigate the ultrastructure of the extracellular matrix (ECM) of cartilage. Specifically, collagen, both synthesized and chondrocyte-produced are examined. The study reveals that AFM is a unique technique that has advantages for characterizing the ECM. This presentation will cover some of the various techniques and specific investigations and findings of this study.

92. *Cell Targeting with Ferrimagnetic Protein Cage Architectures*, **Trevor Douglas** (Montana State University, Bozeman, MT, 506-994-6566, tdouglas@chemistry.montana.edu), **Masaki Uchida** (Montana State University, Bozeman, MT, 406-994-6855, muchida@chemistry.montana.edu) and **Mark Young** (Montana State University, Bozeman, MT, 406-994-5158, myoung@montana.edu).

Protein cages such as virus capsids and ferritins are versatile nanoscale architectures for material syntheses. Conceptually they have three interfaces that can be utilized for synthetic purposes: the interior of a cage, the exterior of a cage and the interface between subunits. By exploiting these interfaces, these protein architectures can serve as multifunctional nanocontainers for spatially directed materials synthesis. For example they can be utilized as nanoscale reaction vessels in order to synthesize and accumulate inorganic nanoparticles within the cages. They can also serve as a platform for chemical or genetic modification in order to impart new functionality by design. This includes size constrained incorporation of catalytic, magnetic, and therapeutic agents. Incorporation of multiple functionalities within these nanometer sized protein architectures demonstrate their potential to serve as functional nanomaterials with applications in medical imaging and therapy. We have used protein cage architectures to synthesize Fe_3O_4 nanoparticles, for use in biomedical applications such as hyperthermia cancer therapy and magnetic resonance imaging (MRI). A targeting peptide, RGD-4C, which binds $\alpha v\beta 3$ integrins on tumor vasculature, was genetically incorporated on the exterior surface of the cages for cell-specific targeting. These materials have been evaluated both in vitro and in vivo for their potential as clinically relevant diagnostic agents.

93. *Intercalator-Functionalized Nucleic Acids as Emerging Tools for Targeting of Double Stranded DNA*, **T. Santhosh Kumar** (University of Southern Denmark, Odense M, Denmark, 65502532, skt@chem.sdu.dk), **Nicolai K. Andersen** (University of Southern Denmark, Odense M, Denmark, 65502551, nka@chem.sdu.dk), **Andreas S. Madsen** (University of Southern Denmark, Odense M, Denmark, 65502599, asm@chem.sdu.dk), **Jesper Wengel** (University of Southern Denmark, Odense M, Denmark, 65502510, jwe@ifk.sdu.dk) and **Patrick J. Hrdlicka** (University of Idaho, Moscow, ID, 208-885-0108, hrdlicka@uidaho.edu).

Development of general methodologies for targeting of double stranded DNA (dsDNA) is a central research area within biological chemistry, fuelled by the promise of tool development for gene regulation, e.g., silencing of disease-related genes. A novel strategy for dsDNA targeting, which relies on intercalator-functionalized Locked Nucleic Acid (LNA) monomers, will be presented. We have devised

synthetic routes toward N2'-functionalized derivatives of 2'-amino-alfa-L-LNA thymine and adenine building blocks. The stability of DNA:DNA and DNA:RNA duplexes is increased dramatically upon a single incorporation of pyrene-functionalized 2'-amino-alfa-L-LNA monomers into DNA strands compared to unmodified duplexes, i.e., thermal denaturation temperatures (Tm-values) of the duplexes are increased by up to +19.5 °C. In marked contrast, incorporation of N2'-ethyl or N2'-acetyl substituted 2'-amino-alfa-L-LNA monomers into DNA strands results in extremely decreased thermal affinities towards DNA/RNA complements. These observations along with other biophysical studies (UV, fluorescence, CD) strongly suggest that the 2-oxo-5-azabicyclo[2.2.1]heptane skeleton of 2'-amino-alfa-L-LNA precisely positions N2'-appended intercalators in nucleic acid duplex cores. DNA duplex probes with certain interstrand arrangements of pyrene-functionalized monomers form labile duplexes, most likely as a consequence of intercalator-induced unwinding of the probe duplex. In the presence of a corresponding target, the probe duplex dissociates and affords fast and sequence-specific recognition of dsDNA at physiologically relevant salt concentrations. This process is followed by the inherent strong pyrene-pyrene excimer fluorescence of the duplex probes.

94. *Probing an Enzymatic Transition State Using Atomic Force Microscopy*, **Byung I. Kim**[1], **Jenniffer Rice**[2], **Joseph Holmes**[2] and **Ken Cornell**[3], [1](Boise State University, Boise, ID, 208-426-3659, byungkim@boisestate.edu); [2](Boise State University, Boise, ID); [3](Boise State University, Boise, ID, 208-426-5429, kencornell@boisestate.edu).

Enzymatic catalysis is known to increase the biochemical reaction up to 10^{10} and 10^{15} times by lowering the activation energy barrier through the binding and stabilization at a transition state. The enzymatic transition state has been studied with atomic force microscopy between an enzyme, 5'-methyl thioadenosine/ S-adenosylhomocysteine nucleosidase (MTAN), and a transition-state analogue, homocystinyl immucillin A (HIA) to understand the intermolecular interactions at the transition state responsible for enzymatic catalytic reactions. The enzyme MTAN is a robust and prototype enzyme, and an ideal target for antibiotic development since it has no corresponding human equivalent but almost universally present among bacterial species that are harmful to human health. The transition state analogue is known to mimic the transition state in the enzymatic reaction without being converted into products. The intermolecular forces have been measured as a function of the separation distance between two biomolcules in the phosphate buffer solution using atomic force microscopy (AFM). Both the enzyme and the inhibitor were immobilized to the AFM tip and the solid support, respectively, to manipulate the intermolecular distance by AFM. The intermolecular interaction has been extracted as a function of distance from the AFM force-distance data by using a simple mechanical model that describes the interaction of the enzyme-inhibitor complex in the AFM system. This approach may provide a new opportunity to study the intermolecular interaction in an enzyme-inhibitor complex, which may lead to a better understanding of the transition states in the enzymatic catalysis.

What Makes a Green City – The Boise Experiment

95. *The Evolution of Green Planning – Philosophy, Trends, and Connections*, **Morty Prisament** (Tetra Tech, Boise, ID, 208-343-4085, morty.prisament@ttemi.com).

No Text Available.

96. *Boise's Climate Protection Program*, **Beth Baird** (City of Boise, Boise, ID, 208-384 3984, bbaird@cityofboise.org).

No Text Available.

97. *Boise Cool Cities Campaign*, **Jessica Ruehrwein** (Sierra Club, Boise, ID, 208-384-1023, jessica.ruehrwein@sierraclub.org).

No Text Available.

98. *Project-Based Education*, **Kevin Van Den Wymelenberg** (University of Idaho, Boise, ID, 208-724-9456, kevinv@uidaho.edu).

The Integrated Design Lab in Boise (IDL?Boise) is funded by the Northwest Energy Efficiency Alliance and Idaho Power to deliver energy related services to design professionals in Idaho and eastern Oregon. Project based education for design market transformation describes an effort to engage with design teams early in the planning process to encourage whole building design through an integrated process. Design teams that utilize the resources available through the IDL?Boise will design buildings that are more comfortable for people, require less energy to maintain and operate, and enhance the health and productivity of their inhabitants. The IDL?Boise offers no cost and cost share services in micro-climate analysis, daylighting and lighting analysis, early energy modeling, and airflow modeling. Additionally, the IDL?Boise coordinates with partners to offer training and education opportunities, design charrettes and works with design teams to overcome financial obstacles through life cycle analysis and utility incentive programs.

This presentation will profile a few projects the IDL?Boise has engaged in with design teams in Idaho. These case studies will range in depth of focus, building type, location and environmental result. Case studies will include Endeavor Elementary School in Nampa, St. Luke's Hospital in Twin Falls, and the Center for Advance Energy Studies in Idaho Falls.

99. *The Carbon Connection, Our Carbon Footprint – How to Rate a Green City?* **Victoria A. Evans** (University of California Davis, Davis, CA, 530-754-4480, vaevans@ucdavis.edu).

No Text Available.

One Hundred Fifty Years of Human Activity In Sagebrush Steppe: Ecological and Genetic Consequences

100. *Ecological Genetics of* Bromus tectorum *(Cheatgrass, Downy Brome) in Western North America*, **Cecilia Lynn Kinter** (Idaho Conservation Data Center, Boise, ID, 208-850-1736, lkinter@idfg.idaho.gov).

The Eurasian annual grass *Bromus tectorum* was introduced to the sagebrush steppe of western North America over 100 years ago. While historic records provide a few insights into the introduction and early dispersal of this pernicious weed, genetic analyses are currently providing much additional information. More than 10 genotypes now thrive in the North American range, and some of their potential source populations in western and central Europe have been identified from across the native range. Greenhouse comparisons show that genotypes now widespread in western North America have higher water use efficiency, photosynthetic capacity, and fitness when compared to

genotypes from most native range populations, and populations that are not invasive in New Zealand. This higher performance appears to be due to establishment of certain native genotypes that are well-suited to the arid steppe, rather than to the evolution of novel genotypes following introduction to North America. Collectively, these studies indicate that future introduction of additional genotypes of *Bromus tectorum* from the native range could threaten areas not currently invaded by the grass.

101. *Germination and Seed Water Status of Native and Exotic Grasses on Biological Soil Crusts*, **Shawna Zimmerman** (Boise State University, Boise, ID, 208-426-3687, shawnazimmerman@mail.boisestate.edu), **Roger Rosentreter** (Bureau of Land Management, Boise, ID, Roger_Rosentreter@blm.gov) and **Marcelo Serpe** (Boise State University, Boise, ID, mserpe@boisestate.edu).

Biological soil crusts are commonly found throughout arid and semiarid steppe communities of the Great Basin of North America. We have investigated the effects of moss-dominated and lichen-dominated biological soil crusts on the germination of various native and exotic grasses. A biological soil crust dominated by short mosses (*Bryum* spp.) significantly decreased the germination of the native grass *Elymus wawawaiensis* and of the exotic grasses *Festuca ovina* and *Bromus tectorum*. Similarly, final germination in a crust dominated by the lichen *Diploschistes muscorum* was a third of that on soil. In contrast to these results, the presence of tall mosses (*Syntrichia* spp.) or a mixed crust comprised of various lichens and mosses did not inhibit germination of the grasses tested. Short mosses and *D. muscorum* reduced germination through an effect on seed water status. The water potential of seeds on the short mosses or *D. muscorum* was 2 to 4 MPa lower than that of seeds on soil. In addition, the seeds that germinated on *D. muscorum* did not penetrate this lichen and their root tips became necrotic. Our results indicate that some biological soil crusts have a negative effect on seed water status and germination. Through these effects, biological soil crusts may reduce the spread of invasive species and contribute to the development of patchy vegetation patterns in arid lands.

102. *Differentiating Impacted and Least Impacted Springbrooks in Southern Idaho*, **Johnna Sandow** (Boise State University, Boise, ID, 208-373-0163, Johnna.Sandow@deq.idaho.gov) and **Peter Koetsier** (Boise State University, Boise, ID, 208-426-3817, pkoet@boisestate.edu).

Due to their small size and patchy distribution, structure and function of desert springbrooks are not well-understood. As a result, springbrook conservation usually is not a management priority. Although these systems provide important habitat for a variety of plants and animals in the arid environment, many are heavily affected by anthropogenic activity. In this study our objective was to determine if there are physical, chemical, and biological differences between impacted (i.e., grazed) and least impacted springbrooks. We collected samples from 5 "pristine" and 5 impaired springbrook habitats in the Great Basin of southwest Idaho. We gathered qualitative and quantitative habitat information and collected periphyton, benthic macroinvertebrate samples as well as water samples for assessing microbial community resources utilization patterns. We found some significant differences in the biological communities between springbrooks that had been utilized by cattle (impaired) and those that were enclosed ("pristine"). Results from a two sample t-test indicate no significant difference in periphyton biomass between impaired and pristine conditions. Significant differences were found for various measures of the macroinvertebrate community including taxa richness, Hilsenhoff biotic index, and percent Plecoptera. Once methodologies are established to characterize reference springbrooks and quantitatively distinguish impacted from least impacted springbrooks, then land management agencies can begin to take appropriate actions identifying, prioritizing, restoring, and conserving these vial habitats.

103. *Fertile Island Degradation Following Western Juniper Cutting*, **Chris Miwa** (Oregon State University, Corvallis, OR, 978-505-1494, chris.miwa@oregonstate.edu) and **Ron Reuter** (Oregon State University Cascade Campus, Bend, OR, 541-322-3109, ron.reuter@oregonstate.edu).

Western juniper (*Juniperus occidentalis*) cover has more than doubled within the last century and currently occupies over 9 million acres in the Intermountain West. Encroachment has altered the spatial distribution of soil nutrients and plants in these systems, forming nutrient enriched 'fertile islands,' under tree canopies. The purpose of this study was to determine the persistence of fertile island characteristics after restoration treatment (tree removal). The study site was a BLM grazing allotment in Eastern Oregon where trees had been cut 1 ,8 and 15 years ago. In each age class juniper stumps were randomly selected for sampling. At each stump three radial transects, set at 120º from each other, were marked and soil cores were collected to 5-cm depth at distances of 50, 100, 150 and 300-cm from the stump then combined to a single composite sample per distance class. Samples were analyzed for total C and N, soluble P, K, Ca, Fe, Si, Al and Na, inorganic NH4 and NO3 and moisture. Preliminary data show that fertile islands persisted to 15 years post canopy removal for total C and N while accumulations of Ca, P, K and NO3 degraded within 8 years. Soil moisture content did not vary between canopy and interspace zones. In semi-arid and arid systems where N availability is considered to be the most limiting plant nutrient, western juniper fertile islands can be a preferred safe spot for seedling establishment. The persistence of these fertile islands should be taken into account for restoration purposes, such as seeding of forbs and grasses. Further work is needed to determine if these resource islands encourage or inhibit regrowth of native forbs and grasses.

104. *The Influence of Disturbance Events and Rehabilitation on Sagebrush Steppe Ecosystems*, **Stuart W. Murray** (High Desert Ecology, Boise, ID, 208-345-4710, moabcat@cableone.net).

Disturbance events such as grazing and wildfire are common events in sagebrush steppe ecosystems in the intermountain west. Several models have been developed to explain changes in the composition of the vegetation as a result of these disturbances. The state and transition model is the currently accepted model and incorporates non-equilibrium theory to evaluate the conditions of a community based on species composition. However, the descriptions of the states are often qualitative and therefore difficult to use in determining the state of a community based on sampling data. To address this issue, quantitative canopy coverage values for shrubs, perennial forbs, grasses and annuals were estimated for each state in the state and transition model using prior studies from the literature. These values were then compared to sampled vegetation data collected from sagebrush steppe communities that had experienced recent wildfires. The relative canopy coverage and the state of these communities differed by aspect, burn history and rehabilitation efforts. North-facing slopes experiencing moderate intensity fires can recover without rehabilitation. Disturbance caused by re-seeding or replanting activities on north-facing slopes may provide conditions for the invasion by non-native

annuals and can therefore be counterproductive. South-facing slopes have warmer and drier conditions and require rehabilitation efforts to avoid monocultures of invasive annuals following wildfire. Intensive rehabilitation efforts on south-facing slopes appear to facilitate the transition of plant communities to a more pristine state.

105. *Sagebrush, Fire, and Restoration: New Approaches in the Great Basin*, **Robert D. Cox** (USDA Forest Service Rocky Mountain Research Station, Boise, ID, 208-373-4358, robertcox@fs.fed.us) and **Nancy L. Shaw** (USDA Forest Service Rocky Mountain Research Station, Boise, ID).

The relationship between sagebrush, fire, and human activity in the Great Basin has changed drastically since European settlement. Big sagebrush (Artemisia tridentata) has gone from being a target of "weed-control" to a target of restoration efforts. This is partly due to changes in fire patterns; records indicate that the area burned each year in the Great Basin has been increasing. From 1993-2003, the latest 10-year period for which data are available, nearly 7% of the Great Basin burned, including significant areas of current and former sagebrush ecosystems. These large areas highlight both the need and the opportunity for restoring burned or otherwise degraded sagebrush ecosystems. In the past, restoration of sagebrush-dominated plant communities has tended to focus on establishment of a select few shrubs and grasses. Current trends are toward restoration of larger scales at higher-diversity. This approach offers both challenge and promise: seeding and establishing a higher diversity of species will require greater inputs of planning, time, and expertise, but also offers the potential for more realistic and healthy plant communities once restoration is completed. Future success will depend on development of new seeding technologies, selection and increase of new species to seed, and new understanding of post-fire requirements for successful restoration of sagebrush ecosystems.

106. *Insect-mediated Pollination and Spatial Structuring in* Lepidium papilliferum *Populations*, **Ian C. Robertson**[1], **Amy C. Ulappa**[2] and **Stephanie Billinge**[2], [1](Boise State University, Boise, ID, 208-426-2394, iroberts@boisestate.edu); [2](Boise State University, Boise, ID).

Spatial genetic structuring in plant populations is expected to occur when the populations are fragmented and pollen movement and seed dispersal are limited. *Lepidium papilliferum*, a rare mustard endemic to southwest Idaho, fits this description in at least two ways: *L. papilliferum* populations are fragmented at several spatial scales, and the plant's fruit and seed lack obvious structures for long-distance dispersal. Here we examine whether the third condition, limited pollen movement, holds and whether there is evidence of genetic structuring in *L. papilliferum* populations. We show that *L. papilliferum* relies primarily on outcrossed pollination mediated by insects, including several families of Hymenoptera (Apidae, Halictidae, Sphecidae, Vespidae), and Diptera (Bombyliidae, Calliphoridae, Tachinidae). Although these insects may be expected to serve as long distance pollen dispersers, evidence was to the contrary. Insects visiting *L. papilliferum* flowers tended to linger on individual plants or among plants that were in close proximity to one another. More importantly, outcrossing experiments revealed that fruit production in *L. papilliferum* increased as a function of outcrossing distance, indicating that populations are spatially structured. Structuring was evident even at relatively small spatial scales (e.g., < 3 m), suggesting either that genetic relatedness among individuals declines sharply as a function of distance, or that *L. papilliferum*, while intolerant of high levels of inbreeding, is tolerant of low levels of inbreeding. The consequences of habitat fragmentation for gene flow in *L. papilliferum* will be discussed.

107. *Population Genetics of the Rare Polyploid,* Lepidium papilliferum *(Brassicaceae), a Southwest Idaho Endemic*, **Amy J. Stillman** (Boise State University, Boise, ID, 208-559-5026, albicaulis@hotmail.com), **Stephen J. Novak** (Boise State University, Boise, ID, snovak@boisestate.edu), **Ian C. Robertson** (Boise State University, Boise, ID, iroberts@boisestate.edu) and **James F. Smith** (Boise State University, Boise, ID, jfsmith@boisestate.edu).

Rare plant species typically exhibit low levels of genetic diversity within populations and high levels of genetic differentiation among populations. Several mechanisms may counter the genetic consequences of rarity such as polyploidy or an outcrossing mating system. However, for rare species whose size and distribution may already be limited, habitat destruction and fragmentation can alter historic patterns of gene flow and increase the risk of genetic erosion. *Lepidium papilliferum*, slickspot peppergrass, is a rare polyploid, insect-pollinated, herbaceous plant, endemic to sagebrush steppe communities of southwestern Idaho. Plants exhibit a naturally patchy distribution, occurring in specialized microhabitats called slick spots. Habitat destruction and fragmentation has lead to a decline in this species. Enzyme electrophoresis was used to determine the amount and distribution of genetic diversity within and among 25 populations of *L. papilliferum*. Across all populations, 10 of 11 loci (91%) were polymorphic, with an average of 4.27 alleles per locus. On average, the disjunct Jarbidge populations exhibited higher levels of polymorphic loci (P = 80.1%) compared with the Snake River Plain populations (P = 58.1%) and similar number of alleles per locus, A = 2.16 and 2.09, respectively. Measures of genetic diversity were positively correlated with population size for all populations, however this trend was most pronounced in Snake River populations. Genetic differentiation (G_{ST}) among all populations was 0.109. Among populations of each region, G_{ST} was 0.042, indicating that the majority of genetic differentiation among all populations is due to genetic differences between the two regions.

108. *A Phylogenetic Analysis of* Lepidium papilliferum *and* L. davisii *(Brassicaceae) Reveal the Relations of these Rare Endemic Species,* **James F. Smith** (Boise State University, Boise, ID, 208-426-3551, jfsmith@boisestate.edu), **Amy J. Stillman** (Boise State University, Boise, ID, albicaulis@hotmail.com), **Steven R. Larson** (Utah State University, Logan, UT, 425-797-1703, stlarson@cc.usu.edu), **Culumber C. Mae** (Utah State University, Logan, UT), **Ian C. Robertson** (Boise State University, Boise, ID, iroberts@boisestate.edu) and **Stephen J. Novak** (Boise State University, Boise, ID, snovak@boisestate.edu).

Previous phylogenetic analyses of *Lepidium* included only a few accessions of *L. montanum* and *L. fremontii* to represent the western North American species. Two additional species endemic to southwest Idaho have posed both taxonomic and conservation questions regarding their species status. *Lepidium papilliferum* was originally described as a variety of *L. montanum*. The plant is restricted to specific edaphic conditions known as slick spots where high clay content creates conditions amenable to *L. papilliferum*. Like *L. papilliferum*, *L. davisii* has specific edaphic requirements and is found in playas, areas similar to slick spots, but larger and with deeper soils. Previous phylogenetic studies have shown that American species of *Lepidium* are allopolyploids with one genome derived from an African clade and

the other from an Asian/European clade. In this study we expanded previous analyses to include both *L. papilliferum* and *L. davisii* with several accessions of *L. montanum* along with published sequences of ITS, cpDNA and *PISTILLATA* first intron. Our results agree with previous studies in that this group has one genome derived from within an African clade and another from an Asian/European clade. The western North American species form a monophyletic group with *L. davisii* sister to the remainder of the clade. Within this clade *L. papilliferum* and *L fremontii* are each monophyletic and sister to each other, but are imbedded within a paraphyletic *L. montanum*. These data suggest that greater sampling among populations and subspecies of *L. montanum* and other *Lepidium* species will be required.

The Chemistry of Advanced Nuclear Systems: Waste Forms

109. *Microstructure and Deformation Physics of Fission-reactor Materials by Multi-scale Simulation*, **Dieter Wolf** (Idaho National Laboratory, Idaho Falls, ID, 208-526-8394, dieter.wolf@inl.gov).

The main thrust of a recently formed multi-investigator Computational Materials Science Network (CMSN) project on "Multiscale Simulation of Thermo-mechanical Processes in Irradiated Fission-reactor Materials" will be described. The objective of this DOE/BES-funded "collaborative research team" is to combine expertise in simulation of damage cascades and in multi-scale simulation of microstructural evolution in polycrystalline materials to elucidate the thermo-mechanical behavior of model fission-reactor materials under irradiation. An important ingredient of the effort is scale linkage within a hierarchical multi-scale approach. To demonstrate the scale linkage, we will discuss simulations of grain growth in nanocrystalline materials. In particular, we show how the quantified insights extracted from atomic-level simulations can be incorporated into a general, hierarchical multiscale approach for the simulation of polycrystalline materials that overcomes the inherent length- and time-scale limitations of the atomic-level simulations.

110. *Modeling Radiation Effects in Ceramics for Immobilization of Actinides*, **William J. Weber** (Pacific Northwest National Laboratory, Richland, WA, 509-376-3644, bill.weber@pnl.gov) and **Ram Devanathan** (Pacific Northwest National Laboratory, Richland, WA).

Radiation effects from alpha decay in crystalline oxide host phases for the immobilization of actinides generally lead to amorphization, macroscopic swelling and increases in dissolution rates. The results of computer simulations, new models, and experimental studies in several relevant materials using short-lived actinides and ion-beam irradiation methods will be presented to highlight the fundamental understanding and models of alpha-decay effects in materials developed over the past 25 years. Ion-beam irradiation techniques have been demonstrated to be very effective in simulating radiation effects from alpha decay over a large range of experimental conditions in order to develop more detailed scientific understanding and predictive models. The integration of computer simulations into these studies have advanced the interpretation of experimental results and led to the development of a comprehensive atomic-level understanding of radiation damage processes and predictive models of the complex evolution of radiation damage in actinide waste forms with time and temperature.

111. *Radiation Tolerance in Structurally Related Oxides*, **Blas Pedro Uberuaga** (Los Alamos National Laboratory, Los Alamos, NM, 505-667-9105, blas@lanl.gov).

The Department of Energy's Global Nuclear Energy Partnership (GNEP) is working towards the goal of a closed nuclear fuel cycle. An integral part of such a fuel cycle is a waste management strategy, which must be in place shortly after the start of spent fuel reprocessing. A primary obstacle in the development of such a strategy is the lack of a sufficiently robust waste form compound. Ceramics destined for use in hostile environments such as nuclear reactors or waste immobilization must be highly durable and especially resistant to radiation damage effects. In particular, they must not be prone to amorphization or swelling. Few ceramics meet these criteria and much work has been devoted in recent years to identifying radiation-tolerant ceramics and the atomic-scale characteristics that promote radiation tolerance. Here, we examine trends in radiation damage behaviour for families of compounds related by crystal structure. Specifically, we consider oxides with structures related to fluorite. We demonstrate that improved amorphization resistance characteristics are found in compounds that have a natural tendency to accommodate lattice disorder.

112. *Irradiation Effects in Oxide Materials*, **L. René Corrales** (The University of Arizona, Tucson, AZ, 520-784-9179, lrcorral@email.arizona.edu).

Understanding the response of materials to irradiation is of extreme importance, for example in evaluating the long-term performance of materials used in nuclear power generation, in the entombment and confinement of nuclear waste, and in other harsh applications such as space travel. Of particular interest is the controlled response of materials to fabricate optical and electronic devices, such as Bragg gratings. In principle, it is experimentally challenging to get at materials response of irradiation at that atomic level; therefore, to determine atomic and molecular level mechanisms of irradiation response, ab initio calculations and atomic-level molecular dynamics simulations are used. Generally, irradiation processes are comprised of both inelastic and elastic processes that together pose a challenge to theory. In an effort to get at the combined processes, we have initially focused on understanding the individual processes, i.e. isolating the inelastic and elastic processes. I will present modern theoretical approaches used to determine the response of silica and germanium doped silica glass to electronic excited states, the response of silica to displacement cascades, and the mechanical / thermal response of a damaged pyrochlore material.

113. *Molecular Dynamics Study of Diffusional Creep in Nanocrystalline UO2*, **Tapan Desai**[1], **Paul Millett**[2] and **Dieter Wolf**[2], [1](Idaho National Laboratory, Idaho Falls, ID, 208-5262492, tapan.desai@inl.gov); [2](Idaho National Laboratory, Idaho Falls, ID).

We have performed Molecular Dynamics (MD) simulations to study creep in nanocrystalline UO2 at temperatures well above the oxygen sub-lattice melting. In the absence of any external loading, we found that the uranium ions diffuse only via the grain boundaries (GB) whereas the oxygen ions show lattice as well as GB diffusion. When these microstructures are subjected to constant-stress loading at levels low enough to avoid microcracking and dislocation nucleation from the GBs, our simulations reveal that in the absence of grain growth UO2 deforms via GB diffusion creep (also known as Coble creep). The creep activation energy agrees well with the zero-stress diffusional activation energy of the slowest moving species, i.e. the

uranium ions. Thus the rate-limiting mechanism for the Coble creep is the GB diffusion of uranium ions.

114. *Determination of Thermodynamic Parameters for Modeling Actinide Solubility and Speciation in High Ionic Strength Aqueous Solutions,* **Donald E. Wall** (Washington State University, Pullman, WA, 509-335-8641, Donald_wall@wsu.edu).

The semi-empirical Pitzer equations provide the basis for the geochemical model that is used to describe the solubility and speciation of actinide ions (primarily Pu and Am) in the high ionic strength solutions that are native to the stratigraphic horizon of the Waste Isolation Pilot Plant. The Pitzer equations provide the single-ion activity coefficients for the An(III,IV,V) ions as well as inorganic (sulfate, carbonate, bicarbonate) and organic ligands (acetate, oxalate, citrate, EDTA) and actinide complexes. Solubility and speciation calculations were performed at Sandia National Laboratories using the in-house code, Fractured Matrix Transport (FMT), incorporating the Harvie-Møller-Weare database; additions to the thermodynamic database, including the Pitzer parameters and standard chemical potentials, were derived from solubility and speciation work carried out primarily at the Pacific Northwest National Laboratory, Forschungszentrum Karlsruhe, and Florida State University. Calculations used to support the Compliance Recertification Application incorporated the solubility limiting solid phases of: $Am(OH)_3$, ThO_2, and $KNpO_2CO_3$ for An(III, IV, V). Am(III) was used as the model for all the trivalent actinides, Th(IV) was used for the tetravalent actinides, and Np(V) was the model for the pentavalent actinides. Solubility and speciation calculations for Pu considered only the trivalent and tetravalent oxidation states, with a probability of 0.5 assigned to the occurrence of each oxidation state. Calculations for Np considered the tetravalent and pentavalent oxidation states, whereas the tetravalent and hexavalent oxidation states were used in the U model.

115. *Characterization of Actinide Containing Zirconia-Magnesia Based Inert Matrix Fuel*, **Kiel S. Holliday** (University of Nevada, Las Vegas, Las Vegas, NV, 702-895-4123, kielholliday@cox.net) and **Ken R. Czerwinski** (University of Nevada, Las Vegas, Las Vegas, NV, 702-895-0501, czerwin2@unlv.nevada.edu).

A zirconia-magnesia inert matrix fuel of varied concentrations containing 5% wt/wt UO2 as a PuO2 analog and 2.5% wt/wt Er2O3 as a burnable poison is being examined. Samples are prepared using a precipitation method allowing for less drastic sintering temperatures and times. Crystallographic structure is determined by x-ray diffraction accompanied by Rietveld analysis. Local structure was probed by x-ray absorbance fine structure on both the zirconium K edge and uranium LIII edge. Phase mixing and pore space was visualized by optical microscopy and scanning electron microscopy. Lastly, phase stoichiometry and total concentrations were evaluated by microprobe and x-ray fluorescence respectively. After characterization of the material its dissolution behavior under high temperature water and various acids are evaluated. Samples are taken in situ and concentrations are evaluated by atomic emission spectroscopy. A soxhlet apparatus is used to determine the corrosion resistance of the material gravimetrically. These studies are aimed at explaining the chemical behavior of the material under reactor, reprocessing, and repository conditions.

Environmental Issues In Idaho: Earth, Wind, and Water

116. *Restoration of Clearwater River Subbasin Spring Chinook Salmon*, **Thomas W. H. Backman** (Nez Perce Tribe, Orofino, ID, 208-621-3570, thomasb@Nezperce.org).

The Nez Perce Tribe (NPT) is restoring watershed functions and supplementing spring Chinook salmon into tributaries of the Clearwater River Subbasin. The NPT watershed measures are targeted to restore stream functions and the Nez Perce Tribal Hatchery (NPTH) Program is utilizing state-of-the-art science conservation methods to supplement spring Chinook in natural production areas. The Nez Perce Tribal Monitoring and Evaluation (M&E) program evaluates the effectiveness of the supplementation strategies providing scientific feedback for adaptive management to improve the survival and performance of the hatchery and naturally reared spring Chinook salmon.

This paper describes the design and operation of the NPTH and M&E program. The NPTH is a complex of supplementation facilities with protocols for broodstock collection, through factorial mating schemes, incubation, rearing experiments, and volitional release of parr from acclimation sites in Lolo and Newsome creeks. The experimental design includes testing a new semi-natural rearing system against the best conventional rearing methods. Monitoring efforts are directed at evaluation of the performance of supplementation fish in each of the following categories, and comparison with the performance of naturally reared and conventional hatchery reared fish.

1. The post-release survival of supplementation fish (both emigrating smolts and returning adults). 2. The homing and reproductive success of supplementation populations. 3. The long-term fitness of supplemented populations. 4. The population dynamics of natural and non-target species.

From the M&E collected information, Viable Salmonid Population (VSP) parameters are estimated that include:

1. Abundance 2. Survival-Production 3. Distribution 4. Life History characteristics 5. Genetics 6. Habitat.

117. *Mores Creek Project – Legacy Mining and Environmental Issues*, **Pam Smolczynski** (Trout Unlimited, Boise, ID, 208-938-1110 ex 14, psmolczynski@tu.org).

The Mores Creek watershed was placered, dredged, and hydraulically mined in the late 1800's. Tailings piles are scattered across open valleys of Mores Creek and are composed of cobbles with depths up to 15 feet. These piles armor the streambanks, preventing channel migration, riparian vegetation growth, and limiting fish and wildlife habitat. At times, temperatures in the creek reach lethal levels to fish. Hydraulically mined cliffs release massive amounts of sediment to a tributary of Mores Creek which is named Elk Creek. Elk Creek once provided native bull trout habitat and is the source of Idaho City's drinking water. The Mores Creek site is highly visible to Idahoans and is very representative of what large tracts of the western landscape silently endure.

The beauty of the Mores Creek project is the simplicity and functionality of its design. Large landscapes cannot be returned to pristine conditions. To stretch our dollars as far as possible, the project design is focused exclusively on making a difference in the riparian zone. Treatments will be applied based on decisions to increase the projects' footprint systematically. Work can be replicated downstream, as more grant funds and land owner participation is secured. With a sound recovery design that concentrates on functionality, large sections of

a stream can be restored successfully over time. The U.S. Forest Service, Trout Unlimited, and the West Central Highlands RC&D have formed a strong working group to implement the project in phases.

118. *Controlling Construction Site Runoff to Minimize Sediment Pollution in Aquatic Habitat*, **Rebecca Mirsky** (Boise State University, Boise, ID, 208-426-3256, RebeccaMirsky@boisestate.edu).

Runoff from construction sites is the largest source of sediment pollution of aquatic habitat in urban areas under development. Too much sediment in the water can interfere with fish rearing, feeding, migration and spawning; interfere with recreational uses; and threaten drinking water supplies. Along with sediment, eroding soils also release nutrients which act as pollutants once they enter waterways, causing algae blooms and low oxygen levels. For this reason, the federal Clean Water Act requires construction operators to have erosion and sediment controls in place before discharging storm water from construction sites and to get a storm water permit. This presentation will discuss some of the common erosion and sediment control methods recommended and used on urban land development and construction sites in Idaho.

119. *Mercury in Idaho: Earth, Wind, and Water*, **Carl A. Brown** (Idaho Department of Environmental Quality, Boise, ID, 208-373-0206, carl.brown@deq.idaho.gov).

Mercury (Hg) is an environmental contaminant that is drawing attention world-wide. There are a number of natural and anthropogenic sources of mercury that contribute to a global mercury cycle. While mercury emission to the atmosphere is the main source of mercury pollution, the bioaccumulation of methyl-mercury in fish is the endpoint that affects most people. There are a number of water bodies in Idaho that have fish consumption advisories because of mercury contamination. To help determine the sources of mercury contamination in Idaho, the Department of Environmental Quality is currently involved in a number of mercury monitoring studies. These include: dry deposition studies, wet deposition studies, snow pack sampling, reservoir and stream sampling, fish sampling, and sediment core sampling. Most of the data collection has focused on identifying mercury sources in the Salmon Falls Creek Reservoir (an isolated water body with a mercury fish advisory). A summary of current Idaho DEQ data will be presented.

120. *Idaho's Energy Future: Is the Answer "Blowin' in the Wind"?* **John Gardner** (Boise State University, Boise, ID, 208-426-5702, jgardner@boisestate.edu).

Not since the 1970's has the issue of energy usage and generation been so central to our national and local discussions. Rising oil and gas prices, the debate over global climate changes and its causes and the projected rise of the Asian economies cause scientists, policy makers and economists to project various doomsday scenarios for the next 50 years. Central to all of this discussion is the way in which we use and manipulate energy.

This talk will provide a broad overview of the energy 'picture' on a global, national and local scale and will present the fundamentals of wind energy, one of the more promising technologies for renewable energy, including a discussion of the many controversies surrounding its increasing use.

New Strategies for Cancer Treatment

121. *Welcoming Remarks*, **Henry A. Charlier Jr.** (Boise State University, Boise, ID, 208-426-3474, hcharlie@boisestate.edu).

122. *Carbonyl Reductase and Anthracycline Chemotherapy*, **Henry A. Charlier Jr.** (Boise State University, Boise, ID, 208-426-3474, hcharlie@boisestate.edu).

Carbonyl reductase (CR) catalyzes the NADPH-dependent reduction of a wide range of carbonyls. CR has been connected to several important processes including but not limited to quinone detoxification, neuroprotection, prostaglandin metabolism, and, of clinical interest, anthracycline metabolism. CR reduction of anthracyclines significantly impacts their use in the treatment of cancer as it has been linked to both drug resistance and cardiotoxicity mechanisms. The oxidation state of the anthraquinone and C13 carbonyls of the anthracyclines greatly influences their anticancer and cardiotoxic properties. CR has long been known to reduce the C13 carbonyl on the anthracyclines. Recent studies in our lab have also shown that the anthraquinone carbonyls are also reduced by CR. The catalytic efficiencies for the anthraquinone carbonyls are much smaller that those for the C13 carbonyls, indicating that the C13 carbonyls are better substrates than are the anthraquinones. In addition to identifying the anthraquinones as substrates for CR, our lab has also discovered several novel substrates and inhibitors for CR. Several compounds resembling a variety of known CR substrates were tested and found to be either substrates or inhibitors. In some cases the difference between a substrate and an inhibitor was the addition of a methyl or hydroxyl group. The new substrates and inhibitors can shed light on the interactions critical for substrate binding and orientation in the CR active site and such information could be used to design novel anthracyclines or inhibitors that could be used to improve the safety and efficacy of anthracycline use in the treatment of cancer. Supported by NIH/P20RR016454 and NIH/R15CA102119-01.

123. *Doxorubicin Cardiotoxicity and Thyroid Hormone*, **Richard D. Olson** (Mountain States Tumor and Medical Research Institute, VA Medical Center Boise, ID, University of Washington School of Medicine, Boise, ID, 208-422-1219, rolson49@aol.com).

Doxorubicin is an anticancer drug used to treat childhood and breast cancers. The most significant side effect is cardiotoxicity which limits the lifetime cumulative doxorubicin dose and prevents doxorubicin from being used in combination with other effective anticancer drugs such as herceptin. The mechanism of doxorubicin cardiotoxicity is thought to involve impairment of cardiac Ca regulation through a mechanism that may involve oxidative stress and impairment of Fe metabolism. We now find in the chronic rabbit model that doxorubicin causes more than 75% decrease in plasma triiodothyronine (T3). T3 is a powerful hormone that regulates Ca metabolism in the heart. Low levels of plasma T3 cause a dilated cardiomyopathy that resembles doxorubicin cardiotoxicity. Based on this study we suggest that doxorubicin-induced cardiotoxicity may involve impairment of the cardiac thyroid tone. Such a decrease in plasma T3 would be expected to down regulate cardiac proteins involved in cardiac Ca handling and contraction. These observations suggest a novel mechanism of doxorubicin cardiotoxicity and a new therapeutic approach to prevent or treat it.

124. *Anthracycline Chemotherapy and Age*, **Barry J. Cusack** (Boise VA Medical Center, Boise, ID, 208-422-1152, Barry.Cusack@

med.va.gov)

No text available.

125. *The Clinical Significance of Oncostatin M and Its Receptors in Breast Cancer Progression*, **Sujatha Kadaba**[1], **Karen Halsted**[2], **Kara B. Bowen**[2], **William E. Fyffe**[2], **Joseph D. Kronz**[3] and **Cheryl L. Jorcyk**[4], [1](Boise State University, Boise, ID, 208-426-4805, sujathakadaba@boisestate.edu); [2](Northwest Nazarene University,, Nampa, ID); [3](Mercy Medical Center, Nampa, ID); [4](Boise State University, Boise, ID, 208-426-4287, cjorcyk@boisestate.edu).

Oncostatin M (OSM) is an IL-6 family cytokine that exhibits both pro- and anti-inflammatory effects. Originally OSM was identified as an inhibitor of tumor cell proliferation in a variety of cell lines from breast, lung and melanoma. Recent studies however have shown that OSM promotes invasiveness and metastatic phenotype of breast tumor cells in vitro. Human OSM functions through two receptor complexes, the type I receptor complex (LIFR/gp130 proteins) and the type II receptor complex (OSMR/gp130 proteins) and activates several signaling pathways resulting in the upregulation of genes that encode for vascular endothelial growth factor or cyclooxegenase-2, which are proangiogenic factors that promote tumor progression. The role of OSM in breast cancer progression in vivo is not known. Our immunohistochemical analysis of breast tissue microarrays has revealed that OSM is highly expressed in invasive breast ductal carcinoma compared to normal breast tissue while its expression decreases in metastatic tissues compared to invasive carcinoma of the breast. This indicates that OSM plays an important role in invasiveness of breast ductal carcinoma. Studies are underway to determine the clinical significance of OSM in breast cancer progression through correlation of OSM staining in breast tissue microarrays with various breast cancer prognostic markers such as Her2/neu status and ER/PR status. We will also study the expression pattern of OSM receptors; OSMR, LIFR, and gp130 and OSM staining in tumor-associated macrophages and neutrophils, in these tissue microarrays in order to understand whether OSM functions in an autocrine or paracrine fashion in breast cancer progression. NIH grant P20RR16454.

126. *Oncostatin M is a Potential Target for Inhibiting Breast Tumor Progression*, **Cheryl L. Jorcyk** (Boise State University, Boise, ID, 208-426-4287, cjorcyk@boisestate.edu).

Tumor-associated and tumor-infiltrating neutrophils (TANs) and macrophages (TAMs) can account for as much as 50% of the total tumor mass in invasive breast carcinomas. It is thought that tumors secrete factors that elicit a wound-repair response from TAMs and TANs, and that this response inadvertently stimulates tumor progression. Oncostatin M (OSM) is a pleiotropic cytokine belonging to the IL-6 family that is expressed by several cell types including activated human T-lymphocytes, macrophages, and neutrophils. While OSM can inhibit the proliferation of breast cancer cells in vitro, recent studies suggests that OSM may promote tumor progression by enhancing angiogenesis and metastasis. In addition, neutrophils can be stimulated to synthesize and rapidly release large quantities of OSM. We have shown that human neutrophils secrete OSM when co-cultured with MDA-MB-231 and T47D human breast cancer cells. Granulocyte-macrophage colony-stimulating factor (GM-CSF) produced by breast cancer cells and cell-cell contact are both necessary for the release of OSM from neutrophils. This neutrophil-derived OSM induces vascular endothelial growth factor (VEGF) from breast cancer cells in co-culture. In addition to VEGF induction, neutrophil-derived OSM increases breast cancer cell detachment and invasive capacity, suggesting that neutrophils and OSM may promote tumor progression in vivo. Importantly, our results could provide the foundation for the rational design of pharmacological agents that inhibit OSM expression, function or signaling. NIH grant P20RR16454.

127. *Synthesis and DNA Binding Properties of Aziridinomitosenes*, **Don L. Warner** (Boise State University, Boise, ID, 208-426-3030, dwarner@boisestate.edu), **Matt K. Haga** (Boise State University, Boise, ID, matthaga@mail.boisestate.edu), **Mandalyn McKay** (VA Medical Center, Mountain States Tumor and Medical Research Institute, and Gem Pharmaceuticals, Boise, ID), **Jamie Montgomery** (Boise State University, Boise, ID, 208-761-8586, jamiemariemontgomery@hotmail.com), **Richard D. Olson** (VA Medical Center, Mountain States Tumor and Medical Research Institute, and Gem Pharmaceuticals, Boise, ID, 208-422-1219, rolson49@aol.com), **Megan Penner** (Boise State University, Boise, ID, meganpenner@mail.boisestate.edu), **Andrea S. Radabaugh** (Boise State University, Boise, ID, 208-426-5740, andrearadabaugh@mail.boisestate.edu) and **Stacia M. Rink** (Pacific Lutheran University, Tacoma, WA, 253-535-7553, rinksm@rainier1.chem.plu.edu).

Mitomycin C is a naturally occurring antibacterial and antitumoral compound that has been shown to alkylate and crosslink DNA. Its ability to form DNA adducts accounts for its anticancer properties. Aziridinomitosenes, a class of related synthetic compounds, share many structural similarities and have also been shown to form DNA monoadducts. We recently reported that a C6/C7 unsubstituted mitosene analog has the ability to form rare sequence specific interstrand DNA crosslinks without enzymatic reduction required by mitomycin C—a previously unobserved cytotoxic event. However, the structure of the crosslink and mechanism of interaction between aziridinomitosene and DNA is not well understood. A proposed model considers four possible electrophilic sites designated C1, C6, C7 and C10. By varying the substituents at each of these sites, we hope to identify key structural components necessary for DNA interstrand crosslink formation and verify the proposed mechanism. Of particular interest are newly synthesized 6-methyl and 7-methyl substituted aziridinomitosenes, which we now report to be more potent than mitomycin C in arresting cell division in human promyelocytic leukemia (HL-60) cells. These compounds and other target aziridinomitosenes will be characterized with regards to reduction potential, aziridine nitrogen pKa, solvolytic stability, and DNA alkylating ability. The studies will help clarify the importance of various electrophilic sites on the molecule and lead to a better understanding of DNA-mitosene interactions.

128. *Glycolytic Enzyme Inhibitors as Novel Anti-cancer Drugs*, **James C.K. Lai** (Idaho State University, Pocatello, ID, 208-282-2275, lai@otc.isu.edu), **Vikas Bhardwaj** (Idaho State University College of Pharmacy and Biomedical Research Institute, Idaho State University, Pocatello, ID, 208-282-2275, bharvika@pharmacy.isu.edu), **Nisha Rizvi** (Idaho State University College of Pharmacy and Biomedical Research Institute, Idaho State University, Pocatello, ID, 208-282-2275, rizvnish@otc.isu.edu), **Tanushree Chatterji** (Idaho State University College of Pharmacy and Biomedical Research Institute, Idaho State University, Pocatello, ID, 208-282-2275, chattanu@pharmacy.isu.edu), **Alfred O. Isaac** (Idaho State University College of Pharmacy and Biomedical Research Institute, Idaho State University, Pocatello, ID, 208-282-2275, isaacorina@pharmacy.isu.edu), **Maria B. Lai** (Idaho State University College of Pharmacy and Biomedical Research Insti-

tute, Idaho State University, Pocatello, ID, 208-716-0008, biqlai@hotmail.com), **Tara Johnson** (Idaho State University College of Pharmacy and Biomedical Research Institute, Idaho State University, Pocatello, ID, 208-282-2275, johntara@isu.edu), **Solomon W. Leung** (College of Engineering and Biomedical Research Institute, Idaho State University, Pocatello, ID, 208-282-2524, leunsolo@isu.edu), **Christopher K. Daniels** (Idaho State University College of Pharmacy and Biomedical Research Institute, Idaho State University, Pocatello, ID, 208-282-3324, cdaniels@pharmacy.isu.edu) and **Alok Bhushan** (Idaho State University, Pocatello, ID, 208-282-4408, abhushan@otc.isu.edu).

According to the Warburg hypothesis, tumor cell survival and proliferation critically depend on aerobic glycolysis rather than mitochondrial glucose oxidative metabolism as energy source. To further test the generality of the Warburg hypothesis, we have systematically investigated the effects of two glycolytic enzyme inhibitors (namely, 3-bromopyruvate (3BP), an inhibitor of hexokinase II, and iodoacetate (IAA), an inhibitor of glyceraldehyde-3-phosphate dehydrogenase) on the survival of several different types of cancer cells, including glioblastoma, pancreatic, and oral cancer cells. Our results demonstrate that both 3BP and IAA induced decreases in cell survival in all cancer cell types studied in a concentration- and time-related manner. Moreover, we found that one mechanism by which IAA induced cell death was necrosis, as determined by lactate dehydrogenase release into the medium, a marker of necrotic cell damage/death. Moreover, IAA was more potent than 3BP in inducing cell death in all the cancer cell types investigated. Thus, the results of our ongoing systematic studies prompted us to hypothesize that we can employ glycolytic enzyme inhibitors, such as IAA and 3BP, as "proof-of-concept" test drugs to derive a novel approach to inhibit cancer cell proliferation and invasion. We are currently conducting additional mechanistic and signaling studies to systematically test this hypothesis further.

129. *Novel Approaches to Block Glioblastoma Invasion*, **Alok Bhushan** (Idaho State University, Pocatello, ID, 208-282-4408, abhushan@otc.isu.edu), **Shilpa Puli** (Idaho State University, Pocatello, ID, 208-760-9316, shilpapuli@gmail.com), **Wajiha Tahar Ali** (Idaho State University, Pocatello, ID, 208-282-5885, wajiha@otc.isu.edu), **Launa M. J. Lynch** (Idaho State University, Pocatello, ID, 208-406-6655, launalynch@gmail.com), **G. Patrick Meier** (Washington State University, Pullman, WA, 509-335-2637, meiergp@wsu.edu) and **James C.K. Lai** (Idaho State University, Pocatello, ID, 208-282-2275, lai@otc.isu.edu).

Glioblastoma Multiforme is a primary brain tumor associated with extensive invasion into surrounding brain tissue. Matrix metalloproteinases (MMPs) and urokinase plasminogen activation (uPA) system are shown to be involved in tumor invasion as they help in degradation of extracellular matrix proteins and thus assist in the movement of cells. MMP-2 and 9 were shown to be upregulated in gliomas, suggesting their involvement in invasion. Genistein and biochanin A are isoflavones commonly known as phytoestrogens and have some anticancer properties. We hypothesized that these two isoflavones can induce a lowering of tumor invasion by decreasing the activity of matrix degrading enzymes. In this study we investigated the effects of genistein and biochanin A on invasive activity of U87MG glioma cells using the Calbiochem in vitro invasion assay system. Our results suggest that genistein and biochanin A induced a decrease in invasive activity of U87MG cells in a dose-related manner. Genistein also induced a decrease in EGF-stimulated invasion thereby implicating an involvement of EGF-mediated signaling in invasion. Our results also indicate that treatment of U87MG cells with the two isoflavones induced decrease in the enzymatic activity of MMP-9 and the protein levels of MT1-MMP and uPAR. In addition, we synthesized analogs of isoflavones and tested their ability to affect biochemical pathways.

130. *Pathway Analysis for Insights to Gene Expression Data*, **Christopher K. Daniels** (Idaho State University, Pocatello, ID, 208-282-3324, cdaniels@otc.isu.edu), **Joy L. Olbertz** (Idaho State University, Pocatello, ID, 208-282-3715, olbejoy@otc.isu.edu), **Kalyan J. Gangavarapu** (Idaho State University, Pocatello, ID, 208-282-3715, kalyan@otc.isu.edu), **Donna S. Clark** (University of Idaho, Moscow, ID, 208-885-7966) and **Mark W. Thomas** (Brigham Young University - Idaho, Rexburg, ID, (208) 496-3001, tho01020@byui.edu).

Multiple myeloma is a proliferation of malignant plasma cells in bone marrow. Growth of these myeloma cells is dependent on the survival factor interleukin-6 (IL6), which inhibits cell death and promotes proliferation. We have been using the IL6-dependent 7TD1 murine hybridoma cell line as a model for multiple myeloma. Additionally, we have created a dexamethasone-resistant 7TD1 cell line which grows independently of exogenously added IL6. Microarray data on IL-6 regulated genes in the parent 7TD1 cell line, provided us with a list of 125 genes that are up- or down-regulated by IL-6. This data was analyzed using the Pathway Studio program (Ariadne Genomics, Rockville, MD), where pathway connectedness between identified genes and their targets were constructed. This analysis provided a map of gene connections for up- and down-regulated genes, respectively. These maps allowed us to target genes that seem to be the most important due to their connection to many pathways, as seen by their hub-character or showed a direct connection to pathways of interest. This work was supported by NIH Grant #P20RR016454 from the INBRE Program of the National Center for Research Resources.

Infectious Disease, Part II

131. *The Development of Bacterial Enterotoxin Chimeras as Potential Vaccines*, **Juliette K. Tinker** (Boise State University, Boise, ID, 208-426-5472, juliettetinker@boisestate.edu).

Cholera toxin is a multisubunit protein toxin secreted by the pathogenic bacterium *Vibrio cholerae*. Binding and internalization of this toxin into intestinal epithelial cells is responsible for the destructive and often fatal secretory diarrhea resulting from ingestion of *V. cholerae*. Extensive characterization of this toxin has lead to the discovery that it is also a very promising immunostimulatory agent, or adjuvant, for the incorporation into vaccines. Adjuvants are "helper" substances that are included in vaccine preparations to ensure a robust immune response, and are especially important when introducing vaccines via an oral or nasal (mucosal) route. The AB5 enterotoxins, such as cholera toxin (CT) and *Escherichia coli* heat-labile toxin (LT), represent the most potent mucosal adjuvants identified to date, and may advance the production of novel mucosal vaccines. Oral or nasal vaccination is desirable for many reasons, including the reduced need for trained personnel, better patient compliance and decreased cost. Our laboratory has constructed chimeric protein fusions of CT, as well as LT, in an effort to produce detoxified vaccine candidates that may be administered mucosally. These molecules have a number of advantages over purified toxin or toxin components as adjuvants, including; the absence of the toxic subunit, presence of a functional receptor-binding subunit, direct attachment of the antigen of inter-

est, and retention of intracellular trafficking motifs. We have recently constructed a cholera toxin chimera that represents a potential vaccine against the bioterror target, *Yersinia pestis*. In addition, research in my laboratory focuses on the development of bacterial enterotoxin chimeras as molecular tools for intracellular trafficking studies, as well as the characterization of novel bacterial toxins that may act as modulators of the immune system.

132. *HIV Envelope: Pursuing A Moving Target For Vaccine Design*, **Wendy Blay** (Seattle Biomedical Research Institute, Seattle, WA, 206-256-7454, wblay@sbri.org), **Theresa Kasprzyk** (University of Washington, Seattle, WA, tkasprzk@sbri.org) and **Nancy L. Haigwood** (Seattle Biomedical Research Institute, Seattle, WA, nhaigwood@sbri.org).

The quest for an HIV vaccine has proven challenging on a number of levels: the immune correlates of control are not fully understood, the virus undergoes rapid evolution, and HIV is exceptionally adept at immune evasion. It is believed that broad, cross-reactive neutralizing antibodies (NAbs) will be an important component of an effective HIV vaccine. As the only viral protein present on the surface of the virion, Envelope is the sole target of NAbs against HIV. The handful of neutralizing epitopes shared by multiple isolates of HIV are well concealed by large variable loops, recessed pockets, and carbohydrates that are able to add, remove, and rearrange in an evolving glycan shield. In contrast, the exposed epitopes are highly variable and typically isolate specific. An important question that remains unanswered lies in the boundaries of variation that exist as the virus evolves and the relationship between these changes and NAbs.

A longitudinal analysis using a macaque model of infection revealed a remarkable degree of conservation in HIV Envelope glycosylation and consistent patterns of change that occur in a small number of carbohydrates proximal to the CD4 receptor binding site. The majority of viral variants that undergo these carbohydrate changes are able to escape a broad modality of neutralizing agents. A cross-sectional analysis of published HIV sequences suggests similar hotspots of glycosylation change. These data help to illuminate possible commonalities in mechanisms of viral escape from NAbs and may aid the design of vaccines that could potentially circumvent such changes.

133. *Immunoproteomic Analysis of the Protective Outer Membrane Fraction of the Rickettsial Pathogen* Anaplasma marginale, **Wendy C. Brown** (Washington State University, Pullman, WA, 509-335-6067, wbrown@vetmed.wsu.edu), **Job E. Lopez** (Washington State University, Pullman, WA, 509-335-6350, jelopez@vetmed.wsu.edu), **Paul A. Beare** (Rocky Mountain Laboratories, National Institutes of Allergy and Infectious Diseases, National Institutes of Health, Hamilton, MT, 406-375-9671, pbeare@niaid.nih.gov) and **Robert A. Heinzen** (Rocky Mountain Laboratories, National Institutes of Allergy and Infectious Diseases, National Institutes of Health, Hamilton, MT, 406-375-9695, rheinzen@niaid.nih.gov).

Rickettsial pathogens in the genera *Anaplasma* and *Ehrlichia* cause acute infection in immunologically naïve hosts and are major causes of tick-borne disease in animals and humans. Immunization with *Anaplasma marginale* purified outer membranes (OM) induces complete protection against anaplasmosis in 75% of cattle, whereas immunization with the immunodominant major surface proteins such as MSP2 has provided little or no protection. The completed genome sequence of *A. marginale* facilitated the identification of subdominant and less abundant immunogenic proteins in the OM fraction, using two approaches. First, 2-D electrophoresis and immunoblotting of OM with immune sera identified numerous antigenic protein spots. Analysis of individual excised proteins by LC-MS/MS identified 21 novel antigens including three type IV secretion system (TFSS) proteins, conjugal transfer protein, VirB9, and VirB10. These were expressed and shown to stimulate IgG2, and $CD4^+$ T cell proliferation and IFN-γ production, responses associated with protective immunity in outer membrane vaccinates. A second approach involved in vitro transcription and translation (IVTT) of ORFs encoding proteins predicted to be membrane localized or to have a signal peptide. PCR products of selected ORFs engineered to express antibody-binding sequence tags were amplified and expressed using IVTT. As proof of principal, VirB9 and additional outer membrane proteins known to stimulate T cell responses were expressed by IVTT and affinity purified by binding to anti-tag antibody coupled to protein-G bound beads, and the beads were added to APC and used to stimulate immune $CD4^+$ T cell proliferation. This novel technology can be used to rapidly screen a large number of proteins from a given pathogen for recognition by both antibody and T lymphocytes if the genome sequence is available.

134. *Loss of Antigen-Specific CD4+ T Lymphocytes During* Anaplasma marginale *Challenge in Cattle*, **Sushan Han** (Washington State University, Pullman, WA, 509-335-6076, sushan@vetmed.wsu.edu).

Anaplasma marginale is a rickettsial pathogen of cattle that causes morbidity, mortality, and persistent infection. How the rickettsia maintain persistence in the immunocompetent host is poorly understood. Previously, cattle immunized with an immunodominant surface protein of *A. marginale* developed strong antigen-specific CD4+ T lymphocyte responses that following challenge, rapidly disappeared in peripheral blood and remained undetectable throughout persistent infection. To further characterize this loss of infection-induced antigen-specific response, cattle were immunized with a DNA vaccine encoding a conserved 30-mer surface epitope (F2-5B) of *A. marginale* and challenged with live organisms. Upon challenge, F2-5B-specific peripheral blood CD4+ T-lymphocyte proliferation and IFN-*f*× secretion again disappeared at peak rickettsemia and remained undetectable until necropsy at 9 weeks to 12 weeks post-challenge. Bovine MHC class II DRB3*1101 tetramers were used to detect the frequency of F2-5B-specific CD4+ T cells in PBMC before and during challenge and from lymphoid organs at death. The frequency of F2-5B-specific CD4+ T lymphocytes sharply decreased in peripheral blood just before peak rickettsemia and remained low until death. F2-5B-specific T-lymphocytes were not detected with tetramers in lymphoid organs at the time of necropsy, showing that antigen-specific T cells were not sequestered in these tissues. Rapid loss of *A. marginale*-specific CD4+ T lymphocytes at the peak of antigenic stimulation during infection is consistent with activation induced cell death and represents an important mechanism by which *A. marginale* controls the host immune response to achieve persistence.

135. *Lipid A Mimetics for Protection Against Pulmonary Plague*, **Carolyn Hovde Bohach**[1], **Christina L. Airhart**[2], **Harold N. Rohde**[2], **Claudia F. Deobold**[2], **Gregory A. Bohach**[3] and **Scott A. Minnich**[4], [1](University of Idaho, Moscow, ID, 208-885-5906, cbohach@uidaho.edu); [2](University of Idaho, Moscow, ID); [3](University of Idaho, Moscow, ID, 208-885-6666, gbohach@uidaho.edu); [4](University of Idaho, Moscow, ID, 208-885-7884, sminnich@uidaho.edu).

A hallmark of *Yersina pestis* infection is a reduced inflamma-

tory response. Synthetic lipid A mimetics were used as therapeutics to stimulate the innate immune response or as vaccine adjuvants with *Y. pestis* antigens to protect against pneumonic plague. Mice were treated intranasally with nontoxic lipid A mimetics prior to and/or after an intranasal challenge of 10, 100, or 200 LD50 of *Y. pestis* CO92. Controls were treated with PBS and mice were monitored for time-to-death. In addition, the effect of treatment with lipid A mimetics combined with sub-optimal gentamicin antibiotic therapy was measured. Finally, the efficacy of intranasal vaccination with *Y. pestis* immunogens, capsular protein Caf1 and/or V-antigen, with a lipid A mimetic as adjuvant were measured. Mice treated with the lipid A mimetics 24h prior to challenge with 10-200 LD50 of *Y. pestis* had an increased time-to-death or were protected and the effect was pathogen-dose dependant. The lipid A mimetic provided a synergistic effect when combined with a sub-optimal gentamicin treatment with survival rates as high as 85% in mice treated with the lipid A mimetic 24h prior to and 24h after bacterial challenge. The compounds also function effectively as adjuvants. Within 45 days, a single dose vaccination with Caf1 and/or V-antigen provided 80% protection after a 100 LD50 *Y. pestis* CO92 challenge. 100% protection was rapidly induced (within days) when two doses of vaccine were administered. In conclusion, the modified lipid A compounds stimulated innate immunity in the mouse nasal and respiratory mucosa. These compounds provided protection or delayed time-to-death from *Y. pestis* challenge, enhanced antibiotic action, and were effective vaccine adjuvants when combined with known protective antigens for pneumonic plague.

The Great Wilderness Compromise

136. *Idaho Wilderness: A Personal Political Journey*, **Cecil Andrus** (28th Governor of Idaho, 46th U.S. Secretary of Interior, Boise, ID, 208-345-6933, jonchristensen@stanford.edu).

No text available.

137. *The Central Idaho Economic Development and Recreation Act*, **Lindsay Slater** (Chief of Staff for Rep. Mike Simpson, 2nd District, Idaho, Washington, DC, 202-226-7227, lindsay.slater@mail.house.gov).

No text available.

138. *The Boulder-White Clouds Wilderness*, **Craig Gehrke** (The Wilderness Society, Boise, ID, craig_gehrke@tws.org).

No text available.

139. *Yellowstone to Yukon and the Emergence of a Large Scale Conservation Vision*, **Gary M. Tabor** (Wildlife Conservation Society, Bozeman, MT, 406-522-9333, gtabor@wcs.org).

The Yellowstone to Yukon initiative (Y2Y) is the largest transboundary conservation effort in North America. Almost 300 conservation non-governmental organizations in the United States and Canada have joined in implementing a common vision of conserving the most intact nature in the Rocky Mountains. Like many places on the planet, habitat fragmentation and climate change are having profound impacts on this landscape. On the one hand, the region is experiencing unprecedented levels of oil and gas development impacting its wild areas and wildlife and on the other hand, Glacier National Park, the poster landscape of climate change, will lose all its glaciers in the decades to come. Here lies the challenge and paradox of conservation in an increasingly crowded and consumptive world. The landscape vision of Y2Y embodies concepts of ecological science that promotes conservation at a scale large enough to allow for adaptation and resilience and to sustain ecological processes. Yet, as in the case of Glacier, a collective blindness exists about the impacts of insatiable fossil fuel hunger. As nature grows scarce, we demand more from what is left. No where is this paradox played out more than in people's individual choice to engage in off-road motorized recreation in pristine landscapes. Can human vision overcome the growing human footprint?

140. *America's Conservation Landscape*, **J. Michael Scott** (University of Idaho, Moscow, ID, 208-885-6960, mscott@uidaho.edu).

Text Not Available.

Joint Session of the Anthropology and Archaeology, Earth Sciences, and Ecology and Environmental Sciences Sections

141. *Snow Depth Estimation Using GPS*, **Mark Jacobson** (Montana State University - Billings, Billings, MT, 406-657-2203, mjacobson@msubillings.edu).

This presentation explores a proof-of-concept method for estimating snow depth by using the Global Positioning System (GPS) frequency of 1.5 GHz. During the past two decades, little attention has been paid to microwave interactions of snow pack at 1.5 GHz or lower. Snow depth is a key parameter in estimating snow water equivalence (SWE). Seasonal snow cover is the major source of fresh water over wide areas of the mid-latitudes. SWE, the product of snow density and depth, is the most important parameter for hydrological study because it represents the amount of water potentially available for runoff. The theoretical model for snow depth estimation consists of a vertically-mounted antenna located above either a single-layer or a double-layer of dielectric material, which in turn is located above a perfectly conducting surface. The received power at the antenna is computed from conventional transmission line equivalent circuit theory. The theoretical results are compared with GPS measurements from a 16' X 16' structure with dielectric materials of Polystyrene, Styrofoam and snow. It is anticipated that this comparison will lead to an algorithm for calculating snow depth for different snow conditions. The model produces unique power variations and angular frequency components for different dielectric layers. The GPS measurements are also investigated with regards to power variations and angular frequency components.

142. *Geology and Hydrogeology of Boise, Idaho*, **Spencer H. Wood** (Boise State University, Boise, ID, 208-344-9854, swood@boisestate.edu) and **Ed Squires** (Hydro Logic, Inc., Boise, ID, 208 342 8369, ed@hydrologicinc.net).

The Boise foothills display many of the rocks down-faulted and lying beneath downtown Boise. These rocks reveal much of the post-Idaho-batholith history of the western Snake River Plain. Feldspar K-Ar ages of rhyolite flows exposed at the old Penitentiary and Cottonwood Creek are 11.8, and 11.3 Ma. These rhyolite layers are aquifers for artesian hot water (150-190 ºF) that lie at a depth of about 2000 feet beneath the Statehouse. Basalt flows and pyroclastics, 300-500-ft thick, with whole-rock K-Ar ages of 9-11 Ma, overlie and seal the rhyolite geothermal aquifer. Above basaltic rocks are up to 1600 feet of mudstone and sand deposited by Neogene Lake Idaho. The upper sand units form the major cold-water aquifers of the western plain, and are a major water supply for Boise, Meridian, Nampa and Caldwell.

In the foothills the lake deposit is transgressive mudstone, named the Terteling Springs Formation, that grades to sands and oolites near the contact with the batholith granite. Glass separates from volcanic ash layers within the uppermost transgressive mudstone of the Terteling Springs Formation correlate geochemically with regional ashes dated about 3.1 Ma, an age of the upper Glenns Ferry Formation. Overlying this mudstone is a prograding deltaic sand sequence 400-ft thick in the foothills, deposited when Lake Idaho overtopped its spill point and drained into ancestral Hells Canyon. This regressive delta-sand sequence, not recognized in the southern plain, is named the Pierce Gulch Sand, and can be traced on geophysical logs as a major aquifer system 500 to 1100 feet deep in the western plain.

143. *Remote Sensing in the USDA, Forest Service: Applied Science in the Management of Natural Resources*, **Jerry D. Greer** (USDA, Forest Service, Remote Sensing Applications Center, White Bird, ID, 208-839-9912, jgreer@ctcweb.net).

Like other agencies managing natural resources, the United States Department of Agriculture, Forest Service, depends upon data acquired by remote sensing technology. Data sets are analyzed with a variety of computer based data assessment and comparison tools. The USDA Forest Service maintains a unit specifically assigned the task of identifying new technology and transferring it to ground level managers. The unit supports managers in the implementation and continued use of the new analytical tools.

Specialists in earth and life sciences support decision makers in the process of managing and allocating resources. Other specialists in geographic information systems, global positioning systems, computer technology, remote sensing and statistics are key players. Today, more than ever before, the assessment and management of biodiversity, forests, rangelands, wildlife, minerals and water, depend upon data of known quality collected routinely by remote sensing instruments. This world of applied science is dependent upon scientists who both develop sensors and who develop a scientifically based understanding of new processes being monitored.

The future appears to be one involving an increasing human population dependent upon a fixed if not decreasing resource base. The increase in demand for scarce resources translates into a need for better decisions. Improvement in decisions will be helped by improving the quality of data while reducing its unit cost. We are concerned about the data crunch which is developing from the loss of continuity of the sensors we have come to trust and use.

Here, we report on the program of the USDA Forest Service.

144. *Spatial Dynamics in Population Genetics: Heaving Toward Speciation*, **Guy A. Hoelzer** (University of Nevada Reno, Reno, NV, 775-784-4860, hoelzer@unr.edu), **Rich Drewes** (University of Nevada Reno, Reno, NV, drewes@interstice.com) and **Rene Doursat** (Ecole Polytechnique, Paris, France, Rene Doursat).

A commonly held view in evolutionary biology is that speciation is generally driven by external geographical boundaries. We propose a 2-D cellular automata model showing that an initially homogeneous population might spontaneously segment into different species through sheer isolation by distance. The model includes sexual individuals as agents, with diploid genomes comprised of two autosomal chromosome pair, and which follow simple rules relating to their mutation, reproduction and migratory dispersal. Each chromosome is a sequence of nucleotide bases (GATC) subjected to mutation (base substitution) at rate μ. Individuals are hermaphrodites able to function as either the male or female in a sexual encounter. The mean reproductive rate in the population is regulated each generation to buffer swings in population size resulting from a variety of factors, such as stochastic mortality. The model shows an inherent tendency toward spatial self-organization, as has been the case with other spatially explicit models of evolution. Each generation we assess the genetic difference between pairs of randomly chosen individuals and plot a frequency histogram of these differences (the mismatch distribution) to explore the non-spatial pattern of genetic diversity in the population. A well-mixed version of the model exhibits a relatively stable and unimodal distribution of genetic differences as has been shown with previous models. However, a much more interesting pattern of temporal waves emerges when the dispersal of individuals is limited to short distances. When we incorporate a simple outbreeding depression function, the amplitude and separation of these waves is greatly enhanced, and localized subpopulations can give way to parapatric speciation.

145. *Creating an Archive of 3D Virtualizations of the Footprint Evidence for an Unrecognized Hominoid in the Pacific and Inter-Mountain West,* **D. Jeffrey Meldrum** (Idaho State University, Pocatello, ID, 208-282-4379, jeff.meldrum@gmail.com).

Persistent reports of observations of an unrecognized hominoid, commonly referred to as Bigfoot or sasquatch, emanate from the forests of the Pacific and Inter-Mountain West. Reports occasionally correlate with the discovery of large tracks. A sample of footprint casts representing a wide temporal and geographic range has been evaluated, including analysis employing 3D imaging techniques. High resolution 3D scans are accomplished using a Cyberware Model Shop Color 3D Scanner at the Idaho Virtualization Laboratory (IVL) -- http://ivl.imnh.isu.edu/. These are being archived for subsequent on-line access by interested researchers. The models can be uploaded into a virtual 3D viewer. They offer exceptional capacity for visual representation and inspection, and the potential for prototyping research quality replicas. They lend themselves to a variety of outline, landmark, and geometric morphometric analyses, as will be illustrated with selected examples. They permit quantification of variation in successive tracks displaying traces of foot kinematics. Through superimposition and subtraction methods, repeat appearances of presumed individual specimens can be evaluated. Alleged sasquatch footprints are readily distinguished from human footprints by their proportions, e.g. heel length/breadth, and their morphology, e.g. lacking the trace of a stiff longitudinal arch. Several specimens exhibit a distinctive midtarsal pressure ridge and other indications of midfoot flexibility, characteristic of apes and early hominids. A featured example involves the footprints associated with the controversial Patterson-Gimlin film. The film-subject's feet evidence kinematics that correlate with dynamic features evident in the associated footprints, in that a "midtarsal break" is indicated. These specimens present evidence of a biomechanicly sound foot adaptation appropriate to the type of bipedalism employed and the predominant texture of the substrate in habitat-types sasquatch is purported to frequent.

146. *Pronghorn Dental Age Profiles and Seasonality Data from Hogup Cave, Utah*, **Brenda L. Hill** (University of Utah, Salt Lake City, UT, 801-558-2192, brenda.hill@anthro.utah.edu) and **David A. Byers** (University of Utah, Salt Lake City, UT, 801-581-6251, dbyers@sisna.com).

Historic accounts of Native American pronghorn hunting describe a variety of methods that were utilized to hunt this species across western North America including on-encounter single kills

to large-scale communal drives where many animals were killed en masse. Recent work has shown that prehistoric hunters in the Great Basin also participated in communal hunts of pronghorn although this work suggests that communal hunting began only after pronghorn populations expanded during the late Holocene. In this paper, we test the hypothesis that pronghorn hunting changed from on-encounter procurement of individual animals during the middle Holocene, to a strategy emphasizing communal hunting during the late Holocene. To this end, we examine pronghorn dentitions from Hogup Cave, Utah—an archaeological site that produced a trans-Holocene sequence of pronghorn skeletal elements— to determine ages of death, construct mortality profiles, and estimate kill seasonality for each of the site's strata. Our results fail to support a shift in hunting patterns between the middle and late Holocene. Instead, mortality profiles and kill seasonality vary little across the entire occupational history of the site.

Joint Session of the Chemistry, Industrial Science and Technology, and Physics Sections

147. *Worldwide Energy Efficiency Developments*, **Henry Oman** (Consulting Engineer, Normandy Park, WA, 206-878-4458, h.oman@ieee.org).

The world's growing petroleum consumption and exhaustion of United States' oil fields are causing the prices of petroleum and its products to rise. Most nations are searching for technology that is effective in reducing their consumption of petroleum products. Outstanding progress was once made in China where emperors made the key decisions. Around 1900 the last emperor was ousted, and military leader made decisions that caused their government to fail. Then communists took over the government and were headed for failure, until they invited a team of Boeing engineers to advise them how to make good decisions. As result, today a team of nine graduate engineers makes key decisions. Heading the team is Hu Huang, age 62, president of the People's Republic of China and a graduate of Tsinghua University in Beijing where he studied water conservancy engineering. A key decision of the team was to construct on the Yangtze River the Three Gorges hydropower plant that generates 18 gigawatts of power 24 hours day. This energy, if distributed throughout China, could propel every man, woman, and child a distance of 15 km per day on electric bicycles, which are now being produced at a rate of over four million a year. New nuclear power plants are being built as fast as possible to reduce the need to import fuel oil for power generation. In remote regions of China where electric power is not yet available, students have to study their lessons during nights.. China is building nuclear power plants as fast as possible to reduce its petroleum consumption.

148. *Linear Free Energy Equation to Predict Free Energies of Formation of Oxides and Hydroxides of Trivalent Lanthanide, and Actinides,* **Anpalaki J. Ragavan** (University of Nevada at Reno, Reno, NV, 775-674-0397, ragavan@unr.edu).

The crystalline oxide and hydroxide phases of lanthanides and actinides, are useful and increasingly being considered for trace element removal in water and waste-water treatment systems. Lanthanides and actinides are chemically very similar to each other, show similar crystal-chemical and solution-chemical properties, and most often form ionic compounds with other trivalent cations. Standard Gibbs free energies of formation of the oxide and hydroxide phases of lanthanides and actinides are often required as end-members of solid solutions (co-precipitation of the sorbate metal hydroxide phase with the original metal oxide surface phase), for geochemical modeling of the trace element partitioning between solids, or between solids and aqueous solutions.

Linear free energy relationships for trivalent cations with crystalline M_2O_3 and, $M(OH)_3$ phases of lanthanides and actinides were developed from known thermodynamic properties of the aqueous trivalent cations, modifying the Sverjensky and Molling equation. The linear free energy relationship for trivalent cations is as: $G^o_{f,MvX} = a_{MvX} \Delta G^o_{n,M}{}^{3+} + b_{MvX} + \beta_{MvX} r_M{}^{3+}$ where the coefficients a_{MvX}, b_{MvX} , and, β_{MvX} characterize a particular structural family of M_VX solid, $r_M{}^{3+}$ is the ionic radius of M^{3+} cation, $G^o_{f,MvX}$ is the standard Gibbs free energy of formation of M_VX and $\Delta G^o_{n,M}{}^{3+}$ is the standard non solvation free energy of the cation. The coefficients for the oxide family are: a_{MvX}= 0.2705, b_{MvX} = -1984.75 (kJ/mol), and β_{MvX} = 197.24 (kJ/mol. nm). The coefficients for the hydroxide family are: a_{MvX} = 0.1587, b_{MvX} = -1474.09 (kJ/mol), and β_{MvX} = 791.70 (kJ/mol. nm).

149. *Identifying Unknown Nanocrystal Phases by Lattice-fringe Fingerprinting with Open Access Database Support,* **Peter Moeck** (Portland State University, Portland, OR, 503-725-4227, pmoeck@pdx.edu).

New needs in determining the crystallography of nanocrystals arise with the advent of science and engineering on the nanometer scale. Direct space high-resolution phase-contrast transmission electron microscopy (HRTEM) when combined with tools for image-based nanocrystallography possess the capacity to meet these needs. This paper introduces such a tool, i.e. lattice-fringe fingerprinting (in two dimensions) for the identification of unknown nanocrystal phases and compares this method briefly to qualitative standard powder X-ray diffractometry (i.e. spatial frequency fingerprinting). Open-access crystallographic databases are also discussed briefly because the whole fingerprinting concept is only viable if there are comprehensive databases to support the identification process. That discussion provides the rationale for our ongoing development of a dedicated open-access Nano-Crystallography Database. Although feasible in contemporary HRTEMs, lattice-fringe fingerprinting (and image-based nanocrystallography in general) will become much more viable with the increased availability of aberration-corrected transmission electron microscopes. When the image acquisition and interpretation are, in addition, automated in such microscopes, fringe fingerprinting will be able to compete with powder X-ray diffraction for the identification of unknown nanocrystal phases on a routine basis. Since it possesses a range of advantages over powder X-ray diffractometry, lattice-fringe fingerprinting may then capture a significant part of the nanocrystal metrology market.

150. *Rapid Fluorescent Detecting Liquid Surface Curvature in Thin Well Plate*, **Lifeng Cai** (Touro University California, Vallejo, CA, 707-638-5490, lcai@touro.edu) and **Miriam Gochin** (Touro University California, Vallejo, CA, 707-638-5482, mgochin@touro.edu).

Capillarity is profound in high density multi-well plate; different meniscus liquid surface is observed dependent on liquid surface characters. The meniscus liquid surface has significant effect on fluorescence intensity when detect using a top read plate reader. We established a sensitive and rapid method to detect the liquid meniscus change by exploiting total internal reflection of emission light in the curved liquid surface, up to 60% fluorescence decrease is expecting

and observed and monitored with relative standard derivation 0.02 in high-throughput (HT) manner. Current method provides a rapid and sensitive way to study liquid-solid interaction or monitor processes involving liquid surface property changes. Directly apply this discovery led to a rapid assay for surfactant critical micelle concentration. The method combines the high sensitivity and universality comparable with the classic surface tension method, and simplicity and HT which is superb than current developed methods. The HT potency is further demonstrate by an assay for micelle formation properties of small drug-like compounds, a common cause of promiscuous inhibition in HT enzyme inhibitor assay. Our preliminary results showed a potential HTS assay with Z' factor of 0.76 in 384 well plate, and have good separation between aggregatable and non-aggregatable small molecules. Small volume of sample required, simply sample handing by mix and measure, almost none cost for reagent, make it an ideal HTS assay. Liquid surface characters change is ubiquitous and plays important roles in many chemical, biological and physical systems; new assay method may be developed based on our discovery.

151. *Conductance Measurements in a Shear Banding Wormlike Micellar System*, **Panos Photinos** (Southern Oregon University, Ashland, OR, 541-552-6475, phaas@sou.edu).

We present electrical conductance measurements in the micellar system 10% (weight by volume) of cetylpyridinuim chloride/sodium salicylate (molar ratio 2:1) in 0.5 M NaCl brine. This system is known to form wormlike micelles, and shows viscoelastic behavior. In particular, for shear rates above 3 s^{-1} the shear stress exhibits a plateau, attributed to shear banding and the appearance of shear-induced nematic order. We used a cylindrical glass cell with a gap of 1 mm, and measured the conductance in the direction of the velocity and in the direction of the velocity gradient. The measurements were taken as the shear was turned on and off, and also with shear step-up, shear step-down. The experiments that involved shear rates corresponding to the plateau region show a rather complex and long lived (over 1 minute in some cases) transient behavior characterized by at least three time constants. The turn-off behavior is considerably simpler, and characterized by relaxation time constants of less than 500ms.

152. *Nanotechnology Opens Solar Power from Satellite in Geosynchronous Orbit*, **Henry Oman** (Consulting Engineer, Normandy Park, WA, 206-878-4458, h.oman@ieee.org).

As the world's petroleum resources approach exhaustion the cost of petroleum-based energy climbs and alternative energy resources are being evaluated. Solar energy, which costs nothing, has the disadvantage that it is not available at night or cloudy days, so costly energy storage apparatus is required. No-cost high-intensity solar energy is available 24 hours at an overhead position geosynchronous orbit, but capturing it and delivering it in a microwave beam to Earth-surface loads would have been costly in the past. The cost of this imported petroleum motivated a system analysis and preliminary design of a solar power satellite in geosynchronous orbit that would deliver continuous power to an earth-surface receiving station. The analysis revealed that an overwhelming cost item would have been the fleet of fuel-consuming rocket ships that would lift the solar-power satellite components into geosynchronous orbit. The recently developed carbon-based nanotechnology cable eliminates that need for these rocket ships. This cable, which can carry over 40 times the load that a steel cable having the same weight can carry,. An earth-surface winch would then hoist the first components to the satellite's geosynchronous location where they would be assembled into a power producing solar array. Power from this array can then hoist the rest of the solar-power plant up to geosynchronous orbit. Boeing has just announced the development of a 40% efficient silicon solar cell. Using these cells would cut the size of a 7000 megawatt solar array into half the size of a solar array in which power is generated with the best previously available solar cells.

153. *The General-Purpose Heat Source Radioisotope Thermoelectric Generator: Powering Spacecraft to the Outer Planets,* **Gary L. Bennett** (Metaspace Enterprises, Emmett, ID, 208-365-1210, UserSg4282@aol.com).

To provide power for a new generation of sophisticated outer planet spacecraft, the general-purpose heat source (GPHS) radioisotope thermoelectric generator (RTG) was conceived in 1979 as the most powerful (~300 We) RTG ever flown by the U.S. Originally planned for the International Solar Polar Mission (ISPM) (which became the Ulysses program), the GPHS-RTG was also used to provide all of the electrical power on the Galileo spacecraft that orbited Jupiter; the Cassini spacecraft that is currently orbiting Saturn; and the New Horizons spacecraft that is on its way to Pluto. Altogether, seven GPHS-RTGs have been flown, making it one of the most successful RTG programs in U.S. history. At its original beginning-of-life (BOL) power of 300 We within a mass envelope of 55.9 kg, the GPHS-RTG also has the highest specific power (5.3 We/kg) of any U.S. RTG flown. The excellent performance of the GPHS-RTGs enabled extended missions for both the Galileo and Ulysses spacecraft and bodes well for extended missions for the Cassini and New Horizons spacecraft.

154. *The Living Grand Unified Field Theory*, **Ravi Sadana** (Retired from: Clarke Institute, University of Toronto, Toronto, ON, Canada, 951-461-0423, ravisadana@netscape.net).

Based on the principle of a space force field, a broad conceptual framework is developed by postulating the fundamental role space plays in the physics of the universe, by postulating a "master code" governing the expression of original mass in space, by laying the foundation of the discipline of metaphysical sciences and introduces the phenomenon of The Cantilever Effect. The dimension spacetime is decoupled and the two are independently defined. The constituents of the universe are divided into two classes: Those entities that occupy physical space (class 1 entities) and those that don't occupy physical space (class 2 entities). A property of the universal space, named 'space density' is hypothesized. The theory reduces the properties of Class 1 constituents, at their fundamental level, to four key attributes of the physical space they occupy, namely, the volume, the local value of space density in constant units, its absolute magnitude on the space density spectrum, and the coordinates of the relative location of the volume center thus describing and linking masses and their interactions at the lowest common denominator level. Also introduced is a space density variant on a continuum, extending from infinity to minus infinity, with special reference to the dynamic role of space in the transformation, alignment and distribution of forces in its vibrant internal structure.

It is unified because it addresses all quanta and forces at play in the universe and it is living because it concatenates entities in class 1 to entities in class 2 on one continuum.

155. *United States, The World's Greatest Petroleum Consumer*, **Henry Oman** (Consulting Engineer, Normandy Park, WA, 206-878-4458, h.oman@ieee.org).

Effective business development activity has raised the United States consumption of petroleum to one fourth of the world's petroleum production. The third largest petroleum consumer is the nation of China, which has a population of over 1.3 billion people, and has an annual consumption of one third of United States consumption. Japan's consumption is one-fourth of the United States consumption. Most of the rest of the world's nations consume less petroleum than Japan consumes. The growth of the United States annual petroleum consumption has resulted primarily from the petroleum industry's effective promotion of petroleum consumption, and hiding conservation opportunities. For example, once California's legislature passed a law requiring that by 2004 one percent of the cars sold in California had to be propelled with electric power. Each manufacturer had to lease 100 electric cars to California residents. The industry was able to delay the introduction date until 2010, the leases were cancelled, and General Motors burned its cars in the desert. At the same time a two passenger electric car in an efficiency race delivered 150 miles of travel with the kilowatt-hour energy content in one gallon of gasoline. Much of our petroleum consumption goes into transporting people to their workplaces. For example, workers drive to Bellevue, WA to work at a factory that makes electronic devices, like a digital volt-ohm meter that sold for around $130. Today a local store offers us digital volt-ohm meters manufactured in China, for $4.00 each. Chinese workers commute from home to their workplace on efficient electric bicycles.

Joint Session of the Agriculture and Horticultural Sciences and Biological Sciences Sections

156. *The Effect of Soil Salinity on Bean Dry Matter and Leaf Conductance*, **Abdelfettah Berrada** (Colorado State University, Rocky Ford, CO, 719-254-6312, abdel.berrada@colostate.edu), **Mark A. Brick** (Colorado State University, Fort Collins, CO, 970-491-6551, Mark.Brick@ColoState.EDU) and **Grant E. Cardon** (Utah State University, Logan, UT, 435-797-2278, grantc@ext.usu.edu).

A greenhouse study was conducted at the Arkansas Valley Research Center in 2006 and 2007 to determine the effects of increasing soil salinity on leaf stomatal conductance and dry matter of three dry bean (*Phaseolus vulgaris* L.) cultivars; Bill Z, UI911, and Sacramento. A local salt in 2006 and a combination of NaCl and CaCl2 in 2007 was added to each pot at the beginning of the experiment to reach target ECe values ranging from 1.5 to 11.0 dS/m. Bean plants were harvested at full bloom to early pod formation for dry matter (DM) accumulation, oven-dried at 65 oC, then weighed. Plant DM decreased significantly as the electrical conductivity of the saturated paste extract (ECe) increased. There was no significant salinity by bean cultivar interaction for DM in either year. Leaf conductance and transpiration were measured with the LI-COR LI-1600 Steady State Porometer three times during the plant growth period. Both leaf conductance and transpiration decreased significantly as ECe increased in 2006 and 2007. There was also a significant salinity by bean cultivar interaction in 2007, with Bill Z showing the biggest drop in leaf conductance and transpiration at ECe equal to or above 6.0 dS/m. Plant uptake of K, Ca, Mg, and Na generally increased as ECe increased.

157. *Using Organic Mulches to Manipulate Tree Growth and Secondary Compounds in Ponderosa Pine*, **Javier Lugo-Pérez** (University of Idaho, Moscow, ID, 208-885-7420, lugo3147@uidaho.edu) and **John E. Lloyd** (University of Idaho, Moscow, ID).

Mulching around trees can improve edaphic conditions that benefit tree establishment and development. The carbon and nitrogen ratio (C:N) of organic mulches can influence soil nitrogen availability through promoting nitrogen mineralization or immobilization. According to plant defense hypotheses, resource availability (e.g. nitrogen) may influence plant carbon allocation to growth and secondary metabolism. In our study, we used ponderosa pine (*Pinus ponderosa*) to measure the impact of organic mulch C:N ratio on growth and monoterpene production. Using the growth differentiation balance (GDB) hypothesis as a model, we predicted that under similar assimilation rate there will be a trade-off between growing rate and foliar monoterpene content. To test this prediction, we planted 25 large trees (~2.5m height) and 50 small trees (~0.30m height) in 50 cells isolated peripherally with landfill liner. The soil inside the cells was covered with one of the following five compost to bark mulch proportions: 1:0, 1:1, 1:2, 1:4 and 0:1, corresponding to the following C:N proportions: 10:1, 30:1, 45:1, 70:1 and 130:1. The experimental design was a randomized complete block design-split-plot in time with five blocks and one replicate per block. For both tree size categories, assimilation rate, relative growth rate and foliar monoterpene content were not different among treatments within year 2005 and 2006. Between years, we detect an increment in growth and reduction on foliar monoterpenes which support the predicted trade-off proposed by the GDB hypothesis. Inconsistent correlations between growth rate and monoterpene content within years suggest that this relationship is highly variable among individuals.

158. *Morphological Characteristics of Western U.S. Mammals As Visualized by Light Microscopy and Scanning Electron Microscopy*, **Britten D. Sessions** (Brigham Young University, Provo, UT, 949-701-7266, brittensessions@byu.edu), **Wilford Hess** (Brigham Young University, Provo, UT, 801-422-2451, wilford_hess@byu.edu) and **Wesley Skidmore** (Brigham Young University, Provo, UT, 801-422-4621, wesley_skidmore@byu.edu).

Surface scale patterns of hair from twenty-one selected species of mammals from Western United States were studied using light microscopy and scanning electron microscopy. Selected samples from seven orders were studied. The orders represented are Artiodactyla, Carnivora, Chiroptera, Didelphimorphia, Insectivora, Lagomorpha, and Rodentia. Hair width, scale length and height, scale patterns and scale position in relation to the longitudinal direction of hair were used to characterize differences in hair morphology in the respective orders and between species within orders. A dichotomous key was included to help characterize the species studied. Hair morphology results indicate that a more complete atlas which included most or all of the mammals in an area, could provide a means to characterize the differences in both guard hair and underfur of mammalian species and could provide a more complete source of information which would be useful for forensics, taxonomy and archaeology, particularly if hair cross section characteristics were included.

159. *Scanning Electron Microscopy of Bat Hair from Utah*, **John Sowa** (Brigham Young University, Provo, UT, 860-967-1414, isitreally@byu.edu), **Britten D. Sessions** (Brigham Young University, Provo, UT, 949-701-7266, brittensessions@byu.edu), **Chanell E. Nielson** (Brigham Young University, Provo, UT, 949-466-5592, chanells@byu.net), **Wesley Skidmore** (Brigham Young University, Provo, UT, 801-422-4621, wesley_skidmore@byu.edu) and **Wilford Hess** (Brigham Young University, Provo, UT, 801-422-2451,

wilford_hess@byu.edu).

Surface hair scale patterns from nineteen selected bat species (families Vespertilionidae and Molossidae) from Utah were studied using scanning electron microscopy (SEM). Hair width, scale length and height, scale patterns and scale positions in relation to the longitudinal direction of hair were used to characterize differences in hair morphology between species within families. Previous bat hair morphological studies indicate possible similarities and variations within families. Hair morphology studies make it evident that large variations and slight similarities can be visualized and that the variation in hair morphology between and within species of the family Vespertilionidae suggest that more precise measurements than those used in the past may be necessary to better characterize the hair morphology within and between species in this family. In the family Molossidae there are indications that between species distinctions and possibly within family distinctions may be possible using SEM images to visualize and characterize morphological characteristics of hair, although only two species were studied in this family.

160. *Molecular Evidence for Environmental Trigger of Mass Evolutionary Acceleration: An Experimental Model for the Cambrian Explosion,* **Aaron G. Filler** (Cedars Sinai Medical Center - INM, Santa Monica, CA, 310-621-1983, afiller@earthlink.net), **Andrew M.L. Lever** (Cambridge University, Addenbrooke's Hospital, Cambridge, United Kingdom, 011-44-1223-336-747, AMLL1@mole.bio.cam.ac.uk) and **Geoffrey P. Harrison** (Cambridge University, Addenbrooke's Hospital, Cambridge, United Kingdom, AMLL1@mole.bio.cam.ac.uk).

The fidelity of reverse transcription in retroviruses provides a potential model for modulation of rates of evolution. In normal reverse transcription, the enzyme falls off its template at hairpin loops and other points of three dimensional contour change. This results in an increased rate of transcription errors at these fall-off and reattachment sites compared with stretches of template in linear flat arrays.

Reverse transcriptase is bound to its RNA template at a site that incorporates divalent metal cations. Chelation buffers of trivalent cations of similar cationic radius to magnesium used as an in vitro medium resulted in reverse transcription with the substitute ions. However, the rate of production of large transcripts was greatly accelerated and the production of smaller fragments was reduced. This yielded a much higher rate of cDNA production and an increased fidelity. This experiment therefore demonstrates that changes in cationic environment can alter the fidelity of transcription.

The Cambrian explosion in which most of the extant animal phyla appear relatively suddenly has been difficult to explain because there has been no obvious mechanism whereby a variety of separate lineages could simultaneously undergo accelerated rates of mutation for a limited period of time. The Cambrian transition involved a major environmental change that has been shown to have greatly altered the cationic composition of the ancient sea. We hypothesize that the mechanism we have revealed may be a reasonable model for how an environmental shift that alters the cationic composition of ocean water could trigger an increased rate of mutation in multiple separate lineages.

161. *Active Remodeling in Lymphangioleiomyomatosis as Revealed by Serial Analysis of Gene Expression (SAGE)*, **Tiffany J. Whitney** (Idaho State University, Pocatello, ID, 208-403-7270, whittiff@isu.edu), **Maureen Brandon** (Idaho State University, Pocatello, ID, branmaur@isu.edu) and **Blanca Camoretti-Mercado** (University of Chicago Medical School, Chicago, IL, 773-702-5448, bcamoret@medicine.bsd.uchicago.edu).

LAM patients exhibit symptoms and histological characteristics similar to other pulmonary diseases. Smooth muscle (SM) cells from the lung can produce and secrete extracellular matrix (ECM) modulators, including cytokines and transforming growth factor (TGF) beta. It was recently reported that LAM lesions expressed abundant TGF beta.

We constructed a SAGE library of primary LAM-derived cultured cells. We sequenced 17,904 cDNA tags that represent 2,111 genes with at least two copies. We identified nearly all 2,111 genes, and compared their expression levels to a normal lung SAGE library (GSM762). We were unable to detect the presence of TSC2 transcripts, the tumor suppressor frequently found mutated in LAM. Interestingly, TSC1 was expressed at lower levels (60%) than in normal lung. While the expression of many genes including caveolin, TGF alpha, and several ribosomal proteins were equivalent in both libraries, we observed at least a two-fold increase in expression of many genes involved in TGF beta signaling, including connective tissue growth factor, TGF beta receptor type I, and Smad3. Moreover, upregulation and / or induction of TGF-beta responsive genes like thrombospondin-1 and -4, and of the ECM protein-encoding genes collagen type I, III, IV, VI, laminin, and fibronectin 1 was evident. Matrix metalloproteinases (MMP) 1, 2, 3, 14, and 19 were also more abundant in LAM-derived cells. However, TIMP1, TIMP2 and TIMP3 transcripts showed augmented abundance. Our data suggest the presence of active remodeling in LAM relative to normal lung, which we speculate is likely driven by activation of TGF beta signaling.

162. *Breast Cancer Stimulation of Osteoclast Differentiation: The Role of Oncostatin M*, **Ken Tawara**[1], **Patrick Aranda**[2], **Sujatha Kadaba**[2], **Andrew Oler**[2] and **Cheryl L. Jorcyk**[2], (1)(Boise State University, Boise, ID, 2083409368, kentawara@mail.boisestate.edu); (2)(Boise State University, Boise, ID).

Oncostatin M (OSM) is a pleiotropic cytokine in the interleukin (IL)-6 superfamily. OSM inhibits the proliferation of breast cancer cells in vitro and is therefore being evaluated as a potential cancer therapy. Evidence from the literature and our preliminary data; however, suggest that OSM may promote the formation of breast cancer bone metastases. OSM has been shown to promote osteoclast formation and enhance bone resorption by up-regulating proteins such as receptor activator of NF-êB ligand (RANKL). In addition, we have demonstrated that OSM promotes the development of a metastatic phenotype in vitro and that OSM induces the expression of several proteins known to participate in bone resorption and bone metastasis, including proteinases, cyclooxygenase (Cox)-2 and vascular endothelial growth factor (VEGF). Thus far no studies have investigated OSM's role in bone metastasis and osteoclast differentiation. In order to investigate the effect of OSM on an in vitro model of breast cancer, we have co-cultured mouse bone marrow cells with mouse mammary cancer cells. Here we show that osteoclastogenesis is strongly stimulated by the presence of mammary cancer cells with the addition of OSM and RANKL. Additionally, we will co-culture mouse calvarie bone with mouse mammary cancer cells, to look for stimulation of osteolysis when OSM and RANKL are added. Thus far our findings suggest that OSM, in addition to RANKL, stimulates the formation of osteoclasts and the activity of these osteoclasts are expected to furthur increase with the additon of OSM and RANKL. NIH grant: P20RR16454

163. *Oncostatin M Induces VEGF through HIF-1α*, **David Chang** (Boise State University, Boise, ID, 208-860-0592, davidchang@cableone.net).

Oncostatin M (OSM) is a multifunctional, IL-6 type cytokine that exhibits both pro- and anti-inflammatory effects. OSM has been shown to inhibit the proliferation of breast and other tumor cell lines in vitro and has been suggested as a potential cancer therapeutic. Other studies have provided evidence that OSM plays a promotional role in tumor progression through stimulation of cell detachment and invasion in vitro and induction of vascular endothelial growth factor (VEGF) in endothelial and astroglioma cells. We have shown that OSM induces VEGF by approximately 4-fold in human breast cancer cell lines in a dose- and time-dependent manner. Conditioned media from OSM-treated breast cancer cells causes a 12-fold increase in neovascularization in an in vivo Matrigel plug assay. Additionally, here we demonstrate a novel property of OSM in the upregulation of hypoxia-inducible factor-1 alpha (HIF1*f*α), a potent pro-angiogenic transcription factor. This induction by OSM is seen by 4 hours and peaks at 24 hours. Our results give direct evidence that OSM-induced VEGF in human breast cancer cells occurs through activation of HIF1*f*α. NIH grant P20RR16454.

164. *In Vivo Anatomical Studies of the Indian Parrot (*Psittacula krameri*) Brain by MRI Microscopy*, **Nimisha Kankan** (Government Degree College, Saidabad, Allahabad, Allahabad, India, 91-9919324534, nimishakankan@rediffmail.com) and **Shubha Srivastava** (Government Degree College, Saidabad, Allahabad, Allahabad, India, 91-9451059907, shubhasri20032003@yahoo.com).

Parrots are known for their communication skills and abilities to reproduce sound combinations like human speech. In the present study we try to investigate the correlation between vocal behavior and neuroanatomical data of theIndian parrot *Psittacula krameri*. We used Magnetic Resonance Imaging (MRI) procedure that allows obtaining 2D and 3D high quality images of the fore-brain of Indian parrots. MRI imaging was performed on Magnetom Harmony 1.0 Tesla (Siemens, Germany) of horizontal bore microscope/NMR provided with shield gradient (50.0 cm. width) and strength of 23.0mT/m. The 3D and 2D spin Echo sequence was used to obtain 29 coronal, 19 axial and 26 sagittal slices of 1.0 mm. thickness. The procedure took about 80 minutes after anaesthetizing the bird. The bird recovered without any unusual events after 3 hours. Coronal, axial and sagittal images through the telencephalon and complete brain have been viewed. These images are useful tool to understand the organization of brain neuroanatomical features without killing the animal. We compared the MRI images of parrot brains with human brain MRI images, paying special attention to the Vocal Control Area (HVC) of the parrots and the same region of human brains. Our findings indicate that both parrots and humans have evolved specialized neuroarchitecture for vocal learning and sound production. Further work is going on to reveal any direct parallels between the two brain systems.

165. *Emotional Intelligence and Vocal Learning in the Indian Parrot (*Psittacula krameri*)*, **Shubha Srivastava** (Goverment Degree Collage, Saidabad, Allahabad, Allahabad, India, 91-9451059907, shubhasri20032003@yahoo.com) and **Sudhi Srivastava** (Government Degree College, Saidabad, Allahabad, Allahabad, India, 91-9451059907, shubhasri20032003@yahoo.com).

This is a parrot who speaks "spritual truth." 3000 year old Indian mythological literature includes many stories and records about parrot's interspecies communication skill, capability to think before speaking, awareness, guide in wisdom, faithfullness and capability to acquire human-like speech. Early folktales and legends reveal that ancient Indians were quite aware of the high level of intelligence, talkative skill and emotional intelligence of parrots. However, the study of language acquisition by animals is a fairly recent science, having begun only about 30 years ago. To uncover these elements and to represent the presence of emotional intelligence in the Indian parrot, we surveyed some pet parrots, and our findings are interesting. We have found out that parrots are very good learners. They can maintain emotional relationships with humans. They also have emotions like human beings and sometimes they show their emotions, such as jealousy, love fear anger or friendship, to their master. Another interesting fact which we have noticed is that parrots can produce many sound combinations like humans. There are many regional languages in India and pet parrots mimic the same languages which their owners speak. We recorded that pet parrots can mimic words of Hindi, Bengali, Bhojpuri, and English. It has also been noticed that some parrots make meaningful use of vocalization and are able to associate words with their meanings and form simple sentences. Parrots can remember names of the family members and children, and can distinguish simple instruments and their use like remote and cell phones.

The present behavior studies may reveal some unknown facts about parrots.

Western Society of Soil Science

166. *Bioassisted Remediation of Cadmium and Lead Contaminated Soil*, **Shiou Kuo** (Washington State University, Puyallup, WA, 253-445-4573, skuo@wsu.edu) and **Richard Bembenek** (Washington State University, Puyallup, WA, 253-445-4572, bembenek@wsu.edu).

In metal-contaminated soils, reducing the affected soil volume would reduce the cost of remediation. We examined the efficiency of several plant species (*B. kaber*, *B. juncea*, *B. napus*, *D. purpurea* and *F. arundinacea*) and application of dilute EDTA/oxalate (1.0 mM) to mobilize Cd and Pb upward in a soil enriched with 3 mg Cd kg-1 and 150 mg Pb kg-1 under greenhouse conditions. The chelate solution, delivered to the bottom of the soil column, was also used as the main source of moisture to the plants. The result showed that all species accumulated less than 0.8% of Cd added and less than 0.1% of Pb added in the aerial plant parts. With the exception of *D. purpurea* and *B. kaber* all other plant species were more effective than treatment of the chelate solution alone in mobilizing Cd and Pb upward to the surface layer. Of the total Cd added less than 2% remained at the bottom of the column (12 to14 cm), whereas greater than 50% of the Cd added was transported to the surface layer (0 to 2 cm). Of the total Pb added less than 3% remained in the bottom layer, whereas greater than 35% of the added Pb was accumulated in the surface layer in the soil cropped to *B. juncea*, *B. napus*, and *F. arundinacea*. As the correlation of the concentrations of Cd and Pb accumulated in the surface layer and plant dry matter yield was high, growth vigorousness of the plants had important bearing on the extent of upward mobilization of the metals.

167. *Total and Bioavailable Chromium along a Toposequence in San Luis Obispo, CA*, **David Guerena**[1], **Chip Appel**[2], **Craig Stubler**[3], **Britani Harris**[4], **Arwen Ross**[4], **Ryan Tappero**[5] and **Donald L. Sparks**[5], [1](Cal Poly State University, San Luis Obispo, San Luis Obispo, CA, 805-215-8168, dguerena@calpoly.edu); [2](Cal Poly State University, San Luis Obispo, San Luis Obispo, CA,

805-756-1691, cappel@calpoly.edu); [3](Cal Poly State University, San Luis Obispo, San Luis Obispo, CA, 805-756-2188); [4](Cal Poly State University, San Luis Obispo, San Luis Obispo, CA, 805-756-2261); [5](University of Delaware, Newark, DE).

The presence of large quantities of chromium (Cr) in soil and plants is of major concern due to its toxicity to humans. Total (USEPA 3050a) and bioavailable (USEPA 1311) levels of Cr were measured along a serpentinic toposequence in central California. Soil samples from the surface (0-10 cm) and subsurface (10-30 cm), as well as the above ground plant biomass, were collected from several slope positions. The Cr levels in these materials were determined and compared to several soil chemical and physical properties using least squares regression. The oxidation states of Cr in the soils were found with XANES. The average total and bioavailable soil chromium concentrations were 1457.1 mg kg-1 and 1.6 mg Cr kg-1, respectively. The average total plant chromium level was 115.2 mg Cr kg-1. The differences between Cr in the soil surface and subsurface were not statistically significant at any sampling location. The concentrations of total soil and plant Cr were highest in the backslope slope positions. Though the backslope slope positions had slightly elevated levels of Cr, slope position did not have a large influence on the concentrations of soil and plant total Cr. The soil chemical and physical properties did not demonstrate any significant linear relationships with total Cr levels. The dominant form of chromium found in the bulk soil, as ascertained by XANES, was Cr3+, which agrees with the low amount of bioavailable Cr found at the site. Sepentinitic soil parent materials naturally weather to yield soils possessing high Cr concentrations. Thus, the ability to understand how soil properties influence Cr retention and oxidation states is crucial to effective landscape management of areas rich in this metal.

168. *Biogeochemistry of Surface and Subsurface Serpentine Soils on the Central Coast of California*, **Myles H. Davis**[1], **Craig P. Stubler**[2], **Tom A. Ruehr**[2] and **Chip S. Appel**[2], [1](California Polytechnic State University, San Luis Obispo, San Luis Obispo, CA, 805-602-0318, mhdavis@calpoly.edu); [2](California Polytechnic State University, San Luis Obispo, San Luis Obispo, CA).

Serpentinite parent materials from the Franciscan mélange located on the Central Coast of California weathered to form soils with an abundance of Mg, Ni, Cr, Mn, Co, and Fe, and low amounts of Ca and K. The purpose was to examine the unique biogeochemistry of serpentinite-derived soils by determining the metal cations assessed with different extracting solutions and organic acids were used to desorb metal cations. Differences among the four paired soils represented variations in serpentinite mineralogy. Adsorbed Ca and Mg were predominantly in exchangeable forms with Ca:Mg ratios ranging from 0.06-0.29. Total metal cation levels (Ni, Cr, Mn, Co, and Fe) were high for all soils, with approximately 10 % of the total Ni and Mn, and < 1 % of the total Cr and Fe being exchangeable. The surface and subsurface metal cation pools differed having similar trends across the four paired soils. Total Ni, Cr, and Fe concentrations were greatest in the subsoil. Surface soils had greater concentrations of exchangeable forms. Ca, K, Mn, and Ni were partially associated with soil organic matter. Low concentrations of ammonium citrate or ammonium oxalate (0.1 mmol/L) inhibited metal desorption and increased Mg concentrations in solution relative to the KNO_3 (0.01 mol/L) control. The presence of organic acids at high concentrations (10 mmol/L) increased metal desorption and lowered Mg concentrations. These results indicate a biogeochemical influence is projected for vegetative establishment and growth of serpentine endemic plants.

169. *An Ecosystem Approach for Restoring Severely Eroded Soils of Southern Guam*, **Mohammad H. Golabi** (University of Guam, Mangilao, Guam, 671-735-2134, mgolabi@guam.uog.edu) and **S. A. El-Swaify** (University of Hawaii, Honolulu, HI, 808-956-8149).

Severely eroded lands of southern Guam are referred to as badlands. The challenge facing soil and environmental scientists is to develop conservation and restoration strategies that address crop production needs within a framework of increasing environmental and financial constraints. In this investigation, an integrated approach is designed to evaluate crop rotation, conservation tillage and residue management for soil and water conservation as well as the application of composted organic wastes for soil quality improvement. The objectives of this project are to: 1) assess the effects of conservation practices and crop residue management on water runoff and infiltration, 2) evaluate cropping rotation and tillage management for the restoration of the productivity of these eroded soils and, 3) evaluate the effect of composted organic waste application as soil amendment for increasing the organic matter content for improving the overall quality of these severely eroded soils. Two sets of twelve field plots (33ft X 28ft) each are set up at the University of Guam's experiment stations in Southern Guam for this project. Plots designated for conservation practices were initially planted with sunnhemp seeds to provide a nitrogen source and cover before corn was planted. Control plots, however, were left fallow and without cover before corn planting. Plots designated for compost application were fallow initially. In this presentation, the methodology as well as up-to-date data will be presented to illustrate the effect of restoration and conservation strategies that are employed for sustaining the productivity of these severely eroded soils of southern Guam.

170. *Impact of Ponderosa Pine Management Practices on Carbon Dynamics and Soil Microbial Community*, **Amitava Chatterjee** (University of Wyoming, Laramie, WY, 307-399-7528, amitava@uwyo.edu), **George F. Vance** (University of Wyoming, Laramie, WY, 307-766-2297, gfv@uwyo.edu), **Elise Pendall** (University of Wyoming, Laramie, WY, 307-766-6293, pendall@uwyo.edu), **Daniel B. Tinker** (University of Wyoming, Laramie, WY, 307-766-4967, tinker@uwyo.edu), **Peter D. Stahl** (University of Wyoming, Laramie, WY, 307-766-2179, unclem@uwyo.edu) and **Lachlan J. Ingram** (University of Wyoming, Laramie, WY, 307-766-5587, lachy@uwyo.edu).

Forest ecosystems play an important role in the global carbon (C) cycle, and may help reduce atmospheric concentrations of CO_2. Ponderosa pine (*Pinus ponderosa*) is a dominant tree species in Wyoming and a primary source for the timber market. It is therefore necessary to evaluate present forest management practices for their ability to increase C sequestration potentials. Four ponderosa pine stands (unmanaged, even-aged, uneven-aged, and heavy harvest) management practices were evaluated for total C pools, soil organic C pools (active, slow, and resistant), and soil microbial abundance. The total aboveground ecosystem C pool of the unmanaged stand (121 Mg C ha^{-1}) was higher than the managed stands. A significant difference in soil organic C was determined within the 5-15 cm soil depth. The heavy harvest stand had higher soil organic C (26.1 Mg C ha^{-1}) than even-aged (19.9 Mg C ha^{-1}) and unmanaged (20.2 Mg C ha^{-1}) stands. Uneven-aged and heavy harvest management stands had higher resistant C pool. Gram positive bacteria and total fungi populations were significantly higher in unmanaged soils of 0-5 cm depth than in the

uneven-aged and heavy harvest managed stands. Gram negative bacteria populations were higher in soils of the heavy harvest stand than either the unmanaged or even-aged stands at the 5-15 cm soil depth. From this study, it can be concluded that forest management practices have the potential to alter ecosystem C pools and processes within a ponderosa pine forest of Wyoming.

171. *Dryland Crop Yields and Soil Organic Matter as Influenced by Long-term Tillage and Cropping Sequence*, **Upendra M. Sainju** (USDA-ARS, Sidney, MT, 406-433-9408, upendra.sainju@ars.usda.gov), **Thecan Caesar-Thonthat** (USDA-ARS, Sidney, MT, 406-433-9415), **Andrew Lenssen** (USDA-ARS, Sidney, MT, 406-433-9471), **Robert Evans** (USDA-ARS, Sidney, MT, 406-433-9496) and **Joseph L. Pikul** (USDA-ARS, Brookings, SD, joe.pikul@ars.usda.gov).

Long-term management practices are needed to sustain dryland crop yields and maintain soil organic matter in the northern Great Plains. We evaluated the 21-yr effects of no-till continuous spring wheat (NTCW), spring till continuous spring wheat (STCW), fall and spring till continuous spring wheat (FSTCW), fall and spring till spring wheat-barley (1984-1999) followed by spring wheat-pea (2000-2004) (FSTW-B/P), and spring till spring wheat-fallow (STW-F) on crop grain and biomass (stems + leaves) yields and soil C, N, and pH levels in eastern Montana. Spring wheat grain and biomass yields varied among years due to variation in rainfall and were lower in STW-F than in other treatments. Similarly, grain and biomass yields of barley and pea in FSTW-B/P varied among years. Soil inorganic and organic C contents at the 0- to 20-cm depth in 2004 were greater in NTCW, STCW, and FSTCW than in STW-F. Similarly, soil total N content was greater in NTCW and STCW than in FSTW-B/P and STW-F and greater in FSTCW than in STW-F. Potential N mineralization was greater in STCW than in NTCW, FSTW-B/P, and STW-F. In contrast, NH4-N and NO3-N contents were greater in FSTW-B/P than in NTCW and STCW. Soil pH did not differ among treatments. Long-term reduced tillage and continuous cropping increased spring wheat and biomass yields and soil C and N storage compared with the conventional system, such as STW-F. Tillage and inclusion of legumes, such as pea, in the crop rotation, however, increased soil mineralizable and available N, thereby potentially reducing the rate of N fertilization to crops.

172. *Effect of the Exotic Earthworm* Aporrectodea trapezoides *on Carbon Storage Through Formation of Soil Macroaggregates: A Microcosm Study,* **Yaniria Sánchez-de León** (University of Idaho, Moscow, ID, 208-885-7916, sanc0745@uidaho.edu), **Katherine Smetak** (University of Idaho, Moscow, ID, smet4265@uidaho.edu) and **Jodi Johnson-Maynard** (University of Idaho, Moscow, ID, jmaynard@uidaho.edu).

Earthworms influence terrestrial carbon storage through their effects on carbon inputs and losses. We studied the effect of the exotic earthworm *Aporrectodea trapezoides* on plant productivity, soil macroaggregate formation, and the transfer of litter carbon into different soil fractions in a microcosm experiment. We established treatments with and without *A. trapezoides* in enclosures with the grasses *Poa pratensis, Festuca idahoensis* and *Bromus inermis*, and used ^{13}C-labeled litter to monitor the transfer of litter carbon into the soil. After 70 days, high earthworm mortality (over 50% in some treatments) was observed. The presence of *A. trapezoides* did not increase plant productivity. However, the presence of earthworms influenced the aggregate distribution in *P. pratensis* treatments. Large macroaggregates (> 2000µm) were higher with earthworms (1.08%) than without earthworms (0.56%), and small macroaggregates (2000-250µm) were higher with earthworms (52.57%) than without earthworms (38.91%). No difference was observed in the total concentration of aggregate-associated carbon. Earthworm tissues were ^{13}C enriched relative to the soil, however earthworms had no effect on the aggregate-associated ^{13}C. Our results showed that the influence of *A. trapezoides* on carbon storage was principally through increasing the amount of soil macroaggregates. More time or higher earthworm densities may be required to detect impacts on plant productivity. Our results suggest that carbon from litter was preferentially allocated into the earthworm tissues rather than egested in casts. The influence of *Aporrectodea trapezoides* on carbon losses was not measured in this study and should be a focus of future research.

173. *Earthworm Population Density and Diversity in Differently-Aged Urban Landscapes*, **Katherine Smetak** (University of Idaho, Moscow, ID, 208-885-9245, smet4265@uidaho.edu), **Jodi Johnson-Maynard** (University of Idaho, Moscow, ID, 208-885-9245, jmaynard@uidaho.edu) and **J.E. Lloyd** (University of Idaho, Moscow, ID, 952-922-3810, JLloyd@RainbowTreecare.com).

Earthworms play important roles in soil development, nutrient cycling, and plant productivity where their populations are large. The relationship among soil properties, management practices, and earthworm density in urban systems, however, has not been fully studied. This study was conducted to gain a better understanding of the impact of disturbance and management intensity on earthworm populations in urban landscapes. Earthworms and soils were collected from residential yards less than 10 years old and from residential and urban parks that were greater than 75 years old. In 2004, mean earthworm density ranged from 527 to 24 individuals m^{-2} and was highest in urban parks and lowest in young residential sites. In 2005, mean earthworm density in old residential (260 individuals m^{-2}) and urban park (437 individuals m^{-2}) sites were significantly higher than those measured in young residential sites (31 individuals m^{-2}). Bulk density of the 0-to 10-cm depth was higher in young residential sites (1.59 g cm^{-3}) than in urban park (1.30 g cm^{-3}) or old residential sites (1.30 g cm^{-3}). Mean total soil C to a 30-cm depth was different across the three landscape types (3.6 kg C m^{-2} in urban parks, 2.9 kg C m^{-2} in old residential, and 1.4 kg C m^{-2} in young residential sites). Fertilizer additions in urban park sites were associated with increases in earthworm density and total soil C. Soil compaction in young landscapes may directly and indirectly limit earthworm density. Bulk density, however, tends to decrease while soil C content increases as urban systems mature and these changes are associated with increases in earthworm population density.

174. *Local Soil Knowledge and Crop Allocation in the Talamanca Mountain Foothills, Cabécar Indigenous Territories, Costa Rica*, **Leigh Winowiecki** (University of Idaho, Moscow, ID, 208-885-7554, leigh@uidaho.edu), **Matthew P. Whelan** (Duke University), **Paul McDaniel** (University of Idaho, Moscow, ID, paulm@uidaho.edu) and **Eduardo Somarriba** (CATIE, Turrialba, Costa Rica).

Utilizing experiential-based insights and knowledge of local people living and depending on the land can improve the success of development and extension projects. Local soil knowledge is the knowledge of soil properties possessed by people living in an environment. It is embedded in their culture and management techniques. The objective of this study was to understand how farmers in three Cabécar communities use local soil knowledge to allocate crops

across the foothill region. These farmers practice no-input subsistence and cash-crop farming. Twenty-four interviews were conducted and consisted of: participant observation, semi-structured interviews, participatory mapping exercises, and farm transect walks. Results of the study determined farmers distinguish between soil types using soil color and texture. Landscape position is used as the primary indicator to locate the different soil types. Farmers associate specific soil types with specific crops. Pastures are established on nutrient-poor Ultisols they call red soil. These soils are located on ridge tops. Banana, a nutrient-needy crop, is planted in depressions, where soils have a thicker A horizon over clay-rich subsoil. Farmers call this black soil. These soils are also classified as Ultisols but differ from red soil in their chemical properties. Average pH value for the red soil is 4.5 and 5.4 for the black soil. The black soil has 3 times more NH4OAc-extractable calcium and potassium than the red soil. Farmers seek out black soil for crops in these highly dissected foothills. These data and experiences will be used to aid future agricultural development work in the region.

175. *Novel Communication for Wireless Sensor Networks Using Magnetic Induction*, **Nathan D. Jack** (Utah State University, Logan, UT, 435-797-2883, natedjack@yahoo.com) and **Krishna Shenai** (Utah State University, Logan, UT, 435-797-2883, kshenai@engineering.usu.edu).

Demands on fresh water and energy are ever increasing. A great need exists for small, low cost, low power wireless soil moisture sensors, which can be integrated into an automated watering/irrigation control system for need-based application of water. Current sensors are buried at a desired depth and relay soil information to the surface by means of a physical link such as a cable, antenna, or the protruding embodiment of the probe itself. This physical link to the surface is easily damaged by agricultural equipment and is unsightly and obtrusive, making use of these sensors in athletic fields or home lawns undesirable.

The authors are developing a novel method for underground communication in wireless sensor networks using magnetic induction. A wireless, fully-buried soil moisture sensing node will be equipped with a ferromagnetic coil. The soil information, superimposed upon a carrier frequency, excites the coil, establishing a quasi-static electromagnetic field. This field induces a voltage at the surface receiver, similarly equipped with a ferromagnetic coil, from which the data is extracted. Transmission will not be affected by soil type, composition, compaction, or moisture content, unlike existing RF transmission technologies, and will require less power and lower operating frequencies than RF transmission.

An underground network of these sensors may be formed. The communication range for magneto-inductive systems is short. Therefore, network data is relayed in a multi-hop fashion until it reaches a desired destination for further processing. This novel technology will enable the large-scale deployment of underground wireless soil sensor networks.

Joint Session of the General and Interdisciplinary, Health Sciences, and Science Education Sections

176. *Open Access Crystallographic Databases for Materials Science Education and Research*, **Peter Moeck** (Portland State University, Portland, OR, 503-725-4227, pmoeck@pdx.edu).

Open-access Internet-based crystallographic databases that store information in the Crystallographic Information File (CIF) format are reviewed. The Crystallography Open Database [1] and its mainly inorganic subset at Portland State University [2] are the focus of this review. Having full crystallographic information (i.e. unit cell parameters, atomic coordinates, and space groups) for tens of thousands of crystals available on the Internet in this standardized format allows for many kinds of Internet-based crystallographic calculations and visualizations. One example of this, interactive crystal structure visualizations in three dimensions [2,3] is demonstrated in this talk.

[1] http://crystallography.net
[2] http://nanocrystallography.research.pdx.edu/CIF-searchable
[3] P. Moeck et al., J. Mater. Educ. 28 (2006) 87-95

177. *Validating the Curriculum Match Method for Measuring Alignment between Course Content and Assessment Measures in College Science and Mathematics Courses,* **Dan W. Black** (Snow College, Ephraim, UT, 435-283-7534, dan.black@snow.edu).

This paper examines the practicality and validity of the newly developed content match method (CMM) for determining the alignment of the enacted curriculum and assessment measures in college science and mathematics courses. The purpose for developing the CMM was to provide a systematic, valid, and efficient method for measuring the alignment between what is learned by students and the assessments used to measure that learning. The two inputs for the CMM are the time students are engaged in the curriculum and the weighted value of that curriculum on an assessment measure. By correlating the values of both inputs, an alignment score is obtained that describes the degree of alignment between the enacted curriculum and assessment measures. This validation study found the CMM to be effective at measuring the match of content between the two. The CMM was less effective at measuring cognitive demand but suggestions are given to improve the method's viability in this area. The CMM is useful for course diagnostic and evaluation by individual instructors, but safeguards would need to be implemented if the method is used for evaluative purposes. The primary safeguard needed would be to insure the validity of the cognitive demand data by incorporation of expert review panels or triangulation of the data from multiple sources. This research may be beneficial to students, instructors, school administrators, and policy makers in that the CMM provides a low-cost, straightforward, and valid method for determining the degree of alignment.

178. *Teaching Nanotechnology to Liberal Arts Students*, **Mel I. Mendelson** (Loyola Marymount University, Los Angeles, CA, 310-338-6020, mmendels@lmu.edu).

Currently <5% of the U.S. Congress has an understanding of science. Studies have confirmed that 80% of the people in America know little or nothing about nanotechnology. Many people are afraid of science, because they do not understand it. Since nanotechnology in the 21st Century will drastically change our lives, there is a critical need for liberal arts students to have nanoscience literacy. Also, today's students will be tomorrow's leaders, managers and policymakers. Hence, there is a critical need for universities to offer a nanotechnology course for non-science majors. In response to this need, a new course was developed for and taught to non-science/engineering majors. The new course was entitled, Nanotechnology (for Non-Majors). Its goal was to enhance visual and hands-on (kinesthetic) learning. The course was designed for active learning - drawing molecular structures, building molecular models, measuring sizes of different

objects covering many orders-of-magnitude, and discussing the ethical/social issues. The course covered applications in biology, medicine, electronics and computers. Some of the micro/nanotech subjects that will be discussed are buckyballs, nanotubes, quantum dots, DNA, transistors, colloids, insect's compound eye, hair growth rate, helpful vs. harmful effects of nanotechnology, and the ethical/social issues. The paper will discuss visual and kinesthetic learning in the classroom. The purpose of the paper is to share some of the teaching methods and exercises that were used to encourage active learning among liberal arts students. An assessment of our course was performed to evaluate the teaching effectiveness.

179. *Saving Science Education in Idaho: Some Lessons from the High School Standards Debate*, **Gary L. Bennett** (Metaspace Enterprises, Emmett, ID, 208-365-1210, UserSg4282@aol.com).

In 1999, the State of Idaho was embroiled in the usual fundamentalist attacks on the theory and fact of evolution as the State Board of Education and its Exiting Standards Commission grappled with the development of high school achievement standards. While the focus was on establishing a certain basic minimum set of standards which would provide assurance to the academic and business communities that high school graduates had mastered the basic subjects to the same level, local religious fundamentalists used the occasion to attack the inclusion of evolution in the biology standards. One attack involved trying to get the creationist textbook Of Pandas and People adopted as a supplementary textbook in the State of Idaho. The broader attack was on the standards themselves. Fortunately, the Exiting Standards Commission and the State Board of Education held firm in support of only teaching science in the science classrooms. At a packed hearing in January 2000, the House Education Committee and the Senate Education Committee of the Idaho Legislature heard testimony in favor of and in opposition to the standards. Thanks in large part to the support of local scientists and mainstream religious leaders, the standards were approved by the Idaho Legislature with the inclusion of the theory of evolution. Since the anti-evolutionists continue to attack science in other states (and are still active in Idaho), some lessons from this debate are drawn.

180. *Confronting the Anti-Evolution Attack on Public Education*, **Lawrence H. Wood** (Retired Physicist, Lacey, WA, 360-456-8965, marylar@comcast.net).

This paper summarizes, in a novel manner, an in depth investigation of the controversial Evolution teaching in public schools issue, prompted in part by "Evolution: Join AAAS on the Front Line [fight against anti-science in public education]" March 13, 2006 e-mail from Alan I. Leshner, CEO, AAAS. Included is: a review of issue's origin in the Book of Genesis, an illuminating comparison of response to Nicholas Copernicus's heliocentric solution to the apparent motion of the sun and stars around the earth illusion (which upset man's cherished position at the center of the universe) and Charles Lyell's geologic discoveries, which punctured the illusion of an apparently unchanging earth, and significantly influenced Charles Darwin's discovery of the Evolutionary Process (which upset man's cherished position as a unique creation of a supernatural creator), a modern explanation of Evolution as a consequence of genetic mixing produced by reproduction (also a controversial subject), a review of Creationism and Intelligent Design (the alternatives to Evolution) with rebuttals to the key arguments against Evolution such as the need for an Intelligent Designer due to biological complexity. The paper will conclude with recent illustrations of the problem, e.g., the Dover Pa. and Kansas School Board attempts to insert Intelligent Design into public education. This material should be of particular interest to those scientists who may confront anti-evolution attacks but haven't had time to study the details.

181. *A Potential Tool for Managing Complex Research Data: SemanticaPro Software*, **Kathleen M. Fisher** (San Diego State University, San Diego, CA, 619-594-6961, kfisher@sciences.sdsu.edu).

SemanticaPro software, developed with members of the U.S. intelligence community, is designed to meet their analytical needs. Its features may be useful to researchers in many fields working with large sets of qualitative information. A semantic network is a graphic notation for representing knowledge involving patterns of interconnected concepts (usually nouns) linked with relationship types (usually verbs). The power of a semantic network lies in its interconnectivity and its ready comprehensibility by the human mind. SemanticaPro is helping intelligence analysts solve many puzzles. The tool set will allow automatic input of data from multiple databases, from text, and from lists of semantic network elements including concepts, relationship types, and triplets. Authors can create relation templates and relation ontologies with roll-up capabilities. Pictures, videos, and documents can be added by drag and drop. Icons can be attached to concepts and relationship types. Geologists and ecologists may enjoy the GIS add-on, which allows display of data on GoogleEarth. Semantic networks can be merged together. Two-dimensional concept maps can be extracted from the n-dimensional networks. Automatic assistance is provided for various styles of concept mapping. For researchers who study texts or have volumes of transcripts, SemanticPro has a powerful ability to query a large set of documents and find everything about the topic of interest within a few seconds or minutes. The software will be demonstrated.

182. *Senile Dementia and Fischer's Presbyophrenia: The Forgotten Giant's Contributions*, **Fred C.C. Peng** (Taipei Veterans General Hospital, Taipei, Taiwan, +81-287-76-3054, pengf001@hawaii.rr.com).

Last year, I argued that the eponym of Alzheimer's disease is a misnomer, because it never existed, does not exist, and will never exist. The purpose of this presentation is to follow-up my argument by focusing on Oskar Fischer's contributions in 1907 and 1910, which were concerned with (1) the notion of senile dementia in the early 20th century, (2) the organic causes of senile dementia, and (3) the histopathological characteristics of such orgnic causes. His findings can be divided into three parts: (1)he disagreed with Redlich who in 1898 had argued with two cases that miliary sclerosis involved the glial cells; (2) he described the connections of three stages in the development of miliary foci, which he also called plaques in place of miliary sclerosis, ranging from the smallest, to the larger, and the largest, and described them in great detail; and (3) he concluded by pointing out that the smallest foci were cell-free because they were extracellular, that only in some of the larger ones were there nuclei to be found because neuronal fibrils became involved to develop glandular proliferations to form glandular necrosis, known later as neurofibrillary tangles, and that on the basis of the absence and presence of glandular necrosis he could classify senile dementia into two subtypes: simple senile dementia and presbyophrenia (old man's mind), respectively. Subsequent researchers have ignored or overlooked Fischer's findings and, instead, attributed erroneously his findings to Alzheimer as if Alzheimer had made them. It is time to correct this historical mistake.

Joint Session of the History and Philosophy of Science, Psychology, and Social, Economic and Political Sciences Sections

183. *Gained in the Translation: The Geological Career of Lou Henry Hoover, 1894-1914*, **Michele L. Aldrich** (Calif. Academy of Sciences, Hatfield, MA, 413-247-5828, maldrich@smith.edu), **Léo F. Laporte** (Univ. California Santa Cruz, Redwood City, CA, 650-364-3386, laporte@cats.ucsc.edu) and **Alan E. Leviton** (Calif. Academy of Sciences, San Francisco, CA, 650-380-2501, aleviton@calacademy.org).

After graduating from Stanford in 1898 with a degree in geology, Lou Henry could not get a field geologist's job. On February 10, 1899, she married Herbert Hoover; the next day they sailed for China, where he advised the Emperor on mining. They traveled in the field together, and Lou went into the mines, to the amazement of the local population. The Hoovers survived the June 1900 Boxer Rebellion. They moved to London in 1902, where Bert established himself in business as a mining engineer and investor, the basis of their considerable wealth. At Stanford, John Branner had introduced the Hoovers to Georgius Agricola's *De Re Metallica* (1556); in 1906, Lou visited the British Museum and began translating it into English. She expected to finish in six months; it took six years. She translated the text and Bert wrote the annotations. The translation, published in 1912 by the *Mining Magazine* of London, imitated the original in binding, paper, typesetting, and beautiful woodcuts (by facsimile in the Hoover version). Three thousand printed copies insured wide distribution. During their London years, Lou also wrote an article on the British seismologist John Milne, published in the *Bulletin of the Seismological Society of America* in 1912. Thereafter, she dedicated herself to public service such as working with the Girl Scouts and serving as First Lady during her husband's presidency (1929-1933). Lou Henry Hoover's geological career presents an interesting contrast to Florence Bascom (1862-1945), the first American woman to become a professional geologist.

184. *Less Blood More Ore: The Social Costs of Western Metal Mining, 1911-1939*, **Mark Aldrich** (Smith College, Northampton, MA, 413-585-3603, maldrich@smith.edu).

Mining is famously dangerously and dirty. Environmental damage and worker injuries are usually termed social costs because they are often borne by third parties—workers and society – rather than by mining companies. This paper traces one form of social costs, work injuries, and demonstrates that they declined dramatically in the early twentieth century. Fatalities and injuries per ton of ore reflect the interaction of worker risk and labor productivity. Risks declined sharply as a nascent safety movement responded to the spread of workmen's compensation laws, while rising labor productivity reduced the number of men exposed to dangers. The gradual shift to strip mining was particularly important as it was both safer and more productive than underground work. Strip mining is often opposed for its environmental damage. Yet these social costs need to be balanced against the reduction in injuries and fatalities that it also brings about.

185. *Measuring the Effects of Environmental Regulations: the Critical Importance of Spatially Disaggregated Air Modeling*, **Maximilan Auffhammer** (University of California), **Antonio M. Bento** (University of Maryland) and **Scott E. Lowe** (Boise State Univeristy, Boise, ID, 208-426-5439, scottlowe@boisestate.edu).

Ambient concentrations of particulate matter less than 10 microns in diameter (PM10) declined by approximately 25% during the 1990s across all California cities. This paper tests whether the 1990 Clean Air Act Amendments (CAAAs) caused this decline. The two key aspects of the CAAAs are the delegation of power from the federal EPA to state agencies and the annual assignment of all counties to a PM10 attainment status. California regulators delegated the responsibility of enforcement of the CAAAs for non-mobile sources to regional air quality management districts. Consistent with previous studies, we find that county-level PM10 non-attainment status is at best associated with modest reductions in PM10 air pollution. However, after creating a surface of PM10 concentrations based on a grid of half kilometers by half kilometers to cover the entire state of California, we find that the dirtier cities of non-attainment counties indeed reduced PM10 substantially more than the cleaner ones, suggesting that previous studies may have failed to capture the true effect of the CAAA due to the lack of spatial resolution in the pollution data used. We also find that because of the delegation of authority from the federal to regional agencies, the spatial variation in the drops of PM10 can be explained by measures that capture the ability of groups – individuals or industry – to form and influence these agencies, geography, weather and neighboring pollution.

186. *Human Nature and Continuing Human Existence*, **Perry S. Bezanis** (San Pedro, CA, 310-833-8231, perryb@condition.org).

Based on purely scientific developments so far, it can be argued that virtually all expressly *non-scientific* modes of human thought and interaction can be traced to evolution out of **pecking order** and the 'neonate ignorance' of all life-forms -in particular then, war, overpopulation, pollution, global warming and loss of biodiversity too.

The very existence of this observation, however and furthermore, also makes it possible to trace *it* to the uniquely human property of **deliverative capability** -which, therefore, *reflexively* and in turn, makes it possible to project the advancement of knowledge to the 'the inevitable *vestigialization* of that pecking order as generally corruptive to the best continuing existence of the life-form' -a function of time, circumstance, sustainability and *genetic imperative*.

(-or to put it another way-)

All *intellectualizable* human expression is a function of *evolving* knowledge. 'Pecking-order-based natural expression', therefore, has no course but to give way to successively 'more knowledgeable decisions' under successively evolving science.

187. *Powering Spacecraft: The Nuclear Option*, **Gary L. Bennett** (Metaspace Enterprises, Emmett, ID, 208-365-1210, UserSg4282@aol.com).

Like any collection of electronic components, a spacecraft requires electrical power to operate. For long-lived missions there are only two currently available options: solar power and nuclear power. For spacecraft that must operate in hostile environments such as the cold, dark regions of the outer Solar System or on hostile planetary surfaces where there is little or no sunlight, nuclear power becomes the only currently available option. Nuclear power sources have enabled or enhanced some of the most challenging and exciting space missions yet conducted, including missions such as the Pioneer flights to Jupiter, Saturn, and beyond; the Voyager flights to Jupiter, Saturn, Uranus, Neptune, and beyond; the Apollo lunar surface experiments; the Viking Lander studies of Mars; the Ulysses mission to study the polar regions of the Sun; the Galileo mission that orbited Jupiter; the Cassini mission orbiting Saturn and the recently launched New Horizons mission to Pluto. In addition, radioisotope heater units have

enhanced or enabled the Mars exploration rover missions (Sojourner, Spirit and Opportunity). Since 1961, the United States has successfully flown 41 radioisotope thermoelectric generators (RTGs) and one nuclear reactor to provide power for 24 space systems. The former Soviet Union has reportedly flown at least 35 nuclear reactors and at least two RTGs to power 37 space systems.

188. *Metaphysical Sciences*, **Ravi Sadana** (Retired from: Clarke Institute, University of Toronto, Toronto, ON, Canada, 951-461-0423, ravisadana@netscape.net).

Physical sciences are involved in the studying of a given area of a discipline by measuring and examining it from the outside, in an investigator-subject relationship with a distinct line of separation. Metaphysical sciences encompass the practicing of a given area of a discipline by immersion from the inside. One practices a discipline by "living" it and by unifying with the intricacies and getting intimately involved in them.

Entities exist in space and space exists within the structure of entities. However not all entities occupy space. Constituents of the universe are divided into two classes. Class 1: Those that occupy physical space. Class 2: Those that do not occupy physical space. Phenomenon of The Cantilever Effect is postulated as a bridge between the two classes. Space is postulated to have a cellular structure that has a property called space density.

Mental and psychological focus of the student for incisive knowledge is developed by learning and following rigorous practises based on sound vibrations, an analogue of the time variant for the inspiration and expiration periods of the breathing cycle, key physiological parameters related to nostril dominance and parameters related to the location of key plexuses on the cerebrospinal axis, particularly, the *cauda equina*, the sympathetic nervous system and the *canal centralis*. Awareness acuity is enhanced through strengthened Cantilever Effect transfers.

The curriculum encompasses theory and practicals.

Contributed Posters

Anthropology and Archaeology

189. *No Impact: Anthropological and Archeological Implications of Isotopes in Rocks from the Akkadian Empire*, **Monica Guerrero** (San Diego State University, San Diego, CA, 510-495-5719, sairieau@yahoo.com) and **Sabine Airieau** (Astrobiology Space Sciences Astrochemistry Institute, Berkeley, CA, sairieau@yahoo.com).

The Akkadian Empire in ancient Mesopotamia was disrupted 4,000 years ago and suddenly collapsed at the peak of its cultural and political expansion. The search for the reason of this collapse pointed to usual culprits: droughts, volcanism, earthquakes, famine, disease and warfare. None of these seemed entirely satisfying, and an unusual culprit was suggested: an asteroid or meteorite impact, large enough to disrupt the climate, and plunge Mesopotamia in desolation. This would have opened the way for the subsequent invasion and destruction of the Empire. The Akkadian state, the first political structure in Mesopotamia that ruled a whole country, rather than a single city, fell.

We looked for forensic evidence of a killer asteroid by studying soil samples from the region and time of the Akkadian collapse. A search for the oxygen and sulfur isotope signatures of an asteroid or meteorite impactor was conducted. No such signature was found. We performed high security laser based chemistry with bromine pentafluoride, collected cryogenic gas samples in vacuum chambers, and analyzed the isotopes with a mass spectrometer. The lack of a meteorite signature rules out an extraterrestrial impact. In addition, numerous civilizations collapsed in Egypt, China, Greece, and elsewhere around the same period, a phenomenon that would require multiple astronomical impactors simultaneously, like the comet impacts on Jupiter in 1994. Such phenomenon would appear in the archeology and literature of these regions, and iridium would appear in soils.

References: Alvarez, 1980, Science 1980, 208, 1095; Clarke, Science 1995, 267, 1302; Kerr, Science 279, 325; Menocal, Science 2001, 292, 667; Orton, Science 1995, 267, 1277; Weiss and Bradley, Science 2001, 291, 609; Weiss, Science 2001, 261, 995.

Agriculture and Horticultural Sciences

190. *Residual Phosphorus Effects on Alfalfa Seed Pollination and Production*, **Bradford D. Brown** (University of Idaho, Parma, ID, 208-722-6701 Ext 216, bradb@uidaho.edu) and **James D. Barbour** (University of Idaho, Parma, ID, 208-722-6701 Ext 250, jbarbour@uidaho.edu).

Higher available P that increases alfalfa biomass reportedly reduces alfalfa seed yield due to poorer pollinator visitation. Available P effects were evaluated in a three year (2004-06) study with in-row plant spacing (12", 24", 36" and 48") at Parma, ID to investigate the mechanism for the yield decline. Plots differing in residual P from previously applied P were further enriched with 0, 25, 50, 75, or 100 lb P/A. Plots were split in the last year and a mix of foliar B, Zn, Mn, Cu, and Fe (5, 5, 2, 2, and 2 lb/A respectively) was applied at late bud. Higher available P increased vegetative biomass each year to a maximum but seed yield decreased each year with available P otherwise necessary for maximum growth. Yields declined with higher P primarily from fewer harvested seed but also from smaller seed in 2 of 3 years. A more dense canopy with higher P also resulted in greater seed depredation by lygus, particularly in the years of lowest production. Fewer seed due to reduced pollination was not confirmed in this study as the percentage of bracts with pods was largely unaffected by P. Wider plant spacing resulted in a higher percentage of bracts with pods but only partially compensated for greater vegetative growth with higher P. Foliar micronutrients increased yield due to increased seed numbers, presumably by reducing flower or pod abortion. Fertilizer P applied for alfalfa seed production may be counter productive in fields with soil P maintained for other crops in the rotation.

191. *Low Phytic Acid Barley Responses to Phosphorus Rates*, **Chad A. Jackson** (University of Idaho, Aberdeen, ID, 208-397-4181, chadj@uidaho.edu), **Juliet M. Windes** (University of Idaho, Aberdeen, ID, 208-529-8376, jwindes@uidaho.edu), **Phil Bregitzer** (USDA-ARS, Aberdeen, ID, 208-397-4162, pbregit@uidaho.edu) and **Donald Obert** (USDA-ARS, Aberdeen, ID, 208/397-4162, dobert@uidaho.edu).

Low phytic acid barley (*Hordeum vulgare* L.) cultivars partition phosphorus in seed tissue differently than conventional barley cultivars through a reduction in seed phytic acid (*myo*-inositol-1,2,3,4,5,6-hex*kis*phosphate) coupled with an increase in inorganic phosphorus. The sensitivity of the low phytic acid characteristic to phosphate fertilization was unknown, therefore the effect of field application of different phosphate fertilizer rates upon yield, total seed phosphorus quantity, inorganic seed phosphorus quantity, and flag leaf phospho-

rus quantity was investigated. Two conventional cultivars, 'Baronesse' and 'Colter', were planted along with two low phytic acid cultivars, '01ID0451H', and 'Herald'. The pedigrees for '01ID0451H' and 'Herald' are Colter*2/lpa1-1 and Baronesse*2/lpa1-1//HB317, respectively. The experimental design was split-plot with phosphate fertilization rates as main plots and cultivars as sub-plots. The experiment was conducted over two years at Aberdeen, Tetonia, and Potlatch, Idaho. Phosphate fertilizer (P_2O_5) was applied in the form of triple-super phosphate (0-45-0) at rates of 0, 56, 112, 168 kg ha^{-1}. Fertilizer was incorporated 7 cm deep using spike tooth harrows. Total seed phosphorus levels increased slightly though significantly with increasing phosphorus application. Inorganic seed phosphorus amounts did not change significantly. The ratio of inorganic seed phosphorus to total seed phosphorus did not significantly change with increasing phosphorus fertility. Flag leaf phosphorus levels increased significantly as a result of increasing phosphorus application. Yield and test weight were unaffected by phosphorus application. In general, the low phytic acid characteristic in the low phytic acid cultivars did not change significantly under increasing P_2O_5 fertilization rates and different environments.

Biological Sciences

192. *Ornamentation in North American Barn Owls (*Tyto alba pratincola*): Does Spottiness Signal Quality?* **Than J. Boves** (Boise State University, Boise, ID, 708-369-3484, thanboves@mail.boisestate.edu) and **James R. Belthoff** (Boise State University, Boise, ID, jbeltho@boisestate.edu).

Elaborate ornamentation, such as long tail feathers and bright coloration, has evolved in many bird species because of intense sexual selection (Darwin 1871). In birds, males usually display more elaborate ornamentation than females, however in barn owls (*Tyto alba*) this pattern is reversed, with females displaying more, and larger, ventral spots than males. In sympatric European subspecies *(T. a. guttata and T. a. alba)*, male barn owls choose females that are heavily spotted because they produce offspring with higher resistance to parasitic infection and with more symmetrical wings (Roulin *et al.* 2000, Roulin *et al.* 2003). In this study, we examined the relationships between ventral spottiness and measures of potential quality (heart fat, wing length, fluctuating asymmetry, stomach contents, and tail length) in both male and female members of the North American subspecies of barn owl *(T. a. pratincola)*. The owls were collected dead along interstate 84 in southern Idaho, where up to 1500 barn owls are killed yearly by vehicular collisions (Boves 2007). Female barn owls were almost twice as spotted as males. In males, but not females, spottiness was related to two quality measures (heart fat and wing length). Our results suggest that while female barn owls may signal certain traits (such as parasitic resistance) to potential mates through plumage spottiness, male spottiness may be adaptive as well (rather than simply a genetic correlation).

193. *Costs and Benefits of Group Living in Owls*, **Justin L. Welty** (Boise State University, Boise, ID, 208-559-3674, justinwelty@mail.boisestate.edu) and **James R. Belthoff** (Boise State University, Boise, ID, 208-426-4033, jbeltho@boisestate.edu).

The choice for group or solitary living can be based on a variety of costs and benefits. Potential benefits of grouping include group defense, early detection of predators, and increased productivity through information or foraging advantages. Costs of group living include parasite transmission, detection by predators, and possible increases in adult and egg yolk androgens resulting from increased conspecific aggression. Western burrowing owl (*Athene cunicularia* hypugaea) nesting distributions range from solitary (>1km between nests) to semi-colonial (as little as 50m between nests). We examined relationships between group living and egg yolk androgens, ectoparasite (fleas) abundance, depredation on dummy nests and on actual nests, and nest defense behavior in burrowing owls nesting within s. Idaho. Egg androgens did not rise with closer neighbors, but ectoparasites increased significantly as distance to nearest neighbor decreased. While grouped and solitary dummy nests were depredated at similar frequencies, fewer actual nests were depredated as distance to nearest neighbor decreased. The potential benefit of group defense or early warning in semi-colonial owls may explain why so few actual nests of semi-colonial owls were depredated. Neighboring males joined with the focal male to attack a dummy predator, and neighboring nestlings returned to their burrows after a warning call from the focal male. Finally, productivity increased as distance to nearest neighbor decreased. While burrowing owls may incur costs of increased parasites, the benefits of decreased depredation from early warning and cooperative defense may help explain why burrowing owls frequently nest in close association with conspecifics.

194. *Multi-Scale Habitat Selection by Flammulated Owls in Idaho*, **Keith P. Barnes** (Boise State University, Boise, ID, 208-336-0366, keithbarnes@mail.boisestate.edu) and **James R. Belthoff** (Boise State University, Boise, ID, 208-426-4033, jbeltho@boisestate.edu).

Flammulated Owls (*Otus flammeolus*) are small forest owls of western North America whose status is of concern for two reasons: limited knowledge about their biology, and widespread anthropogenic manipulations of their breeding habitat. In our study area located in central Idaho, Flammulated Owls inhabited ponderosa pine (*Pinus ponderosa*) /Douglas-fir (*Pseudotsuga menziesii*) forest at elevations of 1200-1800 m. To help understand their breeding requirements and guide forest management, we radio-tagged and monitored habitat use of 24 Flammulated Owls during the 2005 and 2006 breeding seasons. We evaluated habitat selection at four different scales with a used-available design. At the landscape level, owls selected south and east-facing aspects, middle to upper slopes and ridges, and areas of intermediate forest cover. At the home range scale, owls selected areas with higher density of standing dead trees (snags) but showed high variability in use of other forest characteristics. We did not detect selection for habitat characteristics at the scale of nest trees or vegetation surrounding nests. Our lack of detectable selection at scales below the landscape suggests tolerance of a variety of conditions, with the possibility that locating a suitable nest constrains selection for other habitat characteristics. It is possible that such tolerance of a range of conditions has enabled Flammulated Owl populations to persist despite historical widespread alterations to their principle habitat of mature ponderosa pine forests.

195. *Design Algorithms for Detection of Genomic Copy Number Variations (CNV) using the SNPlex™ Genotyping System / COPYPlex™*, **Ryan Koehler** (Applied Biosystems, Foster City, CA, 503-699-6479, koehlert@appliedbiosystems.com).

Genome copy number variations (CNVs) are far more frequent than originally realized and many alter gene copy numbers. However, because of technical limitations, the extent that CNVs contribute to phenotypic variation is still poorly understood. The SNPlex™ Genotyping System combines high sample throughput, study design

flexibility, cost efficiency, and accurate genotyping of SNP and/or indel targets. Multiplexed oligonucleotide ligation/polymerase chain reaction (OLA/PCR) is followed by capillary electrophoresis readout using pre-optimized ZipChute™ reagents. Robust multiplex assay design is challenging and time consuming, so we implemented a design pipeline combining empirical rules and algorithms to automate design. Here we describe modifications of the SNPlex™ Genotyping System platform to address CNVs. Copy number variations are determined by comparing reaction product ratios of test and reference genome regions. The pipeline for CNV design differs from the SNP pipeline in several respects. Each target SNP requires three probes while each CNV target requires two. Currently up to 72 CNV targets can be addressed in one multiplex assay. Probes for SNP assays must be placed at the specific SNP loci. In contrast, there may be thousands of viable placements for probes addressing a CNV. With this freedom, prioritization based on heuristic scoring metrics associated with assay performance becomes desirable. To prioritize placements efficiently, we seek to evaluate computed sequence scores and understand how these vary with respect to relative sequence position in order to reduce computation. Example correlations and sampling results are illustrated. Finally, experimental results for CNV assays utilizing the SNPlex™ Genotyping System are reported.

196. *Molecular Mechanisms Controlling CD40L Gene Expression: Implications in Asthma*, **Ashley Masterson** (Boise State University, Boise, ID, 208-426-5940, ashleymasterson@mail.boisestate.edu), **Alma Hodzic** (Boise State University, Boise, ID, 208-426-5940) and **Denise Wingett** (Boise State University, Boise, ID, 208-426-2921, denisewingett@boisestate.edu).

CD40L expression plays an integral role in the activation of the immune system. CD40L is predominantly expressed on the surface of activated $CD4^+$ T cells and interacts with the CD40 receptor expressed on B cells to stimulate B cell growth, differentiation, and antibody production. Specifically, CD40L has been implicated in asthma and allergy response. One category of commonly used asthma medications, Beta-adrenergic agonists, has been associated with life-threatening asthma episodes and asthma-related deaths. These Beta-agonists are cyclic AMP inducing agents, where cAMP acts as a second messenger to relay the effects of extracellular stimuli. This causes an intracellular signaling cascade resulting in gene expression. Previous studies from our lab have shown that cAMP can increase CD40L expression in T cells from asthmatic individuals, although little is known regarding the molecular mechanisms controlling CD40L expression. Preliminary results using site-directed mutagenesis of the CD40L proximal promoter have shown that the transcription factors NFATc2, CREB1, and MEF2 are likely involved in regulating the cAMP response of CD40L gene expression. By using siRNA interference to reduce the levels of these transcription factors in $CD4^+$ T cells, CD40L expression decreased significantly following activation with cAMP. The identification of specific transcription factors involved in cAMP induction of CD40L expression is important for the production of new asthma therapies with reduced side effects.

197. *hGH-V Gene Expression and Promoter Activity under Glucose and 5-Azacytidine (5azaC) Effects*, **Marina MJ Romero-Prado** (Universidad de Guadalajara, Guadalajara, Mexico, +52-33-1058-5200 ext 3657, maropra16@yahoo.com), **Hugo A. Barrera-Saldaña** (Universidad Autonoma de Nuevo Leon, Nuevo Leon, Mexico, +52 (818) 123-8249, hbarrera@fm.uanl.mx) and **Jose Luis Castrillo-Diez** (Universidad Autonoma de Madrid, Madrid, Spain, +34-617-4193-81, jlcastrillo@cbm.uam.es).

The metabolic conditions affecting placental development depend on genetic constitution, nutritional state and other external factors. The secretion of hGH-V had shown to be dependent on glucose presence but the regulatory effects of this metabolite in the possible involvement of DNA methylation on its regulatory mechanism had not been studied. In this work we compared the activity of hGH-V distal promoter with its endogenous mRNA expression in human placental choriocarcinoma cell lines, in the presence of glucose or the genome demethylating agent 5azaC. High levels of glucose considerably diminished hGH-V mRNA endogenous levels in placenta cell lines, whereas the expression of a GH-V transgene from a transfected PAC construct was diminished to a lesser extend. These results were modified by the presence of 5azaC which was able to induce a higher hGH-V gene expression. Our results suggest that the suppressive glucose effect requires a genomic context with a mechanism dependent of a methylation pattern in placental cells.

198. *The Role of MalQ in Carbohydrate Utilization and Gene Regulation in the Lyme Disease Spirochete*, **Elizabeth A. Morton** (The University of Montana, Missoula, MT, 406-370-8760, eamorton@hotmail.com) and **D. Scott Samuels** (The University of Montana, Missoula, MT, 406-243-6145, scott.samuels@umontana.edu).

The causative agent of Lyme disease, *Borrelia burgdorferi*, cycles between mammalian hosts and tick vectors. These two environments differ in many aspects, including temperature and available sugar substrates. Outer surface lipoprotein (Osp) C is a major factor involved in the transmission of *B. burgdorferi* from tick to mammal. In wild-type spirochetes, a temperature shift from 23°C to 37°C induces an increase in OspC production. The gene *malQ* encodes amylomaltase, which converts maltodextrins to glucose. Glucose is the main sugar in mammalian blood, while tick hemolymph contains trehalose. In other bacteria, *malQ* has also been found to be involved in gene regulation and expression of virulence factors. Therefore, we hypothesize a role for MalQ in environmental sensing involved in transmission to and infection of the mammal, perhaps through interaction with the alternative sigma factor responsible for *ospC* expression, RpoS. We intend to explore the role of *malQ* in both sugar metabolism and gene regulation, as they relate to the ability of the spirochete to sense and survive in disparate environments. A strain of *B. burgdorferi* from which the *malQ* gene was deleted has been constructed, and complementation is underway. This mutant will be used in growth studies to assess the role of MalQ in *B. burgdorferi*'s ability to utilize sugars such as maltose and trehalose. The *malQ* mutant exhibited constitutive OspC production at both 23°C and 37°C. This strain will thus also be used in *ospC* and *rpoS* expression studies in order to explore a possible regulatory role of MalQ.

199. *Group A Streptococcal Myonecrosis: Vimentin Mediates "Inside-out" Infection at Sites of Non-penetrating Muscle Trauma*, **Stephanie M. Hamilton** (Veterans Affairs Medical Center/ The University of Idaho, Boise, ID, 208-422-1599, juststeph_1@yahoo.com), **Clifford R. Bayer** (Veterans Affairs Medical Center, Boise, ID, 208-422-1599, cliff.bayer@va.gov), **Dennis L. Stevens** (Veterans Affairs Medical Center, Boise, ID, 208-422-1599, dlsteven@mindspring.com) and **Amy E. Bryant** (Veterans Affairs Medical Center, Boise, ID, 208-422-1599, amy.bryant@mindspring.com).

Group A streptococcal (GAS) myonecrosis is associated with high mortality (30-70%) and severe morbidity including multiple amputations. 50% of cases have no portal of entry, yet infection develops

at the site of a non-penetrating muscle injury. We have shown that GAS binds vimentin on injured skeletal muscle cells (SkMC) in vitro. The present study investigates whether the GAS/vimentin interaction contributes to myonecrosis in vivo.

A murine model of eccentric contraction (EC)-induced SkMC injury was utilized. Here, the tibialis anterior (TA) and extensor digitorum longus (EDL) muscles (N=14) were electrically stimulated (10-12v, 100-150hz for 400ms, q 30-60 sec x 50) while rotating the foot distally, forcing the contracted muscle to lengthen. The opposite untreated leg served as control. The mean isometric torque (MIT) was recorded pre- and post-exercise. At 12-72 h, total RNA was isolated from TA muscles and vimentin expression was quantitated by RT-PCR. In separate experiments, M type 3 GAS was infused into exercised animals (N=8). At 6 h post-GAS infusion, blood specimens and muscle and spleen homogenates were plated for quantitative bacteriology.

EC-induced injury reduced MIT by 20-80%. Vimentin was increased at 12 hr post-injury, maximal at 48 h (12-fold increase), and declined by 72 h. In exercised animals infused with GAS, 2-30-fold more organisms were found in the EC-injured muscles compared to the control muscles.

These findings suggest that upregulation of vimentin mediates the homing of GAS to sites of muscle trauma and imply that interventions targeting the vimentin/GAS interaction may prevent or attenuate this devastating infection.

200. *Evaluating Toxicity of Metal Oxide Nanoparticles and Their Potential Utilization in Treatment of Autoimmune Disease*, **Cory L. Hanley**[1], **Janet Layne**[2], **Madhu Reddy**[3], **Hua Wang**[3], **Kevin Feris**[2], **Alex Punnoose**[3] and **Denise G. Wingett**[4], [1](Boise State University, Boise, ID, 208-871-2430, coryhanley@gmail.com); [2](Boise State University, Boise, ID); [3](Boise State University); [4](Boise State University, Boise, ID, 208-426-2921, denisewingett@boisestate.edu).

Nanoparticles (NPs) in the size range of 1-100 nm are being aggressively investigated for potential use in the treatment of human diseases due to their unique physical, chemical and biological properties. The toxicity of metal oxide nanoparticles, specifically in human primary cells, needs to be established so that their potential biomedical applications may be considered. We have demonstrated that 4 to 20 nm ZnO nanoparticles display more potent cytotoxic effects in activated versus resting primary human T-helper cells. This is an important finding, as autoreactive (activated) T-cells are a subset of cells responsible for mediating several autoimmune diseases. Furthermore, we have shown that antibodies can be linked to ZnO NPs for targeted delivery to specific cells. This has important implications, including the improved ability to selectively eliminate autoreactive T-cells involved in autoimmune disease with minimal negative effects on the overall host immune response.

201. *Susceptibility of Cancer Cells to ZnO Nanoparticle Toxicity - Potential Utility for Treatment of Cancer*, **Janet Layne**[1], **Cory Hanley**[2], **Kevin Feris**[2], **Alex Punnoose**[3], **Madhu Reddy**[3], **Hua Wang**[3] and **Denise G. Wingett**[4], [1](Boise State University, Boise, ID, 208-426-2921, janetlayne@cableone.net); [2](Boise State University, Boise, ID); [3](Boise State University); [4](Boise State University, Boise, ID, 426-2921, denisewingett@boisestate.edu).

Nanoparticles (NP) present attractive modalities in the emerging field of nanomedicine as these structures are in the size range of molecules naturally occurring in living cells. We have demonstrated that zinc oxide NP have potent cytotoxic effects on cancer cells at concentrations that minimally affect primary human immune cell viability. Although at considerably higher concentrations of NP a loss of normal primary T cells can be observed, death of cancerous cells can occur at greater than ten-fold lower concentrations. We have also successfully linked a variety of antibodies to NP, which is expected to allow for greater targeting of cancer cells. The greater susceptibility of cancerous T cells to zinc oxide nanoparticle toxicity, combined with the ability to enhance targeting via attachment of specific antibodies, suggests that NP may have potential clinical utility in the treatment of cancers while largely sparing healthy body cells.

202. *The Effects of Oncostatin M on Human Breast Cancer In Vivo*, **Amanda J. Bruesch** (Boise State University, Boise, ID, 208-426-4805, amanda.bruesch@gmail.com) and **Cheryl L Jorcyk** (Boise State University, Boise, ID, 208-426-4287, cjorcyk@boisestate.edu).

Oncostatin M (OSM) is a pleiotropic cytokine in the IL-6 family and is produced by many different cell types, including human T-lymphocytes, macrophages and monocytes. The data on the effects of OSM on tumor cell lines has shown contradictory results. Many labs have shown that OSM decreases breast cancer cell proliferation, indicating it may slow or stop tumor growth. However, *in vitro* data from our lab suggests that OSM may promote breast tumor progression and metastasis by enhancing angiogenesis, cell detachment, and invasiveness.

In vivo studies have long proven difficult due to the lack of homology between human OSM and mouse OSM, as well as other species. In a bold attempt to understand OSM's functions *in vivo* we have used a mouse xenograft model to analyze human breast cancer. Mice were injected subcutaneously with the human breast cancer cell line MDA-MB-231. The developing tumors could then be treated peritumorally with exogenous OSM, a neutralizing antibody to the OSM receptor β, or a combination of the two treatments. Resulting data shows that oncostatin M does decrease tumor growth rates. However, further studies will help to elucidate how OSM contributes to tumor progression and metastasis through angiogenesis cell detachment and invasion. NIH grant P20RR16454.

203. *Evidence of Changes in Medial Giant Axon Membrane Electrophysiology During Nerve Regeneration Following Ventral Nerve Cord Crush in* Lumbricus terrestris, **Michael Havens** (Montana State University - Billings, Billings, MT, 406-657-2248, mhavens@msubillings.edu) and **Katie Kuhr** (Montana State University - Billings, Billings, MT).

The medial giant axon in earthworms has been the target of numerous studies due to the ability of the axon to regenerate following axotomy. We have developed a preparation that allows frequent in vivo measurement of electrophysiological parameters of axon function during regeneration of the medial giant axon. Anesthetized earthworms were placed on a recording stage and pin electrode pairs were placed through the worm. The placement of stimulating and recording electrodes was chosen to allow the entire waveform of the medial giant axon compound action potential to be measured with a digital oscilloscope and analysis software. Following measurement of the axon firing threshold (FT), conduction velocity (CV), duration, amplitude and refractory period (RP), a 5mm incision was made midway between the stimulating and recording electrodes. The skin was pinned back and the ventral nerve cord was crushed with a pressure-calibrated pair of forceps. The electrodes were then removed and the

worm was allowed to recover. During daily recording sessions, the medial giant axon was observed to regenerate after an average of 4.3 days. CV and amplitude of the regenerated axon were significantly reduced. FT, duration and RP were significantly increased. Waveform analysis suggested that membrane sodium and potassium channels were correctly regenerated. However, the slope and duration of the after hyperpolarization was decreased. A possible retrograde signaling agent from the site of axon injury is suggested.

204. *Development of a Rhodopseudomonad H_2 Producing Microbial System Driven by Agricultural Wastewater*, **Kevin Feris**[1], **Dana Moracco**[2], **Joni Barnes**[3] and **Cathy Rae**[3], [1](Boise State University, Boise, ID, 208-426-5498, KevinFeris@boisestate.edu); [2](Boise State University, Boise, ID); [3](Idaho National Laboratory, Idaho Falls, ID).

There is a compelling need for new sources of clean, inexpensive, and renewable energy to replace our petroleum-based energy system. One novel approach is the development of strategies that exploit the light-dependent photoheterotrophic capability of purple nonsulfur bacteria (PNSB) to convert agricultural wastewaters into fuels such as hydrogen (H_2). This type of microbial metabolism generates significant quantities of H_2 from organic substrates, and if driven by a lost cost biomass feedstock, presents a significant opportunity to enhance our ability to efficiently generate affordable, biomass-based, and locally controlled alternative fuels. *Rhodopseudomonas capsulata* and *Rhodobacter sphaeriodes* are PNSB strains that produce H_2 gas when grown anaerobically with organic acids and light as carbon and energy sources, respectively. Agricultural wastewater produced during potato processing contains large amounts of organic acids (e.g. acetate, propionate, butyrate, etc.) and thus, represents a potentially significant source of growth substrates for PNSB. Here we 1) demonstrate the ability of *R. capsulata* and *R. sphaeriodes* to produce H_2 using potato wastewater as their sole C and N source, 2) assess which carbon compounds in the wastewater are consumed during H_2 production, and 3) investigate the prevalence of native hydrogen producing PNSB in potato wastewater. These studies demonstrate that agricultural wastewaters can serve as viable feedstocks to drive PNSB based H_2 production and provide benchmarks for the potential development of a consolidated process for bioenergy production via wastewater treatment.

205. *Developmental Expression of Collagen Type XI in Zebrafish (*Danio rerio*)*, **Jason S. Adams**[1], **Raquel Brown**[2], **Jeremiah Maschmann**[2], **Katey Irwin**[2], **Luke Woodbury**[2], **Linda Mercer**[2] and **Julia Thom Oxford**[3], [1](Boise State University, Boise, ID, 208-426-2544, jasonadams2@mail.boisestate.edu); [2](Boise State University, Boise, ID, 208-426-2544); [3](Boise State University, Boise, ID, 208-426-2544, joxford@boisestate.edu).

Zebrafish have the potential to illuminate the development and function of the vertebrate musculoskeletal system. The musculoskeletal system includes muscle, bone, articulated joints, cartilage, tendon, and ligament. Zebrafish mutations faithfully phenocopy many human disorders.

Collagen type XI is a heterotrimeric molecule composed of three alpha chains, alpha1(XI), alpha2(XI), alpha3(XI). Collagen XI belongs to the fibrillar collagen family and is organized into cartilage fibrils with collagens type II and IX. Its importance lies with the establishment and maintenance of cartilage. Collagen XI can be found within the nucleus pulposus of the intervertebral disc, in the developing notochord, in embryonic tissue, vitreous humor, tectoral membrane, mitral valve, and skeletal muscle of other species.

This study will look at the expression and function of collagens type XI in the early development of the zebrafish cranial and axial skeleton. This information can then be used to further research of human disorders within the musculoskeletal system.

206. *Characterization of the Collagen type XI Isoforms using Analytical Ultracentrifugation and Circular Dichroism Spectropolarimetry,* **Luke G. Woodbury** (Boise State University, Boise, ID, 208-426-2544, lukethekid@gmail.com), **Dawn Muhlestein** (Boise State University, Boise, ID, 208-338-8931, dawnmuhlestein@boisestate.edu) and **Julia Thom Oxford** (Boise State University, Boise, ID, joxford@boisestate.edu).

Type XI collagen is a minor constituent of the extracellular matrix of cartilage and is essential in the regulation of collagen fibril assembly and diameter. The alpha 1 chain of Collagen XI (a1CollXI) contains a variable region that is modulated by alternative splicing in a tissue-specific and developmental manner. Recombinant isoforms were expressed in *Escherichia coli* and purified using affinity chromatography. Purified isoforms were characterized by Circular Dichroism spectral analysis. The information gained from Circular Dichroism spectral analysis will help us to understand the secondary structures of the isoforms. Sedimentation characteristics of the isoforms were determined by analytical ultracentrifugation. The information gained from the sedimentation experiments will help us to understand how protein-protein interactions influence fibrillogenesis.

207. *Identification of Collagen Gene Loci in* Danio rerio, **Jeremiah M. Maschmann** (Boise State University, Boise, ID, 208-340-8750, jeremiahmaschmann@mail.boisestate.edu), **Julia Thom Oxford** (Boise State University, Boise, ID, joxford@boisestate.edu) and **Jason S. Adams** (Boise State University, Boise, ID, 208-426-2544, jasonadams2@mail.boisestate.edu).

Zebrafish (*Danio rerio*) have become an increasingly popular vertebrate model organism. Their strengths in developmental research include embryo transparency, ease of genetic crossing, and large breeding numbers. My research has been limited to the elucidation of their collagen-gene loci. Construction of a working map for the location of these genes has been undertaken. Of specific interest, is locating the gene, Col11a1. Its necessity is evaluated from its absence, as seen in humans suffering from Stickler Syndrome. After transcription, the RNA undergoes alternative splicing, resulting in at least eight known isoforms. It is therefore important to ask whether or not zebrafish synthesize ColXI and in which forms. Bioinformatic techniques have lead to a proposed location of the gene on chromosome 24. With this information, reagents, including morpholino-oligos, PCR primers, and cDNA probes, have been constructed. Bench analysis of the organism will provide further evidence supporting or refuting this argument.

Ecology and Environmental Sciences

208. *Estrogen Equivalent Concentration of Seventeen Major Paranonylphenol Isomers Related to Commercial Mixtures in a Sediment Core Taken from Ariake Bay, Japan,* **Keiji Okuda** (Nihon University, Fujisawa, Japan, +81-466-84-3720, kjokuda@brs.nihon-u.ac.jp), **Takao Katase** (Nihon University, Fujisawa, Japan, +81-466-84-3720, katase@brs.nihon-u.ac.jp), **Taketo Uchiyama** (Nihon University, Funabashi, Japan, uctaketo@pha.nihon-u.ac.jp), **Hiroaki Saito** (Nihon University, Funabashi, Japan, h.saito@pha.

nihon-u.ac.jp), **Mitsuko Makino** (Nihon University, Setagayaku, Japan, mimakino@chs.nihon-u.ac.jp), **Yasuo Fujimoto** (Nihon University, setagayaku, Japan, fujim-y@chs.nihon-u.ac.jp), **Yun-Seok Kim** (National Institute for Agro-Environmental Sciences, Tsukuba, Japan, yskim@affrc.go.jp) and **Heesoo Eun** (National Institute for Agro-Environmental Sciences, Tsukuba, Japan, eun@niaes.affrc.go.jp).

The seventeen isomers of branched para-nonylphenols (para-NP) in Technical mixture purchased from Sigma - Aldrich Corporation were isomer-specifically determined with complete separation using their synthesized standards by SIM of structurally specific ions, m/z 135 (alkan-2-yl type isomer), 149 (alkan-3-yl type isomer) and 163 (alkan-4-yl type isomer) on 100m - Petrocol DH column under isocratic temperature of 190 centigrade by GC-MS. Of the seventeen isomers, eight isomers of 4-(2,4-dimethylheptan-4-yl)phenol, 4-(4-methyloctan-4-yl)phenol, 4-(3-ethyl-2-methylhexan-2-yl)phenol (3E22NP), 4-(2,3-dimethylheptan-2-yl)phenol, 4-(3,4-dimethylheptan-4-yl)phenol (s-, and r- types) and 4-(3,4-dimethylheptan-3-yl)phenol (s-, and r-types) synthesized for their determinations were first used as standard substances. The nine other isomers are as follows: 4-(2,4-dimethylheptan-2-yl)phenol, 4-(2,6-dimethylheptan-2-yl)phenol, 4-(3,6-dimethylheptan-3-yl)phenol, 4-(4-ethyl-2-methylhexan-2-yl)phenol, 4-(3,5-dimethylheptan-3-yl)phenol (s-, and r- types), 4-(2,5-dimethylheptan-2-yl)phenol, 4-(3-methyloctan-3-yl)phenol and 4-(2-methyloctan-2-yl)phenol. The seventeen isomers in the Technical mixtures individually occurred at mass percent portion of more than 2 %. The total mass percent portions (A) in the mixture from Sigma - Aldrich Corporation covered with 78 %. The seventeen isomers were assayed estrogenically by yeast estrogen screen system and the activity of 3E22NP was the highest, while that of 4-(3-methyloctan-3-yl)phenol was the least. Their relative activities (B) to that of 3E22NP were individually calculated. Therefore, estrogen equivalent concentrations (EEC = A × B) of the Technical mixture was predictively evaluated. The ratio of the EEC to the conventional concentration, total mass percent portions of the seventeen isomers in Technical mixture from Sigma - Aldrich Corporation was 0.22. The predicted estrogenic activity of one measured concentration of para-NP in Technical mixture was approximately one-fifth fold smaller than the measured estrogen agonist activity. The ratio of the EEC in a sediment core taken from Ariake Bay, Japan was calculated similarly.

209. *Assessing Microbial Response to Nutrient Loading in Natural Stream Systems in the Dry Creek Experimental Watershed, ID*, **Pamela S. Hess** (Boise State University, Boise, ID, 208-585-6501, pamelahess@mail.boisestate.edu), **Mariona Nadal** (Boise State University, Boise, ID, 208-371-7302, krismas84@gmail.com) and **Kevin Feris** (Boise State University, Boise, ID, 208-426-5498, KevinFeris@boisestate.edu).

Nitrate is a common surface water contaminant. There is evidence that elevated levels of nitrogen can influence microbial dynamics and ecosystem function in aquatic ecosystems. Understanding the influence of excess nitrogen on microbial mediated ecosystem functions is important for evaluating environmental impacts of nutrient loading. We have selected two perennial first order tributaries from the Dry Creek experimental watershed (DCEW) near Boise, ID, one of which has unusually high concentrations of nitrate, to study microbial responses to nutrient loading in a natural system. First order streams frequently contain heterotrophic communities relying on nutrient input from riparian zones to survive. Aquatic fungi are primary decomposers of exogenous organic matter in these ecosystems and therefore have profound impacts on aquatic ecosystem function. The role of bacteria in the function of litter degradation is less understood. An observational experiment was conducted from October to January, 2007 to test the hypothesis that an abundance of nitrogen will change both fungal and bacterial community structure dynamics and thus litter degradation rates. Although molecular analysis of our samples is ongoing, preliminary results suggest that 1) microbe-mediated degradation rates may match rates that include invertebrate activity when nitrogen is not a limiting nutrient; 2) bacterial community succession associated with litter degradation may occur more rapidly in nitrogen-rich systems in relation to nitrogen-limited systems. On-going experiments are assessing the influence of elevated N on fungal community succession.

210. *Resilience of a Terrestrial Arthropod Community to a Catastrophic Event*, **R. Andrew Rodstrom** (Washington State University, Pullman, WA, 509-335-5504, andrewrodstrom1@yahoo.com) and **John J. Brown** (Washington State University, Pullman, WA, 509-335-2129, brownjj@wsu.edu).

Epigeal arthropod communities are an integral part of a well functioning ecosystem. This community can often be an indicator of the overall health of an area. When hybrid poplar plantations are harvested, this acts as a catastrophic event within this ecosystem. This project investigated the epigeal arthropod community two years before and two years after the harvest of hybrid poplars in an attempt to document the change in community composition on either side of this planned catastrophe. Arthropod communities were surveyed primarily using pitfall traps, with some supplemental surveying conducted with light traps to provide a broader image of the overall insect community of this system. Temperature data was also recorded both above and below ground in pre- and post-harvest communities to try and quantify potential abiotic differences between the communities. We hypothesized that epigeal arthropod community composition, based on the Shannon-Weiner diversity index, of the post-harvest community would not resemble that of the pre-harvest community. Our results indicate that there is a strong response to both season and harvest within these communities. In addition, we show that the post-harvest community quickly recovers to resemble that of the pre-harvest community. Overall the most common species present in both communities was *Calathus ruficolis* (Coleoptera: Carabidae). This monospecific dominance is most prevalent in the fall, with spring and summer showing greater evenness. We also show that temperatures mirror the community's quick return to pre-harvest species diversity levels.

Health Sciences

211. *Loss of Antigen-Specific CD4+ T Lymphocytes during* Anaplasma marginale *Challenge in Cattle*, **Sushan Han** (Washington State University, Pullman, WA, 509-335-6076, sushan@vetmed.wsu.edu).

Anaplasma marginale is a rickettsial pathogen of cattle that causes morbidity, mortality, and persistent infection. How the rickettsia maintain persistence in the immunocompetent host is poorly understood. Previously, cattle immunized with an immunodominant surface protein of *A. marginale* developed strong antigen-specific CD4+ T lymphocyte responses that following challenge, rapidly disappeared in peripheral blood and remained undetectable throughout persistent infection. To further characterize this loss of infection-induced antigen-specific response, cattle were immunized with a DNA vaccine encoding a conserved 30-mer surface epitope (F2-5B) of

A. marginale and challenged with live organisms. Upon challenge, F2-5B-specific peripheral blood CD4+ T-lymphocyte proliferation and IFN-*f*× secretion again disappeared at peak rickettsemia and remained undetectable until necropsy at 9 weeks to 12 weeks post-challenge. Bovine MHC class II DRB3*1101 tetramers were used to detect the frequency of F2-5B-specific CD4+ T cells in PBMC before and during challenge and from lymphoid organs at death. The frequency of F2-5B-specific CD4+ T lymphocytes sharply decreased in peripheral blood just before peak rickettsemia and remained low until death. F2-5B-specific T-lymphocytes were not detected with tetramers in lymphoid organs at the time of necropsy, showing that antigen-specific T cells were not sequestered in these tissues. Rapid loss of *A. marginale*-specific CD4+ T lymphocytes at the peak of antigenic stimulation during infection is consistent with activation induced cell death and represents an important mechanism by which *A. marginale* controls the host immune response to achieve persistence.

212. *Pathogenesis beyond pX01 and pX02 – In Silico Analysis of* Bacillus Anthracis, **GongXin Yu** (Boise State University, Boise, ID, 208-426-2314, gongxinyu@boisestate.edu) and **Laura Bond** (Boise State University, Boise, ID, 208-426-1438, LBOND@boisestate.edu).

Bacillus anthracis, identified by CDC as one of priority agents amenable for use in biological warfare and bio-terrorism, is a highly virulent gram-positive and spore-forming bacterium. pXO1 and pXO2 are usually the focal point in the pathogenesis study of the pathogen. Indeed, pX01, encoding pag, lef and cya for protective antigen (PA) that mediates delivery of the two active (A) portions, edema factor (EF) and lethal factor (LF), which, when activated, result in disruption of signaling pathways, cell destruction and ultimately shock. pX02, involving in polyglutamic acid capsule formation, is responsible for protecting the bacteria from phagocytosis and other host protective mechanisms upon entering the host. To further our understanding of molecular mechanisms that differentiate this species from its nonpathogenic sister strains *B. cereu* and *B. thuringiensis*, we conducted a comprehensive pathogenesis analysis of *B. anthracis* through GenVar, a genome context-based, and sequence variant-oriented analysis pipeline for comparative studies of closely related bacterial pathogens. The analysis discovered many *B. anthracis*-specific sequence variants upon comparing to *B. cereu* and *B. thuringiensis*. The sequence variants are genes disrupted by the frame shifts and premature stop codons or modified by insertions and deletions and cover some of the most important genes for bacterial pathogenesis such as those coding for flagella, two-component sensor protein, collagen adhesion protein, penicillin-binding protein, spore germination protein, hemolysin II and bacillolysin. The results indicate that the sequence variants, derived from recent Bacillus evolution, are likely to be an essential part of the virulence determining factors besides pXO1 and pXO2. It is the evolution of these genes, together with pX01 and pX02, that differentiates the virulent *B.anthracis* from its avirulent sister species.

213. *Organic Spices as Non-contact Antimicrobial Coatings*, **Jeremiah Hull** (Boise State University, Boise, ID, 208-426-5429, jeremiahsprivatemail@yahoo.com), **Ken Cornell** (Boise State University, Boise, ID, 208-426-5429, kencornell@boisestate.edu) and **Greg Hampikian** (Boise State University, Boise, ID, 208-426-4992, greghampikian@boisestate.edu).

For centuries spices and natural oils have been incorporated into foods and other objects to protect against spoilage. More recently, spices have been investigated for their use as oral and topical antibiotics to fight infectious disease. In this study, we investigate the use of organic oils derived from Tea tree, Red thyme and Cassia bark as antimicrobial coatings. When applied to packaging materials, these oils demonstrated patterns of both contact and non-contact antimicrobial activity against cultures of E. coli. The results suggest a new avenue for the development of coated materials with inherent antimicrobial activity for use in wrapping food or medical devices to protect against contamination.

214. *New Drug Targets for Treating Lyme Disease*, **Maria Martinez**[1], **Cassie Bassett**[2], **Cassie Dayan**[3], **Diana Saidac**[4], **Nikhat Parveen,**[4] and **Ken Cornell**[5], [1](Boise State University, Boise, ID, 208-899-6838, MariaMartinez5@boisestate.edu); [2](Boise State University, Boise, ID, 208-426-9394, CassieBassett@mail.boisestate.edu); [3](Boise State University, Boise, ID, 208-426-9394, cassiedayan@msn.com); [4](New Jersey Medical School, Newark, NJ, 973-972-4483, parveeni@undmj.edu); [5](Boise State University, Boise, ID, 208-426-5429, kencornell@boisestate.edu).

The spirochaete *Borrelia burgdorferi* causes Lyme disease, an illness spread by the bite of an infected tick. *Borrelia* is unusual among bacterial species in that its genome encodes up to three forms of 5' methylthioadenosine / S-adenosylhomocysteine nucleosidase (MTN), an enzyme that plays a critical role in methionine and adenine salvage, and the production of autoinducer 2 quorum sensing molecules. To further investigate the importance of these enzymes for *Borrelia* survival and to begin to study their role as targets for antibiotic development, genes for cytoplasmic and membrane bound forms of MTN were cloned and expressed as recombinant hexahistidine tagged proteins in *E. coli*. Specific activity measurements and kinetic studies conducted on enzymes purified by Ni-chelate affinity chromatography indicate that the nucleosidases cleave both 5' methylthioadenosine and S-adenosylhomocysteine with high efficiency. In addition, a panel of non-hydrolyzable transition-state analogs showed potent inhibition of nucleosidase activity, with Ki values ranging from 0.4 to 4 nM. The results highlight a possible route for the development of new drugs to treat Lyme disease that target essential nutrient salvage pathways.

215. *Purine Auxotrophy, Giardia's Achilles' Heel?* **Jeremy Bonander** (Boise State University, Boise, ID, 208-559-6122, jeremybonander@mail.boisestate.edu) and **Ken Cornell** (Boise State University, Boise, ID, 208-426-5429, kencornell@boisestate.edu).

Giardia intestinalis is the leading cause of non-bacterial diarrhea on the planet, affecting up 6 million Americans and 1.3 billion people worldwide. Up to 20% of all cases of disease (~ 260 million) are refractory to treatment, thus new drugs are needed. Like other parasitic protozoans, *Giardia* is a purine auxotroph, and has a unique pathway that allows it to recycle both adenine and methionine that is expended during the biosynthesis of polyamines. To further investigate this pathway as a target for drug development, the gene encoding a unique 5' methylthioadenosine nucleosidase (MTN) central to the salvage pathway was identified by BLAST search using known bacterial enzyme sequence. The *Giardia* MTN gene was subsequently PCR amplified, cloned and expressed as a recombinant hexahistidine tagged protein in *E. coli*. Purified recombinant enzyme demonstrated a subunit molecular weight of 32.4 kDa, and a specific activity of 8.9 U/mg for 5' methylthioadenosine hydrolysis. Enzyme kinetic studies and inhibitor analysis are currently underway to further assess the sensitivity of this pathway to drugs that would function by starving

the parasite of essential purine and methionine constituents.

216. *Cloning and Expression of* Entamoeba histolytica *MTA Nucleosidase*, **Robert Ormond** (Boise State University, Boise, ID, 208-571-1795, robertormond@boisestate.edu), **Tyrell Simpkins** (Boise State University, Boise, ID, 208-286-5464, simkinst@msu.edu) and **Ken Cornell** (Boise State University, Boise, ID, 208-426-5429, kencornell@boisestate.edu).

Entamoeba histolytica causes amebiasis, an enteric disease characterized by bloody diarrhea, intestinal cramping, stomach pain, and in severe cases liver abscesses. The disease is primarily spread through fecal contamination of water and food, and is one of the leading causes of dysentery encountered in developing countries. As with other parasitic protozoans, *Entamoeba* cannot synthesize its own purines or methionine, and thus has developed unique salvage pathways to obtain and recycle these compounds. In order to develop new and better therapies for treating amebiasis, the gene encoding a specific salvage enzyme, 5' methylthioadenosine nucleosidase (MTN) was identified, cloned, and expressed as a recombinant protein in E. coli. Purified recombinant *Entamoeba* MTN showed a specific activity of 3.7 U/mg enzyme and a Km of 0.2 uM for the native substrate 5' methylthioadenosine. Analysis of MTN inhibitors may reveal new antibiotics that kill *Entamoeba* cells by interrupting their ability to recycle essential purine and methionine metabolites.

217. *Methylthioribose Kinase, a Sweet Target for Antibiotic Design*, **Chelsea Isom** (Boise State University, Boise, ID, 208-371-8857, chelseaisom@gmail.com), **Cassie Dayan** (Boise State University, Boise, ID, 208-426-5521, cassiedayan@msn.com) and **Ken Cornell** (Boise State University, Boise, ID, 208-426-5429, kencornell@boisestate.edu).

The salvage of methionine from the sugar 5-methylthioribose (MTR)requires a unique enzyme, 5-methylthioribose kinase (MTRK), that is found in plants and a few bacterial species. MTRK converts MTR to MTR-1-phosphate in an ATP dependent step. Due to it absence in humans, this enzyme is an attractive target for the design of specific antibiotics that would affect a relatively narrow range of bacterial pathogens, including *Klebsiella pneumonia* and *Bacillus anthracis*. To further explore MTRK as a drug target, the corresponding gene from *Klebsiella pneumoniae* was cloned and expressed as a recombinant protein. Enzyme analysis utilizing a pyruvate kinase / lactate dehydrogenase colorimetric assay indicates that MTRK has a Km for MTR of 19uM, and a kcat of 402/sec. MTRK inhibitors demonstrated the ability to block both in vitro growth and biofilm formation in *Klebsiella* cultures. Finally, a new system using immobilized 5' methylthioadenosine nucleosidase to enzymatically synthesize substituted sugars as MTRK inhibitors is described.

218. *Construction of LcrV-Enterotoxin Fusions for use as Potential Mucosal* Yersinia *Vaccines*, **Chadwick T. Davis** (Boise State University, Boise, ID, 208-426-05478, ChadDavis1@mail.boisestate.edu) and **Juliette K. Tinker** (Boise State University, Boise, ID, 208-426-5472, juliettetinker@boisestate.edu).

There is an ever present need for the production of novel vaccines to combat infectious disease. The induction of specific immune responses in mucosal tissues by the oral or nasal administration of vaccines is highly desirable for many reasons, including protection from airborne or aerosolized biowarfare agents. Cholera toxin (CT) from *Vibrio cholerae* and heat-labile toxin (LTI) from *Escherichia coli* are vaccine adjuvants that have the unique ability to induce mucosal and systemic immune responses to mucosally co-administered antigens. These bacterial proteins however are too toxic for use in humans in their native forms. The studies we present here reveal the construction and purification of novel CT and LTI chimeras containing the surface LcrV antigen from *Yersinia*. These molecules retain the native toxin binding subunit necessary for adjuvanticity but replace the toxic moiety of CT and LTI with LcrV, and represent potential mucosal vaccines against the bioterror agent *Y. pestis*. We utilized plasmids that express the non-toxic A2 and B subunits of CT and LTI from an *E. coli* leader to direct secretion to the periplasmic space. We cloned *lcrV* from *Y. enterocolitica* into these plasmids and transformed into *E. coli* for expression. The novel molecules were extracted from the bacterial periplasm and purified. Proper folding and composition was verified by SDS-PAGE and Western blot using anti-CT and anti-LcrV antibodies. In addition, protein concentration was quantified and chimeras were further characterized via ELISA. Our studies indicate that potential vaccine enterotoxin chimeras can be properly assembled and purified from *E. coli*. In addition, these molecules represent important novel mucosal vaccines and will open the door to many future studies involving immunization and protection studies.

219. *Utilizing RNA Interference to Knockdown the Expression of Oncostatin M Receptor Beta*, **Patrick S. Aranda** (Boise State University, Boise, ID, 208-412-4688, inf_bliss@yahoo.com) and **Cheryl L. Jorcyk** (Boise State University, Boise, ID, 208-426-4287, cjorcyk@boisestate.edu).

According to the National Cancer Institute, in the United States it is estimated that 12.7 percent of women born today will be diagnosed with breast cancer at some time in their lives. Cancer cells rely on a multitude of proteins to metastasize, proliferate, and destroy the body. One of these proteins is the cytokine oncostatin M (OSM), a multifunctional signaling protein. We recently reported that an increase in OSM is related to an increase in vascular edothelial growth factor (VEGF). VEGF increases angiogenesis, the formation of new blood vessels, supplying the cancer cells with the oxygen, nutrients, and vessels to proliferate and metastasize. In mice, mOSM signals through a specific receptor complex consisting of a heterodimer of gp130 and the mOSMR beta subunit, resulting in such effects as inflammation, remodeling of the extracellular matrix, hematopoeisis, and modulation of cell growth and differentiation. One way to reduce the expression of a gene, such as mOSMR beta, is through RNA interference (RNAi). Utilizing RNAi the functional role that OSM and OSMR play in angiogenesis and tumor progression will be elucidated by knocking down the expression of mOSMR beta. We propose that knocking down mOSMR beta mRNA, which will lead to the reduction in mOSMR beta on the surface of mouse cells, will result in a reduction of aggressive qualities in mouse mammary cancer cells *in virto* and *in vivo*.

220. *Identification of Proteins that Interact with the Surface of Collagen Fibrils*, **Raquel Brown** (Boise State University, Boise, ID, 208-426-2125, rbrown@boisestate.edu) and **Julia Thom Oxford** (Boise State University, Boise, ID, joxford@boisestate.edu).

The extracellular matrix of articular cartilage is composed of collagens, proteoglycans and a variety of noncollagenous, nonproteoglycan molecules which interact to ultimately contribute to the structural integrity, compressibility and tensile strength of the tissue. As the interaction between collagen fibrils and cartilage components contributes to ordered skeletal development, the goal of our investigation was to examine the potential interactions that link the collagen network to other matrix constituents. Utilizing the recombinant aminopropeptide of

collagen α1(XI), which resides on the surface, proteins extracted from bovine articular cartilage were separated by affinity chromatography. Molecules extracted from the articular cartilage and enriched by their association with the surface of the collagen fibril were identified by tandem mass spectrometry. Proteins enriched by the association with the surface of the α1(XI) collagen fibril were predominantly: the collagen types IX, XII and XIV; the extracellular matrix proteins, COMP (thrombospodin-5), thrombospondin-1, matrilin-1 (CMP), chondroadherin, PARP, matrilin-3, chondrocalcin and proteoglycans; biglycan and fibromodulin. The results presented here provide evidence that the NTD of collagen α1(XI) may associate, either directly or indirectly, with a variety of cartilage matrix constituents in the connective tissue and suggest the possibility that this region of collagen α1(XI) may add structural support bridging the environment between chondrocytes and the surrouding extracellular matrix or play a role in fibrillogenesis.

221. *The Effect of Socioeconomic Factors on the Use of Dental Care in Pacoima , California , 2001 and 2004*, **Kim Le Huynh** (University of California Los Angeles, Los Angeles, CA, 408-207-6135, kimlehuynh@yahoo.com), **Habiba Ismail** (University of California Los Angeles, Los Angeles, CA, 310-424-8300, habiba_i2003@yahoo.com) and **Erika Gomez** (University of California Los Angeles, Los Angeles, CA, 626-319-5896, eg91801@yahoo.com).

The oral health status of most Americans has improved dramatically over the last three decades. However, this increase is not seen in underserved communities such as Pacoima, a community of 98,000 residents in the northeast San Fernando Valley of Los Angeles with a predominantly Latino (86%) immigrant population. A cross-sectional Community Engagement study collected data from 800 Pacoima households to create a community household survey, *A Comparison of Data on Businesses and Residents 2001-2004* (Philliber, 2004). This study assesses the effects of socioeconomic factors on dental service use in Pacoima households over two points in time (2001 and 2004). SAS and STATA statistical programs were used to perform bivariate and multivariate analyses using data sets from these two years. The "Behavioral Model of Health Services Use" (Andersen, 1996) was used to measure the importance of various independent variables as they relate to the utilization of dental services. Among the independent variables tested in the bivariate analyses were home ownership, citizenship and bank accounts. These variables showed an influence on dental care use in 2001 and 2004. During this time, there was a 4% increase in homeownership and increases in: citizenship (2%), English comprehension (6%), educational level (15%), insurance (6%), and self-reported oral health status (6%). The results suggest that there was an increasing use of dental services among Pacoima homeowners between 2001 and 2004. Despite this, Pacoima continues to remain a low dental access area and these results point to the increasing oral health needs of the residents. Key words: Pacoima, home ownership, oral health services.

222. *Dental Practice Characteristics and the Mix of Services*, **Courtney A. Naten** (University of California Los Angeles, Los Angeles, CA, 916-798-5819, cnaten@hotmail.com), **Damon D. Webber** (University of California Los Angeles, Los Angeles, CA, 310-562-4581, ddwebber@hotmail.com) and **Adel P. Newell** (University of California Los Angeles, Los Angeles, CA, 678-642-6360, apnewell@xula.edu).

This study examines the characteristics of dental practices and their significance in determining the type and quantity of services rendered. By understanding these relationships practitioners could better evaluate the structure of their practices and design practices to address service disparities while improving productivity.

This study is based on results from a 2003 survey of 13,653 California private dental practices with 51% responding. The survey questions concerned practice design, patient and staff characteristics, and services provided. The mix of services were broken down into three categories; Primary (diagnostic, preventive, etc.), Secondary (operative, endodontics, etc.) and Tertiary (oral and maxillofacial surgery, prosthodontics, etc.). To narrow the focus of this study data received from specialists, including pedodontists, were excluded. Univariate and bivariate analysis was performed on the resulting data set ($p<.05$).

The data revealed that large practices (5+ chairs) produced larger percentages of secondary and tertiary work. Practices that had 1 or more full time equivalent hygienist produced higher percentages of secondary and tertiary work. Dentists that felt not busy enough reported conducting a smaller percentage of tertiary work than dentists that felt busy enough or too busy. Acceptance of sliding scale fees was associated with smaller percentages of tertiary care. Patient ethnic variation was also observed. Practices with more than average white patients did more secondary work. Practices with more than average Latino and black patients did less secondary and more tertiary work.

While further research is needed to refine and focus the various correlations between practice characteristics and the mix of services this study has shown that characteristics of dental practices such as; practice structure, employment, staffing, fees and busyness determine the mix of services provided.

223. *Studies on Relationship between Longevity and Geological Environment in Bama County of China*, **Zhiyong Zhang** (Guangxi Medical University, Nanning, Guangxi, China, 86-771-5358804, rpazz@163.com), **He Sheng Jiang** (Guangxi University, Nanning, Guangxi, China, 86-771-2621715, hsjiang@tom.com), **Min He** (Guangxi Medical University, Nanning, Guangxi, China, 86-771-5358634, M_H_@sina.com), **Jian Qin** (Guangxi Medical University, Nanning, Guangxi, China, 86-771-2068311, qinjian1617@sina.com), **Huaxiang Lu** (Guangxi Medical University, Nanning, Guangxi, China, 86-771-2068311, maxpeon@gmail.com), **Zhihua Jiang** (Guangxi Medical University, Nanning, Guangxi, China, 86-771-2068311, laojiang20@163.com), **Yuan Zou** (Guangxi Science & Technology Department, Nanning, Guangxi, China, 88-771-5881030, zoyuan1029@163.com), **Yurong Qin** (Guangxi University, Nanning, Guangxi, China, 86-771-3245643, qyr111@163.com), **Jinchao Chen** (Bama Longevity Research Institute, Bama County, China, 86-778-6212999, bm2004@gx163.com) and **Zhibiao Huang** (Guangxi Center for Chemical Analysis & Measurement, Nanning, Guangxi, 86-771-5318285, hlj58894@tom.com).

Bama County of Guangxi province, China, is a famous longevity area in the world. The third nationwide population census of China in 1982 showed that there were 50 centenarians in Bama County (total population was 192,000), which constituted 12% of all 412 centenarians of Guangxi province (total population was 36,000,000). Now there are 76 centenarians in Bama, with the ratio of 31/100,000 population, which is the highest in the whole country with a county as unit. Although development of society and economy maintains nearly equilibrium and the climate, foods structure and diet habit are similar in all towns of Bama, the level of longevity is widely divergent in different towns. Our investigation found that most long-lived elderly distribute in rock-mountain areas and seldom in earth-hill areas. About 60% of centenarians are living on both sides of some underground rivers. It seems that Bama longevity

is associated with the local geological environment. The chemical element analysis of hair (ICP-AES method) found that following element contents of hair (mean±SD, μg/g) from inhabitants living in rock-mountain villages(n=33) are lower than those from ones living in earth-hill villages (n=31) ($P<0.05$): K(27.3±2.4 and 44.7±5.2), Mg(53.4±4.2 and 76.5±6.9), Mn(5.8±0.9 and 20.3±3.5), Sr(1.4±0.2 and 2.6±0.4), Se(0.28±0.1 and 0.57±0.1), Pb(6.5±0.9 and 10.9±1.8), respectively.The reasons for the results remain to further study.

Earth Sciences

224. *Microbial Alteration in Pristine Rocks*, **Sabine Airieau** (ASSAI, Berkeley, CA, 510-495-5719, sabine_airieau@affymetrix.com), **Yvette Piceno** (Lawrence Berkeley National Laboratory, Berkeley, CA, YMPiceno@lbl.gov) and **Gary Andersen** (Lawrence Berkeley National Laboratory, Berkeley, CA).

Pristine meteorites are used as benchmark rocks for planet evolution because they are remnants of the era of planet formation 4.6 Ga. Yet, meteorites host biological activity even when carefully curated. About 50 microbial species were cultured in 21 chondrites and 8 martian stones. In 2005, cell culture plates were incubated 1 and 11 months (20 and 4C respectively). Meteorite fragments from chondrites were broken off stones in sterile mortars. The core of the rocks, less contaminated than the surface, was used for cell culture. Some samples were flakes of wet meteorites isolated after a 10-day water extraction. Independently, several martian meteorites were brushed with sterile swabs and dust grains were collected on weighing paper and isolated in sterile tubes. These samples include Zagami USNM 6545, Lafayette USNM 1505, Los Angeles USNM 7052, Shergotty USNM 321, Nakhla USNM 5892, Nakhla USNM 426 (117.4 g) and Nakhla USNM 426 (18.2 g), and Chassigny USNM-MNHN 2524. Measurements with a Limulus Amoebocyte Lysate (LAL Assay, Carnegie Institution of Washington and Woodshole Laboratory) revealed the swabs tips featured low biological activity except for Nakhla USNM 426 (18.2 g) (below detection limit) and Chassigny (data unavailable). The LAL method assesses gram negative bacterial equivalents. Only one cell culture was successful for the martian meteorites (Los Angeles, Sabouraud Dextrose). The sequences for EET 87770 and Leoville were typical soil and/or plant-related bacteria commonly found in Earth habitats.

Western Society of Soil Science

225. *Soil Development on a Sequence of Moraines, Eastern Sierra Nevada, CA*, **Ann M. Rossi** (University of California Riverside, Riverside, CA, 951-827-3711, aross003@student.ucr.edu) and **Robert C. Graham** (University of California Riverside, Riverside, CA, 951-827-3751, graham@mail.ucr.edu).

Soil chronosequence studies are useful in understanding rates and processes of soil formation as well as the geomorphic relationships of an area. This study focuses on soil development on the glacial moraines along Bishop Creek near Bishop, CA. The ages of these moraines have been previously estimated using cosmogenic surface dating techniques. The moraines in this sequence range in age from 18 to over 160 ka. Soils were sampled and described on four moraine crests with estimated ages of 19, 65, 120, and 160 ka. Soil development is evidenced by the formation of clay lamellae and vesicular A horizons. Pedogenesis has been slow, probably due to the semi-arid climate and sparse vegetation. The sandy and gravelly nature of the soils has limited the accumulation of clays in the subsurface.

226. *Soil-Geomorphic Classification of an Arid Mountain Range, Mojave Desert, USA*, **Daniel R. Hirmas** (University of California, Riverside, Riverside, CA, 951-827-3711, daniel.hirmas@email.ucr.edu) and **Robert C. Graham** (University of California, Riverside, Riverside, CA, 951-827-3751, graham@mail.ucr.edu).

Soil-geomorphic relationships of arid landscapes are well documented in the literature. In the southwestern USA, these studies have focused on piedmont and basin floor parts of the landscape. Although arid mountains compose approximately 38% of the total area in this region, little attention has been given to their soil-geomorphic significance. The goal of this study was to classify landforms of the Fry Mountains, Mojave Desert, as a step toward understanding soil-geomorphic relationships of arid mountains. Mountain landforms were classified based on geomorphic position. Four major landforms were identified: mountaintop, mountainflank, mountainflat, and mountainbase. In addition, component landforms within the mountainflank (e.g., sideslope and bench) and mountainflat (e.g., hill, pediment, and colluvial apron) were identified. Forty-five sampling locations were randomly chosen across the mountains and an additional 20 locations were chosen on the piedmont and basin floor of the study area for comparison purposes. Detailed soil morphological descriptions were made and a suite of rock, vegetation, and morphometric land-surface characteristic (LSC) properties were measured at each location. Discriminant analyses confirmed that these mountain landform designations are indeed distinct from one another on the basis of LSC properties. Soil classifications revealed complex relationships between geomorphic processes of dust and water flux, surface properties, and soil development. Our findings suggest arid mountains are an important link in understanding desert soilscapes.

227. *Comparison of Flood Hazard Assessments on Alluvial Fans Using FEMA, NRCS, and Surficial Geologic Maps: A Case Study in Ivanpah Valley, Nevada,* **Colin R. Robins** (University of Nevada Las Vegas, Las Vegas, NV, 702-895-1162, robinsc@unlv.nevada.edu), **Brenda J. Buck** (University of Nevada Las Vegas, Las Vegas, NV, 702-895-1694, buckb@unlv.nevada.edu), **Douglas J. Merkler** (USDA NRCS Nevada, Las Vegas, NV, 702-262-9047, doug.merkler@nv.usda.gov), **Michael S. Howell** (University of Nevada Las Vegas, Las Vegas, NV, 702-895-4616), **Janice L. Morton** (University of Nevada Las Vegas, Las Vegas, NV, 702-895-3118), **Amanda J. Williams** (University of Nevada Las Vegas, Las Vegas, NV, 702-895-1132), **Maureen L. Yonovitz** (University of Nevada Las Vegas, Las Vegas, NV, 702-895-3874) and **P. Kyle House** (Nevada Bureau of Mines and Geology, University of Nevada Reno, Reno, NV, 775-784-6691, khouse@unr.edu).

Flood hazard maps are essential tools for safeguarding lives and property. Currently, flood hazard maps differ widely depending on the data and methodologies used. In particular, flood behavior on alluvial fans in arid/semi-arid climates differs from that of perennial rivers but is becoming increasingly important as urbanization exponentially expands into arid regions. To help understand these differences, and to ameliorate confusion for map users, we compared FEMA (FEMA 2007), NRCS (Soil Survey Staff, 2007), and surficial geological (House et al., 2006; House 2007) maps for the Ivanpah Valley transportation corridor in southern NV. The FEMA digital flood insurance rate map depicts areas that lie within the 100-yr flood hazard (Zone A) and those that do not (Zone X). The order 3 NRCS survey shows 40 associations, each containing up to 5 distinct components and flood classes. The 1:50,000 geologic map contains 21 unique geomorphologic units. Of the 1001.5 sq. km field area, 3.4% lies within FEMA Zone A, whereas

21.9% (including 1.8% playa) lies within the House (2007) very high flood class alone. NRCS units are directly comparable to neither the FEMA map nor the geologic map due to differences in scale or flood hazard determination. Soil and geomorphologic data do allow direct correlation between House et al. (2006) map units and NRCS component series, however, these maps differ significantly in flood hazard assessment. Although each map varies in scale, methodology used, and types of data collected, geomorphology is perhaps the most important criterion for arid alluvial fan flood hazard determination.

228. *Predictive Soil Maps Generated from Decision Tree Analysis and GIS Technology*, **Jeffrey S. Pace** (Oregon State University, Corvallis, OR, 541-737-4519, paceje@onid.orst.edu) and **Jay S. Noller** (Oregon State University, Corvallis, OR, 541-737-6187, Jay.Noller@oregonstate.edu).

Conducting a soil survey is a time consuming and costly undertaking. Soil scientists must dig in numerous places over large expanses of land in order to properly describe the soils found, assign a taxonomic classification to each and then delineate soil map unit boundaries. Field-gathered data about the landscapes and other important information must also be considered while determining map units.

Digital data measuring environmental variables that affect soil formation are becoming more widely available, and therefore can assist in efforts to complete the mapping of soils in the U.S. Soil and environmental data documented in mapped areas, which contain similar traits as the unmapped land, are processed using GIS and then analyzed using decision tree analysis software. Rule sets created by this analysis are then applied to the unmapped area in order to predict the location of soil map units. With accurate predictive maps the time and money spent conducting soil surveys are being reduced significantly.

This poster explains the steps taken to generate predictive soil maps of Wheeler County, an unmapped county in north-central Oregon. ArcGIS 9.1, ERDAS IMAGINE 8.7 and See5 are the programs used to process the raster datasets, analyze the data and generate the rule sets needed to generate predictive soil maps

229. *Predictive Mapping in the Fremont National Forest, Oregon*, **Melanie R. Malone** (Oregon State University, Corvallis, OR, 541-737-4507, Melanie.Malone@oregonstate.edu) and **Jay S. Noller** (Oregon State University, Corvallis, OR, 541-737-6187, Jay.Noller@oregonstate.edu).

In forested lands, the need for accurate multi-resolution data is becoming more important in order to sustain environmental management. Land type association (LTA) mapping involves combining vegetation, soil type, and general geomorphology into one map unit. One location where this method is being implemented is in the Fremont National Forest (NF) in south-central Oregon. Though the Fremont NF was established in 1908, mapping its contents has proved difficult. The forest spans over one million acres on high volcanic plateau lands on the eastern side of the Cascade Mountains. Much of its topography is the result of the area's tectonic and volcanic history, whereby the activity of faulting and eruptive centers and lava flows has shaped the landscape into a complex terrain.

A predictive mapping approach is being applied to initial LTA mapping of the Fremont NF. All data layers used are converted from grid format to Imagine file format and sampled using the CART model within ERDAS imagine. Additionally, the investigated map units in the areas of interest and the adjoining county maps are sampled for other environmental variables. This step produces the output data matrix for the decision tree analysis, using the program See5. After analysis, raster maps are produced and overlaid on DEM, hillshade, and other environmental layers for field use and sharing amongst collaborators. It is expected that the modeling will occur in two steps: first, derive a detailed (1:24,000) predictive geomorphological map layer, then, second, derive the predictive LTA map and aggregate to 1:100,000 scale.

230. *Using Decision Tree Analysis to Generate Rule Sets for Predictive Soils Mapping*, **Sarah J. Hash** (Oregon State University, Corvallis, OR, 541-737-4507, sarah.hash@oregonstate.edu) and **Jay S. Noller** (Oregon State University, Corvallis, OR, 541-737-6187, jay.noller@oregonstate.edu).

The process of soil survey is often a tedious, time-consuming, and costly endeavor. Well-trained field scientists must cover tremendous expanses of land, dig and describe soil profiles, determine taxonomic classification, and carry out mental interpolation with the collected data to accurately draw soil map unit boundaries. When delineating soils, the soil scientist uses knowledge of the soil-forming factors–spatial and temporal environmental variables whose unique combinations produce unique soils—and how variations in these factors across the landscape dictate where a certain soil type will end and another begin.

Soil scientists may soon be able to take advantage of the plethora of digital data available that actually quantify the environmental variables that affect soil formation. These data can be collected for a previously mapped area analogous to the area of interest, prepared in a GIS, and then analyzed with decision tree classifier software. Generated rule sets are then applied to produce predictive soil maps for the unmapped area. In the near future, rule-based predictive maps that are generated with a high level of confidence could give field scientists a valuable tool for fieldwork planning and project management.

This paper outlines the procedure used in the active initial soil survey of Malheur County, Oregon. Raster datasets are prepared in ArcGIS 9.1 and ERDAS IMAGINE 8.7, and then data are analyzed using the CART sampling tool in IMAGINE and See5 decision tree classifier software.

231. *Impact of Soil Mineral Assemblage and Acidity on Organic Carbon Cycling in a Range of Ponderosa Pine Forests*, **Katherine A. Heckman**[1], **Amy Welty-Bernard**[2], **Craig Rasmussen**[3], **Egbert Schwartz**[2] and **Jon Chorover**[4], [1](University of Arizona, Tucson, AZ, 417-214-2678, kheckman@email.arizona.edu); [2](Northern Arizona University); [3](University of Arizona, Tucson, AZ, 520-621-7223, crasmuss@ag.arizona.edu); [4](University of Arizona, Tucson, AZ).

Ponderosa pine forests play a significant role in regional soil organic carbon (SOC) budgets. However, the underlying mechanisms of SOC stabilization are poorly understood in these systems. We hypothesized that Al-humus complexes, short-range-order (SRO) Fe-oxyhydroxides, and soil acidity impact SOC stabilization and soil microbial community. We sampled a lithosequence of four parent materials (rhyolite, granite, basalt, limestone) under *Pinus ponderosa* to capture a soil acidity gradient and to elucidate the effects of soil mineralogy and Al–chemistry on SOC dynamics and microbial community composition. Three soil profiles were examined on each parent material and analyzed by X-ray diffraction, total elemental analysis, CEC, pH, selective dissolution, C and N content, and 13C stable isotope signature. Microbial communities were examined by most probable number (MPN) analysis before and after treatment with varying

concentrations of Al. In A horizons regression analysis indicated that SOC was only partially related to soil physical and mineral variables with significant positive correlations to clay content, Al-humus complexes and Al- substituted into free Fe-oxides. In subsurface B horizons, regression analysis indicated that Al-humus complexes (r^2 = 0.73; P = 0.0017) and short-range-order Fe-oxyhyrodixes (r^2 = 0.64; P = 0.0052) played a significant role in controlling SOC content. We also noted a shift in form of Al from predominantly monomeric, exchangeable forms in acid soils to Al-humus complexes in basic soils. Our results to date demonstrate variability in SOC stabilization mechanims between four parent materials and with depth, as well as pH and Al-controlled variability in microbial community.

232. *Evaluation of Ponderosa Pine Management Practices Based on Economic Profitability and Opportunity of Receiving Carbon Credits*, **Amitava Chatterjee** (University of Wyoming, Laramie, WY, 307-399-7528, amitava@uwyo.edu), **George F. Vance** (University of Wyoming, Laramie, WY, 766-2297, gfv@uwyo.edu), **Siân Mooney** (Boise State University, Boise, ID, 208-426-1471, sianmooney@boisestate.edu), **Daniel B. Tinker** (University of Wyoming, Laramie, WY, 307-766-4967, tinker@uwyo.edu), **James Arnold** (Wyoming State Forestry Division, Cheyenne, WY, 307-777-6680, jarnol@state.wy.us), **Peter D. Stahl** (University of Wyoming, Laramie, WY, 307-766-2179, unclem@uwyo.edu) and **Bill Haggenson** (Wyoming State Forestry Division, Cheyenne, WY).

Increasing concentrations of carbon dioxide (CO_2) in our atmosphere is thought to lead to changes in global climate and has spawned national and international policies to slow down the rate of CO2 emissions as well as management practices that increase carbon sequestration. Ponderosa pine (*Pinus ponderosa*) is one of the dominant forest species in Wyoming and accounts for 67 percent of Wyoming timber harvest. Moreover, 64 percent of ponderosa pine forests occupy private land and are managed extensively. The economic profitability and potential of developing C credits were estimated for three ponderosa pine stands - unmanaged, even-aged, and uneven-aged sites located in Black Hills National Forest, Wyoming. Economic analysis of C credits and profitability suggest that average annual change in C was highest with even-aged management, whereas maximum economic profitability was accomplished with t uneven-aged management. If a forest manager could receive an annual payment of at least $15.16 Mg-1C ha-1 switching from uneven-aged to even-aged management would be profitable.

233. *Soil Quality Characteristics in High Elevation Riparian Wet Meadows in the Sierra Nevada: Relationships to Hydrologic Functionality,* **Laura J. Jungst** (University of Wyoming, Laramie, WY, 406-240-9289, ljungst@uwyo.edu), **Hayley R. Olsen** (University of Wyoming, Laramie, WY, 435-770-1515, holsen3@uwyo.edu), **Jay B. Norton** (University of Wyoming, Laramie, WY, 307-766-5082, jnorton4@uwyo.edu), **Urszula Norton** (University of California Davis, Davis, CA, 307-760-2189, unorton@uwyo.edu), **William R. Horwath** (University of California Davis, Davis, CA, 530-754-6029, wrhorwath@ucdavis.edu) and **Kenneth W. Tate** (University of California Davis, Davis, CA, 530-754-8988, kwtate@ucdavis.edu).

Upper montane and subalpine wet meadows are crucial components of high-elevation headwater ecosystems across the Western United States. Meadow/stream functionality and soil organic matter (SOM) accumulation in these ecosystems can be highly impacted by human uses and management. SOM increases soil quality and contains much of the earth's terrestrial carbon (C), making it an important component of global C storage. In August, 2006, we launched a field study investigating the meadow functionality and SOM storage of High-Sierra montane and subalpine wet meadows in central California. Nineteen meadows were enrolled in the study to represent a range of hydrologic functionality ratings as determined by the Stanislaus National Forest. The specific objectives of this study were to characterize and quantify soil C storage in subalpine/montane meadows of the central Sierra Nevada and examine restoration potential specifically to increase C storage. This was a cross sectional observational study in which soil physical and chemical characteristics were evaluated and vegetation and channel characteristics were described. The relationship between C quantity and quality would vary with functional condition of the sampled meadows. Furthermore, the extent of channel downcutting would influence the type and amount of SOM stored. We will report the results of analysis of this dataset to evaluate the significance and magnitude of these relationships. Understanding of the relationships between hydrologic functionality, vegetation and SOM will assist in the prioritization of meadow restoration, as well as provide relevant information on C storage in this montane landscape.

234. *Soil Morphology and Organic Matter Beneath Cheatgrass-, Sagebrush-, and Bunchgrass-Dominated Shrub-Steppe Vegetation*, **Jay B. Norton** (University of Wyoming, Laramie, WY, 307-766-5082, jnorton4@uwyo.edu), **Thomas A. Monaco** (USDA-ARS, Logan, UT, 435-797-7231, tmonaco@cc.usu.edu), **Tom A. Jones** (USDA-ARS, Logan, UT, 435-797-3082, tomjones@cc.usu.edu) and **Robert R. Blank** (USDA-ARS, Reno, NV, 775-784-6057, blank@unr.nevada.edu).

Cheatgrass (*Bromus tectorum*) is an invasive annual grass that increases wildfire frequency, degrades native ecosystems, and threatens agriculture across vast areas of the western U.S. Our research examines how cheatgrass may resist reversion to native shrub-steppe vegetation by altering physical and biological properties of soils. The degree of such alteration may impact success of rangeland restoration. We compared morphology and soil organic matter characteristics in soil profiles and replicated 0- to 10- and 10- to 20-cm surface samples at sixteen cheatgrass-dominated sites and geomorphically paired adjacent sites dominated by native sagebrush-steppe vegetation in Utah, Idaho, Nevada, and Oregon. Sagebrush-steppe vegetation ranged from native bunchgrass-dominated sites to degraded sites with little herbaceous cover. Results show differences between sites in soil structure, pH, and the distribution and quality of soil nutrients and organic matter pools. The magnitude of these differences varies with the quality of the native plant community. We suspect that this variation may result from a combination of past site disturbance (e.g., fire frequency, grazing management), the length of time cheatgrass has dominated the site, and basic soil properties that control ecological resistance to change. These factors also likely impact the success of restoration treatments on Great Basin Rangelands.

235. *Influence of Plant Nutrition and Chemical Treatments on* Phymatotrichoposis omnivora *in Cotton*, **John E. Matocha** (Texas A&M University Systems, Corpus Christi, TX, 361-265-9201, jmatocha@ag.tamu.edu) and **James C. Wilborn** (Texas A&M University Systems, Corpus Christi, TX, 361-265-9201, jcwilborn@ag.tamu.edu).

Cotton root rot (*Phymatotrichopsis omnivora*) destroys a significant portion of Texas cotton and affects cotton grown in other states in the Southwest United States. Aerial infrared photography and visual

inspections documented cotton root rot (PRR) affected soils producing diseased cotton and also iron (Fe) and zinc (Zn) deficient grain sorghum crops on the same-site specific soils. This strongly indicated an association between Fe and Zn deficiency chlorosis on the monocot and the severity of PRR incidence on cotton. Validation of field observations through soil sample analyses indicated that nutrients, Fe and Mg and possibly others including Zn and Nickel (Ni) may be in short supply in soils where PRR on cotton becomes severe. As a result, a number of greenhouse and field studies were conducted evaluating various organic, biological, cultural and chemical methods for their effects on suppressing the root rot disease on cotton. Treatment materials appearing most promising in the greenhouse were a Fe-enriched Amaranthus plant material (produced in the field), Florida mined Fe material, a synthetic Fe chelate (Sesquestrene Chel-138) and Iron Sul (acid Fe-S material). In field studies, iron chelate (Fe-EDDHA) applied in the seedrow reduced plant mortalities to 36% from 61% for the control. In field studies, ammonium sulfate (AS) as the primary source of N reduced early plant mortality from 13% in the control to 1.5%. Later in the season AS showed only 14% mortality compared to 62% and 68% for the nitrate source and control, respectively. Soil applied Ni and high rates of Mg SO4 also showed suppressive effects on the PRR disease. Mineral nutrition appears to definitely affect severity of early season PRR incidence on cotton.

Industrial Sciences and Technology

236. *Pitting Studies in Seawater Contaminated Jet Turbine Oil*, **Brandon Christoffersen** (Boise State University, Boise, ID, 208-426-1113, BrandonChristoffersen@mail.boisestate.edu), **Brian M. Marx** (Boise State University, Boise, ID, 208-426-5376, brianmarx@boisestate.edu) and **Darryl P Butt** (Boise State University, Boise, ID, 208-426-1054, darrylbutt@boisestate.edu).

Lubricant systems in military aircrafts, operating in marine environments, suffer from corrosion due to seawater contamination. In particular, bearing and gear alloys are susceptible to pitting corrosion attack in seawater contaminated lubricants. Therefore, the corrosion performance of two bearing alloys were considered in this study. The alloys were immersed in oil solutions and the corrosion results were analyzed as a function of seawater content and time. In particular, seawater concentrations below and above the solubility limit of water in oil (estimated to be 3000 ppm seawater) were analyzed. Optical image analysis was used to measure the pit density/size and an optical profiler was used to measure pit depth. For seawater concentrations above the solubility limit, severe general corrosion was observed, but for concentrations below the solubility limit, pitting corrosion was prominent. After one month of immersion time in a 2500 ppm seawater/oil solution, nearly 20% of the sample surface was covered by pits with a maximum pit depth of 6.6 µm.

237. *Enhancing Corrosion Resistance of Stainless Steel 304 Using Laser Surface Treatment*, **I. M. Ghayad**[1], **M. A. Shoeib**[2], **T. M. Mattar**[2], **H. M. Hussein**[2] and **R. A. AbuShaiba**[3], [1](Central Metallurgical Research and Development Institute, Cairo, Egypt, 202 5010642, dr_ghayad@yahoo.com); [2](Central Metallurgical Research and Development Institute, Cairo, Egypt, 202 5010642); [3](Faculty of Science, AlAzhar University, Cairo, Egypt).

Stainless steel AISI 304 was laser treated to enhance corrosion resistance and improve surface properties. This alloy has many applications in auto industry (car body,) as well as oil and gas industry. Different conditions were applied in the laser surface treatment, namely: laser power density, scan speed, distance between paths, medium gas (air, argon and nitrogen). After laser treatment, the samples microstructures were investigated using optical microscope to examine microstructural changes due to laser irradiation. Specimen surfaces were investigated using XRD, SEM and EDAX before and after laser treatment to examine the surface composition changes brought by laser irradiation. Results showed that laser irradiation enhances the corrosion resistance of AISI 304 Stainless steel to a large extent. Corrosion rates as low as 0.011 mpy for laser treated samples were obtained in comparison to 0.952 mpy obtained for the untreated samples. Superior pitting corrosion resistance was obtained under specific treatment conditions. The enhancement of corrosion resistance depends on the laser irradiation conditions. The corrosion protection afforded by laser treatment is attributed mainly to the grain refinement of the top surface layer. This layer is found to consist of nano-scale grains.

Chemistry

238. *A Density Functional Study of Actinyl - Methoxide Complexes: the Structure and Bonding Properties*, **Da Gao** (Idaho National Laboratory, Idaho Falls, ID, 208-526-3691, da.gao@inl.gov) and **Michael E. McIlwain** (Idaho National Laboratory, Idaho Falls, ID, 208-526-8130, Michael.McIlwain@inl.gov).

The structure and reactivity of actinyl complexes have been an active topic of research in the chemical community because the participation of s, d and f orbital offers a broad array of possible structures and reaction pathways. Motivated by the desire to better understand and then manipulate actinides chemistry, the present work has systematically investigated the structure and bonding properties of actinyl-methoxide complexes from Uranium, Neptunium, to Plutonium using Density Functional Theory (DFT). All calculations have been carried out with different effective core potentials and the associated orbital basis set (specifically, LANL2DZ, CRENBL, and Stuttgart) for U, Np and Pu in order to examine effects of different effective core potentials and the associated orbital basis set on the calculated structure, vibration frequency, and bonding properties. The exchange correlation functional used in this work is B3LYP. The spin orbital coupling effect has also been studied for one case. Our results showed that the bond length difference among U=O=U, Np=O=Np, and Pu=O=Pu is quite small, about 1% variance, while the bond angle differs about 5% among U=O=U, Np=O=Np, and Pu=O=Pu. On the other hand, the calculated infra red frequency showed a notable difference among U, Np and Pu, with Np always the smallest, regardless of the type of effective core potential and the associated orbital basis set applied.

239. *The Effects of Trifluoperazine on Calsequestrin Structure and Protein Aggregation*, **Dawn Muhlestein** (Boise State University, Boise, ID, 208-426-2544, dawnmuhlestein@boisestate.edu), **T.S. Broyles** (Boise State University, Boise, ID, 208-426-3000, TS-Broyles@cableone.net), **James Cole** (University of Connecticut, Storrs, CT, 860-486-4333, james.cole@uconn.edu), **Julia Thom Oxford** (Boise State University, Boise, ID, 208-426-2385, joxford@boisestate.edu) and **Susan E. Shadle** (Boise State University, Boise, ID, 208-426-3153, sshadle@boisestate.edu).

Calsequestrin (CSQ) binds calcium with high capacity and low affinity. Its proper function is essential for calcium handling and muscle contraction in cardiac tissue. Calcium binding is known to induce structural changes in CSQ and is thought be coupled to protein aggregation, in which calcium-dependent linear polymers are formed. However, many of the details of this model, as well as how small molecules

might alter structure and aggregation have yet to be elucidated. We have completed fluorescence studies to determine how the small molecule trifluoperazine (TFP), known to bind CSQ, alters calcium-dependent structural changes. TFP increased CSQ maximal fluorescence and calcium concentration required to reach maximal fluorescence in a dose dependant manner. Circular dichroism studies, conducted to elucidate details secondary structure changes in response to added calcium and TFP, indicate that TFP enhances CSQ alpha-helical content as calcium is added to the protein. Finally, analytical ultracentrifugation (AUC) results suggest that CSQ alone exists as three distinct species of monomer, dimer, and tetramer. Upon addition of calcium, the non-interacting species are still present, but the monomer is present in much lower amounts and aggregates much larger than tetramer are also present. The implications for these effects of small molecule binding on CSQ structure and function will be discussed.

240. *Dichlorophene Inhibition of Human Carbonyl Reductase*, **Christopher K. Ewing** (Boise State University, Boise, ID, 208-440-2370, kif_ewing@yahoo.com) and **Henry A. Charlier Jr.** (Boise State University, Boise, ID, hcharlie@boisestate.edu).

Anthracyclines are widely used chemotherapeutic agents. The reduction of anthracyclines in the cell is linked to the cardiotoxicity often observed in patients after treatment. The risk of cardiotoxicity is increased with increased dosage. Cardiotoxicity severely limits the use of anthracyclines. Creation of the cardiotoxic anthracycline metabolite is catalyzed by NADPH dependent human carbonyl reductase (HCBR). Inhibition of HCBR in conjunction with anthracycline treatment could potentially decrease the risk of cardiotoxicity. Recently our laboratory has discovered a class of inhibitors which possess two substituted phenyl rings linked together by a carbon or sulfur bridging atom. One such inhibitor is dichlorophene. It has an IC50 value of 50 *f*ÝM indicating that it is a poor inhibitor of HCBR. Characterization of this inhibitor will be reported. Knowledge of the mechanism of inhibition can be used to inform the design of more potent inhibitors.

241. *Binary and Ternary Complexes Involving Small Molecules and Carbonyl Reductase*, **Matthew T. Mayer** (Boise State University, Boise, ID, 208-830-1286, mattmayer10@hotmail.com) and **Henry A. Charlier Jr.** (Boise State University, Boise, ID, 208-426-3474, hcharlie@boisestate.edu).

Carbonyl reductase (CR) is an enzyme that catalyzes the NADPH-dependent reduction of various carbonyls. CR has been implicated in the cardiotoxic side effect often observed in cancer patients after treatment with anthracycline drugs. The use of anthracyclines is limited by the cardiotoxicity. Given the role of CR in the cardiotoxicity, it is important to fully understand/characterize the enzyme's structure and function. Equipped with such information new treatments may be designed to improve anthracycline chemotherapy. The present study is aimed at examination of how CR binds small molecules, many of which are known inhibitors of CR. Using fluorimetry, the binding of several enzyme-small molecule complexes were studied. NADPH μM affinities. and NADP+ were found to bind to the free enzyme with The fluorescent probe, 8-Anilino-1-naphthalenesulfonic acid, was found to bind to the free enzyme and enzyme-NADP+ binary complex with μM affinities, but does not inhibit the enzyme as a result of binding.

242. *The Three C's of Renewable Biomass Briquettes*, **Blake E. Stanhouse** (Boise State University, Boise, ID, 208-869-9615, Blakestanhouse@mail.boisestate.edu), **Dana Moracco** (Boise State University, Boise, ID, 208-344-2376, DanaMoracco@mail.boisestate.edu) and **Owen McDougal** (Boise State University, Boise, ID, 208-426-3964, owenmcdougal@boisestate.edu).

The three C's: Composition, Combustion properties, and Chemical analysis of biomass fuel briquettes generated from the compaction of paper and yard waste will be presented. Paper and yard wastes that get sent to landfills could be better utilized as an accessible and renewable fuel source for cooking and heating. The current study seeks to establish the caloric content of biomass briquettes made from variable composition mixtures of paper with yard waste compared to more traditional fuel sources such as wood, wood pellets, and charcoal. Oxygen bomb calorimetry was used to determine the caloric content of compressed briquettes composed of paper, yard waste, and paper to yard waste mixtures. The energy content of biomass briquettes ranged from 1065 to 1417 cal/g depending on composition, while sawdust, charcoal, and wood pellets ranged from 1729 to 1972 cal/g, respectively. Combustion testing of the biomass briquettes will be presented to establish their burn efficiency compared to conventional fuels. The future goal of this research is to develop environmentally conscientious briquette technology to be used at the household and community level through chemical analysis of gaseous emissions, particulates, and residual ash.

243. *OSpec Web: An Online Educational Resource to Facilitate the Instruction of Organic Spectroscopy*, **Matthew Turner** (Boise State University, Boise, ID, 208-331-7882, turner0310@yahoo.com), **Ryan Morton** (Boise State University, Boise, ID, ryanmorton2@mail.boisestate.edu) and **Owen McDougal** (Boise State University, Boise, ID, owenmcdougal@boisestate.edu).

An online educational resource to supplement the instruction of organic spectroscopy is described that contains experimental 1D and 2D homo- and heteronuclear magnetic resonance (NMR), infrared spectrophotometry (IR), and mass spectrometry (MS) data. The spectral database is accessible on the World Wide Web and is intended as a learning aid for students, and as a source of data and theory for instructors of organic chemistry. The database is easily navigable and the data sets are presented in a logical manner so that students gradually strengthen the fundamental problem-solving skills of spectroscopic analysis. The experimental data consists of NMR, IR, and MS for all compounds, and additionally Distortionless Enhancement by Polarization Transfer (DEPT-135), COrrelation SpectroscopY (COSY), and Heteronuclear Single Quantum Correlation (HSQC) spectra for more complex compounds. The unique features of this resource are the pedagogical ordering of compounds, a detailed solution to spectrum interpretation, and multi-dimensional NMR spectra for each compound.

Physics/Chemistry

244. *Polymer Nanocomposite Based Chemiresistive NOx Sensor*, **Divakara A.B.S. Meka** (Portland State University, Portland, OR, 503-334-5008, divakara@pdx.edu), **Linda A. George** (Portland State University, Portland, OR, 503-725-3861, georgel@pdx.edu) and **Shalini Prasad** (Portland State University, Portland, OR, 503-725-3223, prasads@ece.pdx.edu).

The research objective is the development of a portable sensor for monitoring trace gas emissions in the environment. This will be achieved by developing a polymer nanocomposite that undergoes electrical parameter modification to detect the trace gases. The key innovation is the improved signal to noise ratio resulting in enhanced sensitivity in the chemiresistive nanocomposite sensors. The scope

of the current application is the demonstration of a sensor platform for detecting NOx with enhanced sensitivity and specificity through innovative functionalization and packaging of nanomaterial. For the current application, the sensor characteristics will be demonstrated for nitrogen dioxide (NO2).

The goal is to improve sensitivity for carbon-based nanomaterial sensors from parts-per-million (ppm) levels to parts-per-billion (ppb) under real world levels of air contaminants.

The principle of operation of these chemiresistive sensors is based on the measurement of resistance change associated with the adsorption of gaseous agents by the nanomaterial matrix. These NOx sensors function on the chemiresistive principle-variations in the resistance of a NOx sensitive polymer encapsulated active sensing element comprising of carbon nanoparticles is observed due to the selective adsorption of the gas molecules.

In contrast to the current techniques in gas sensing, the technique that is under development has a simple photolithography based fabrication scheme that can be executed on a non specialized wet bench, thus it is less expensive, highly reproducible and robust.

245. *Correction of the Amplification Factor in SAW Sensor's Semi-Empirical Response Equation by Perturbation Theory,* **Zhixiong Cha** (University of Utah, Salt Lake City, UT, 801-428-7412, zc-3ster@gmail.com).

For polymer coated surface acoustic wave (SAW) sensors, the frequency shift due to organic vapor absorption in gas phase is much higher than the frequency shift calculated by the mass loading effect of organic vapor on polymer film. A semi-empirical equation based on fractional free volume contribution of gas vapor induced swelling effect has been introduced to describe the amplification effect of organic vapor on viscoelastic polymer films. This equation is based on an assumption that the frequency shift caused by film's viscoelastic changes due to vapor absorption is additive and proportional to frequency shift caused by mass loading effect due to vapor absorption. The frequency shift due to mass loading effect of vapor doesn't means that the initial frequency shift of the polymer film is also only due to mass loading effect of the film. But in this semi-empirical equation, the initial frequency shift by viscoelastic effect of the polymer film before vapor absorption hasn't been taken into account in the amplification factor. This means the viscoelastic contribution of film should be taken into account when the initial frequency shift is calculated before any vapor sorption. This discrepancy causes deviation of prediction. The equation based on perturbation theory is derived to calculate the mass loading effect of gas vapor on SAW sensor. Two equations are compared and the amplification factor n in the semi-empirical equation is corrected to include the viscoelastic effect.

246. *Iridium Oxide Nanowire Monitors for Protein Detection*, **Vinu L. Venkatraman**[1], **Ravikiran K Reddy**[2], **Fengyan Zhang**[3], **Victor Hsu**[3], **Bruce Ulrich**[3] and **Shalini Prasad**[2], [1](Portland State University, Portland, OR, 5412211243, vinu@pdx.edu); [2](Portland State University, Portland, OR); [3](Sharp Labs of America, Inc).

The overarching research objective is the development of a "point-of-care" device based on iridium oxide nanowires for physiological state identification to monitor human health. This device is based on electrical detection of proteins that are biomarkers for the physiological state. The current scope of work focuses on establishing the feasibility of this technology. The methodology that has been adopted is based on measuring capacitance and calibrating its change in magnitude with concentration of proteins. C reactive protein (CRP) model system is used for the demonstration of this protein identification. We demonstrate the following performance metrics: high selectivity, high sensitivity and linear dynamic range of detection with rapid response time. Iridium oxide has very good conductivity and charge storing capacity, and hence has an ability to detect very small changes to the surface charge. This capability is utilized for demonstrating the performance metrics and forms the basis of the key innovations of the technology. The key innovations are improving the selectivity and sensitivity of detection. We demonstrate these improved performance metrics for the model protein- CRP in purified form as well as from serum samples. High selectivity is achieved by incorporating monoclonal antibodies (protein receptors) on the nanowires, which bind only to specific antigens (proteins). This technique is extremely sensitive to the induced surface charge variations; hence, very small concentrations of proteins (up to femto-molar concentrations) can be detected with an anticipated rapid response time in seconds. This biosensor could be efficiently used for early disease diagnosis or for early toxicity detection in a pharmaceutical industry. Future work entails detection of multiple proteins using a single chip with the same accuracy and reliability.

247. *Development of a Magnetic-Shape-Memory-Based Micro-Accelerometer*, **Chris Pohl**[1], **Michael Hagler**[2], **Volodymir Chernenko**[3], **Makato Ohtsuka**[4] and **Peter Müllner**[2], [1](Boise State University, Boise, ID, 208-426-1127, msedude@yahoo.com); [2](Boise State University, Boise, ID); [3](Institute of Magnetism, Kyiv, Ukraine); [4](Tohoku University, Sendai, Japan).

Ni-Mn-Ga magnetic shape-memory alloys tend to undergo a large deformation upon the application of a magnetic field. This deformation is attributed to twin boundary motion in the martensitic phase and is related to a martensitic phase transformation. Efforts to utilize magnetic-field-induced deformation (magnetoplasticity) in sensors and actuators are attracting attention. A micro-accelerometer is being developed, which harnesses the stress induced change in magnetization of Ni-Mn-Ga thin films. Substrate-curvature experiments were carried out with films in the thickness range between 0.5 µm and 3.0 µm. The samples were heated to maximum temperatures of 65ºC and 130ºC. Through design of experiments (DOE) approach, the correlations between film thickness, stress at which the martensitic transformation occurs, the maximum temperature of a thermal cycle, and heating rate, was assessed. The stress at which the martensitic transformation occurs was found to be mostly influenced by the film thickness.

248. *Development of Metallic Periodic Structures for Surface Plasmon Polariton Sensor*, **Cory Sparks** (Boise State University, Boise, ID, 208-426-1021, csparks314@yahoo.com), **Lincoln Bollschweiler** (Boise State University, Boise, ID, 208-426-1021, lincstar182@hotmail.com) and **Wan Kuang** (Boise State University, Boise, ID, 208-426-1021, wankuang@boisestate.edu).

We present the experimental development of metallic periodic structures for surface plasmon polariton (SPP) sensors. SPPs are surface electromagnetic waves that are spatially confined on the metal surface due to their interaction with electrons. SPP resonance has been widely employed in sensor due to its sensitivity to a small change of dielectric constant at the metal surface. The utilization of periodic structures permits a specifically designed SPP dispersion and makes possible a higher integration density.

Au, Ag, Al and Cr thin-films of varied thicknesses sputter-coated on a fused silica substrate were characterized with a 635-nm diode laser and the reflectance as a function of angle was recorded. These measurements optimized the level of surface plasmon resonance for

sensor output.

The periodic structures were created through electron beam lithography (EBL) utilizing a two-layer resist (200 nm PMMA and 300 nm co-polymer) spin-coated on a Si substrate. The development of the process recipe involved a combination of experiments on beam aperture, beam current, magnification, exposure dosage, and the amount of PMMA development time. The adhesion issue for the metallization of sub-micron patterns is solved by two-layer resist lift-off process. It was found that the rate of the metal film deposited into the exposed area varies with the lattice constant.

Physics

249. *Computational Methods in Discovering the Nature of Gas Hydrates*, **Klaus Johannsen** (Bergen Center for Computational Science, University of Bergen, Bergen, Norway, 47-555-84314, klaus.johannsen@bccs.uib.no) and **Alla Sapronova** (Boise State University, Boise, ID, 208-426-4330, sapronova@earthlink.net).

Clathrate hydrates are a class of solid crystalline compounds that formed if water molecules under pressure and temperature conditions of permafrost or deep ocean regions are linked though hydrogen bonding and create cavities that can host a large variety of hydrophobic molecules. Naturally formed methane hydrate is the most abundant form of clathrate which is of fundamental and practical importance and involves a broad variety of scientific disciplines. The progress in understanding of natural hydrate evolution close related to our understanding of the molecular mechanisms involved in these processes. It is known from both experiment and computation data that the hydrate structure properties, with no chemical bonds between the crystalline host lattice and the enclosed guest molecules, are differ from those of corresponding water/ice parameters and its thermodynamic stability depends on the guest(s) occupying the cavities. Although the thermodynamics and phase equilibria properties of methane hydrates have been extensively studied during the last decade it is clear that the area of hydrate research needs to be further explored. When hydrate phenomena themselves are too difficult or expensive to measure, it is even more interesting to simulate them on the computer. This job is to give a short historical perspective on development of fundamental knowledge about gas hydrates structure evolution with emphasis on the modeling. Molecular dynamics simulations have had recent success in studying the structural changes in gas hydrate nucleation. This review closely investigates all new methods and approaches that have been made and studies they integration into the ProtoMol MD code. All this help to improve the thermodynamic properties' modeling and increase an ability to study a time-dependent phenomena on gas hydrates.

250. *Ferroelectric Films: Molecular Model of Switching*, **Alla Sapronova** (Boise State University, Boise, ID, 208-426-4330, sapronova@earthlink.net), **Vladimir Bystrov** (University of Aveiro, CICECO, Aveiro, Portugal, 351-234-370354, vsbys@mail.ru) and **Ekatherine Paramonova** (Institute of Mathematical Problems of Biology RAS, Pushchino, Moscow Region, Russia, 7-4967-732603, ekatp@inbox.ru).

Recent discovery of ferroelectricity in Langmuir-Blodgett films based on the poly(vinylidene fluoride-co-trifluoroethylene) copolymer with the thickness from one to several molecular monolayers has opened up new opportunities for their applications in nanotechnology and microelectronics (e.g., as a material for non-volatile memory cells). These ultrathin films demonstrated clear polarization switching with a coercive voltage of the order of 1 Volt and therefore compatible with modern microelectronic devices and nanoelectromechanical systems. Sufficiently high polarization values, absence of size effects, and, more importantly, a compatibility with many organic and biological materials are also beneficial for molecular electronics and biology due to a possibility of polarization-driven assembly. This possibility stems from the fact that small polarization areas can be created by applying small voltages to the conducting tip of the scanning force microscope run in the nanolithography mode. These areas can be further used as templates for attracting biologically active molecules to create nanostructures with novel architectures or they can be also used for biorecognition, if sufficient selectivity of the described process is achieved. This paper reports molecular model of switching on ferroelectric films with a copolymer content of 30%. The obtained results compared to the available experimental data. The model verified that the stable polarization patterns can be created in nanoscale ferroelectric films and attest them as suitable candidates for memory and nanotemplate applications.

This work was supported by INTAS-05-1000008-8091 and Portugal FCT-22230

251. *Medical Application of Microwaves*, **Galina Ovchinnikova** (Moscow State University, Moscow, Russia, 7 495 939-1669, rom@phys.msu.ru) and **Alla Sapronova** (Boise State University, Boise, ID, 208-426-4330, sapronova@earthlink.net).

Medical applications of microwaves (i.e., a possibility to use microwave energy and/or microwave technique and technology for therapeutic purposes) based on biological effect of microwaves (MW) are a quite new and a very rapidly developing field. The number of reports on the effects induced by MW influence in various biological materials has been done. But until now no satisfactory mechanism has been proposed to explain the biological effects of this field. One of the current theories is that heat generation by MW is the cause. On the other hand, it is the fact that end results not only depend on action of the field, but also are influenced by the reaction of the system. Therefore the biological effects due to MW cannot be attributed only to a change of temperature. In this study we investigate the effect of MW influence on biological systems and water with respect to they dielectric and thermodynamic property. To explain the system's response to MW influence the MW absorption mechanism [1] based on the concept of ionic transport in biological sub-systems has been used. In addition, the possibility that the MW field can be manipulated in such a way as to re-program the cell physiology mechanisms is discussed with respect to prospective diagnostic techniques based on MW interaction mechanisms in biological materials.

[1] Ovchinnikova, GI. Superproton transport as a mechanism of microwave absorption. Biofizika,1996,41(4):894-897.

INDEX TO AUTHORS

The first number (less than 49) refers to author's appearance in the program.
The second number (49 or greater) refers to the page on which the author's abstract may be found.

A

AbuShaiba, R. A. 29, 46, 103
Adams, Jason S. 44, 95
Addleman, R. Shane 23, 50
Airhart, Christina L. 35, 78
Airieau, Sabine 43, 45, 91, 100
Aldape, Michael J. 30, 67
Aldrich, Mark 42, 90
Aldrich, Michele L. 42, 90
Ali, Wajiha Tahar 34, 77
Andersen, Gary 45, 100
Andersen, Nicolai K. 31, 69
Andrus, Cecil 35, 79
Antolick, Kathryn 23, 50
Appel, Chip S. 41, 85, 86
Aranda, Patrick S. 34, 41, 45, 84, 98
Araujo, David 23, 50
Arnold, James 46, 102
Aston, D. Eric 31, 68
Auffhammer, Maximilan 42, 90
Ayral, Gyan 27, 60

B

Backman, Thomas W. H. 33, 74
Baird, Beth 31, 70
Balasubramanian, Krishnan 28, 63
Barbour, James D. 43, 91
Barnes, Joni 44, 95
Barnes, Keith P. 43, 92
Barrera-Saldaña, Hugo A. 44, 93
Bassett, Cassie 30, 45, 97
Batista, Enrique R. 28, 63
Bayer, Clifford R. 30, 44, 66, 93
Beare, Paul A. 35, 78
Bell, Jason 30, 66
Belthoff, James R. 43, 92
Bembenek, Richard 41, 85
Bennett, Gary L. 40, 42, 82, 89, 90
Benson, Michael T. 28, 62
Bento, Antonio M. 42, 90
Berrada, Abdelfettah 40, 83
Bezanis, Perry S. 42, 90
Bhardwaj, Vikas 34, 76
Bhushan, Alok 34, 77
Billinge, Stephanie 32, 72
Bird, Karyn 27, 61
Black, Dan W. 42, 88
Blank, Robert R. 46, 102
Blay, Wendy 35, 78
Bloxham, Kaci 31, 69
Bohach, Carolyn Hovde 35, 78
Bohach, Gregory A. 35, 78
Bollschweiler, Lincoln 24, 47, 105
Bonander, Jeremy 30, 45, 65, 97
Bond, Laura 30, 45, 97
Bonfrisco, Lou 29, 65
Boves, Than J. 43, 92
Bowen, Kara B. 34, 76
Brandon, Maureen 41, 84
Branen, A. Larry 31, 68
Branen, Josh R. 31, 68
Bregitzer, Phil 43, 91
Breslow, Sara 26, 58
Brick, Mark A. 40, 83
Brodnax, L.F. 28, 62
Brotherton, Jason 23, 50
Brown, Bradford D. 43, 91
Brown, Carl A. 33, 75
Brown, John J. 44, 96
Brown, Raquel 27, 44, 45, 60, 95, 98
Brown, Wendy C. 35, 78
Broyles, T.S. 46
Bruesch, Amanda J. 44, 94
Bryant, Amy E. 30, 44, 66, 67, 93
Buck, Brenda J. 25, 45, 100
Burgess, Steven J. 30, 68
Butt, Darryl P. 23, 29, 46, 51, 65, 103
Byers, David A. 39, 80
Bystrov, Vladimir 47, 106

C

Caesar-Thonthat, Thecan 41, 87
Cai, Lifeng 39, 81
Camoretti-Mercado, Blanca 41, 84
Cantrell, Timothy 23, 52
Cardon, Grant E. 40, 83
Castrillo-Diez, Jose Luis 44, 93
Cha, Zhixiong 24, 47, 105
Chang, David 41, 85
Charlier, Henry A., Jr. 34, 46, 75, 104
Chatterjee, Amitava 41, 46, 86, 102
Chatterji, Tanushree 34, 76
Chen, Jinchao 45, 99
Chernenko, Volodymir 24, 47, 105
Chianese, Robert Louis 26, 57, 58
Chopp, David 30, 66
Chorover, Jon 25, 26, 56, 101
Christensen, Jon 14, 21, 26, 49, 57
Christiansen, Robert L. 17
Christoffersen, Brandon 29, 46, 103
Clark, Aurora E. 28, 63
Clark, Donna S. 34, 77
Clark, S.B. 28, 62
Clement, Bill 17
Cole, James 46, 103
Cole, Jen 31, 69
Combs, Julie 26, 58
Coombs, Isaac 30, 66
Coonse, Kendra 23, 50
Cornell, Ken 30, 31, 45, 65, 70, 97, 98
Corrales, L. René 33, 73
Corti, Giancarlo 31, 68
Cox, Robert D. 32, 72
Crawford, Lyla 17, 37
Crimmins, Michael 25, 56
Croteau, R.B. 30, 67
Cusack, Barry J. 34, 75
Czerwinski, Ken R. 24, 33, 53, 74

D

Daniels, Christopher K. 34, 77
Daniels, Lee M. 27, 61
Davis, Chadwick T. 30, 45, 98
Davis, Myles H. 41, 86
Dayan, Cassie 30, 45, 65, 97, 98
De Jong, Wibe A. 28, 61, 63
Deobold, Claudia F. 35, 78
Desai, Tapan 33, 73
Devanathan, Ram 33, 73
Dinescu, Adriana 28, 62
Douglas, Trevor 31, 69
Doursat, Rene 39, 80
Drewes, Rich 39, 80
Duffin, Paul 30, 67
Du Mazaubrun, Julie 24, 53
Dutro, J. Thomas, Jr. 17

E

Edberg, Heather 23, 50
El-Swaify, S. A. 41, 86
Elliston, James T. 28, 62
Elnaggar, Abdelhamid A. 25, 56
Ensor, Melissa A. 24, 54
Eun, Heesoo 44, 96
Evans, Robert 41, 87
Evans, Victoria A. 32, 70
Ewing, Christopher K. 46, 104

F

Fabry-Asztalos, Levente 30, 68
Falen, Anita 25, 55
Feris, Kevin 30, 44, 66, 94, 95, 96
Filler, Aaron G. 40, 84

Fisher, Kathleen M..... 15, 22, 42, 49, 89
Flores, Emma 26, 58
Ford, Doris 24, 53
Frary, Megan 29, 64
Freeburg, Adam..... 26, 58
Fry, Allyson..... 27, 61
Fujimoto, Yasuo 44, 96
Fujiwara, Tomoko 27, 61
Fyffe, William E..... 34, 76

G

Gale, Debra 24, 52
Gangavarapu, Kalyan J. 34, 77
Gao, Da 28, 29, 46, 63, 103
Gardner, John 33, 75
Gehrke, Craig 35, 79
George, Linda A. 24, 47, 104
Ghayad, I. M. 29, 46, 103
Gibbins, Bruce 30, 66
Gillis, Bill..... 26, 59
Givskov, Michael 30, 66
Gochin, Miriam..... 39, 81
Goff, G. S. 28, 62
Golabi, Mohammad H. 41, 86
Gomez, Erika 45, 99
Goswami, Jayita..... 30, 67
Graham, Robert C. 25, 45, 55, 56, 100
Greenhalgh, Mitchell R..... 24, 27, 53, 61
Greer, Jerry D..... 39, 80
Gresham, Garold L..... 27, 61
Groenewold, Gary S..... 27, 61
Guerena, David 41, 85
Guerrero, Monica..... 43, 91
Gunsaru, Bornface 30, 68
Gutu, Timothy 24, 52

H

Hady, Hossam, Jr..... 29, 64
Haga, Matt K..... 34, 76
Haggenson, Bill..... 46, 102
Hagler, Michael..... 24, 47, 105
Haigwood, Nancy L. 35, 78
Halsted, Karen..... 34, 76
Hamilton, Stephanie M. 30, 44, 66, 93
Hampikian, Greg..... 30, 45, 97
Han, Sushan 35, 45, 78, 96
Hanley, Cory L. 30, 44, 66, 94
Harrell, Steve 26, 58
Harris, Britani 41, 85
Harrison, Geoffrey P. 40, 84
Harrup, Mason K. 24, 27, 53, 61
Hash, Sarah J..... 25, 46, 101
Havens, Michael 44, 94
Hazeki-Taylor, Noriko 27, 60
He, Min 45, 99
Heckman, Katherine A..... 26, 46, 101
Hedrick, James L. 27, 60
Heinzen, Robert A..... 35, 78
Hentzer, Morten 30, 66
Hess, Pamela S..... 44, 96
Hess, Wilford 40, 83
Heuman, Zach 31, 69
Hill, Brenda L. 39, 80
Hinckley, Tom 26, 58
Hindman, Luke 29, 64
Hirmas, Daniel R. 25, 45, 100
Ho, Joanne..... 26, 58
Hodson, Cheryl 30, 68
Hodzic, Alma 44, 93
Hoelzer, Guy A. 39, 80
Holliday, Kiel S..... 33, 74
Holmes, Joseph 31, 70
Hopkins, Sharla..... 29, 65
Horwath, William R. 46, 102
House, P. Kyle..... 25, 45, 100
Howell, Michael S. 25, 45, 100
Hrdlicka, Patrick J..... 31, 69
Hsu, Victor 24, 47, 105
Huang, Liming 27, 60
Huang, Zhibiao 45, 99
Hull, Jeremiah 30, 45, 97
Hull, Laurence C. 28, 62
Hunt, Catherine T. (Katie)..... 14
Huo, Qisheng 23, 51
Hurley, Michael F..... 23, 29, 51, 64
Hussein, H. M. 29, 46, 103
Huynh, Kim Le 45, 99
Hyatt, D.C. 30, 67

I

Ingram, Lachlan J..... 41, 86
Irwin, Katey 44, 95
Isaac, Alfred O. 34, 76
Ishihara, Kazuhiko 27, 59
Ismail, Habiba 45, 99
Isom, Chelsea..... 30, 45, 65, 98

J

Jabal, Jamie M. 31, 68
Jack, Nathan D. 41, 88
Jackson, Chad A. 43, 91
Jacobitz, Frank 30, 67
Jacobson, Mark 39, 79
Jain, Amit 29, 64
Jarvinen, Gordon..... 24, 53
Jiang, He Sheng 45, 99
Jiang, Long..... 31, 69
Jiang, Zhihua..... 45, 99
Johannsen, Klaus..... 47, 106
Johnson, Roy W. 26, 57
Johnson, Tara 34, 77
Johnson-Maynard, Jodi 41, 87
Jones, J. 30, 65
Jones, Tom A. 46, 102
Jorcyk, Cheryl L... 34, 41, 44, 45, 76, 84, 94, 98
Jungst, Laura J. 46, 102

K

Kadaba, Sujatha 34, 41, 76, 84
Kang, ChulHee..... 30, 67
Kankan, Nimisha..... 41, 85
Karandikar, Balchandra 30, 66
Kaser, Timothy 23, 51
Kasprzyk, Theresa..... 35, 78
Katase, Takao 44, 95
Kelly, Jane Xu 30, 68
Kenoyer, Linda..... 31, 69
Kerisit, Sebastian 28, 64
Kim, Byung I. 31, 70
Kim, Yun-Seok..... 44, 96
Kinter, Cecilia Lynn 32, 70
Kiser, Patrick F. 27, 59
Klaehn, John R. 24, 27, 53, 61
Knowlton, William B. 23, 31, 50, 69
Koehler, Ryan..... 44, 92
Koetsier, Peter 32, 71
Kongara, Madhu 30, 66
Kronz, Joseph D. 34, 76
Kuang, Wan..... 24, 47, 105
Kuhr, Katie 44, 94
Kumar, T. Santhosh 31, 69
Kunduru, Vindhya 23, 50
Kuo, Shiou 41, 85

L

Lai, James C.K. 34, 76, 77
Lai, Maria B. 34, 76
Laporte, Léo F. 42, 90
Larson, Steven R. 32, 72
Law, Jack D..... 24, 27, 53, 61
Layne, Janet 44, 94
Leach, Kent 31, 68
LeCompte-Mastenbrooke, Joyce .. 26, 58
Lee, Ai-Cheng 23, 52
Lenssen, Andrew 41, 87
Leung, Solomon W..... 34, 77
Lever, Andrew M.L. 40, 84
Leviton, Alan E. 42, 90
Lewis, N.G. 30, 67
Liebman, Katherine..... 30, 68
Lin, Ying-Ying 23, 52
Lin, Yuehe 23, 51, 52
Liu, Guodong 23, 51, 52
Liu, Jun 23, 51
Lloyd, John E. 40, 41, 83, 87
Lopez, Job E..... 35, 78
Lowe, Scott E. 42, 90
Lu, Huaxiang..... 45, 99
Lugo-Pérez, Javier 40, 83
Luke, Matthew 23, 51
Luther, Thomas A..... 24, 27, 53, 61
Lynch, Launa M. J. 34, 77

M

MacFarlane, Scott 26, 57
Madsen, Andreas S..... 31, 69
Mae, Culumber C..... 32, 72
Maida, Barbara Yablon 26, 57
Maida, Carl A..... 15, 22, 26, 49, 58
Makhlouf, Abdel Salam Hamdy .. 29, 64, 65
Makino, Mitsuko..... 44, 96
Malcom, Shirley..... 15, 21, 49
Malloy, Margaret A..... 28, 62
Malone, Melanie R..... 25, 46, 101
Manley, James C..... 26, 57
Martin, Leigh R..... 24, 53
Martinez, Maria..... 30, 45, 65, 97
Marx, Brian M. ... 23, 29, 46, 51, 65, 103
Maschmann, Jeremiah M..... 44, 95
Massarik, Fred..... 26, 58
Masterson, Ashley..... 44, 93
Matocha, John E..... 46, 102
Mattar, T. M. 29, 46, 103
Mayer, Matthew T..... 46, 104
McDaniel, Paul 17, 25, 41, 55, 87
McDougal, Owen..... 46, 104
McGraw, Donald J. 15, 22, 50
McGuire, Joseph 27, 61
McIlroy, David N..... 23, 31, 52, 68
McIlwain, Michael E. 28, 29, 46, 61, 63, 103
McKay, Mandalyn..... 34, 76
Meier, G. Patrick..... 34, 77
Meixner, Tom..... 25, 56
Meka, Divakara A.B.S. 24, 47, 104
Meldrum, D. Jeffrey..... 39, 80
Menchaca, Patricia R. 25, 56
Mendelson, Mel I..... 42, 88
Menon, Jeevan 30, 67
Mercer, Linda..... 44, 95
Merkler, Douglas J..... 25, 45, 100
Miller, Carla..... 23, 51
Millett, Paul..... 33, 73
Mincher, Bruce J..... 24, 53
Minnich, Scott A..... 35, 78
Minskoff, Noah..... 23, 51
Mirsky, Rebecca..... 33, 75
Mitchell, Matthew..... 26, 59
Miwa, Chris..... 32, 71
Moeck, Peter 39, 42, 81, 88
Moll, Amy J. 23, 50
Monaco, Thomas A..... 46, 102
Montgomery, Jamie..... 34, 76
Mooney, Siân 46, 102
Moracco, Dana..... 44, 46, 95, 104
Morton, Elizabeth A..... 25, 44, 93
Morton, Janice L. 45, 100
Morton, Ryan 46, 104
Moser, Megan L..... 28, 62
Muhlestein, Dawn 44, 46, 95, 103
Müllner, Peter..... 24, 47, 105
Murray, Stuart W..... 32, 71

N

Nadal, Mariona 44, 96
Nagler, James J. 31, 68
Nash, Ken..... 24, 52, 53, 54
Nassau, Eric 26, 58
Naten, Courtney A. 45, 99
Newell, Adel P..... 45, 99
Nie, Zimin..... 23, 51
Nielson, Chanell E. 40, 83
Nilsson, Mikael..... 24, 53
Nitsche, Heino..... 28, 62
Noller, Jay S..... 25, 46, 54, 55, 56, 101
Norton, Jay B. 46, 102
Norton, M. Grant..... 31, 68
Norton, Urszula..... 46, 102
Novak, Stephen J. 32, 72

O

O'Geen, Anthony 25, 54
Obert, Donald..... 43, 91
Ohtsuka, Makato..... 24, 47, 105
Okuda, Keiji..... 44, 95
Olbertz, Joy L..... 34, 77
Oler, Andrew..... 41, 84
Olsen, Hayley R..... 46, 102
Olson, Richard D. 34, 75, 76
Oman, Henry..... 39, 40, 81, 82
Oomens, Jos 28, 61
Ormond, Robert 30, 45, 98
Othberg, Kurt 17
Ovchinnikova, Galina 47, 106
Oxford, Julia Thom.... 23, 27, 31, 44, 45, 46, 50, 60, 69, 95, 98, 103
Ozanich, Richard..... 23, 50

P

Pace, Jeffrey S..... 25, 46, 101
Paramonova, Ekatherine 47, 106
Parsek, Matthew..... 30, 66
Parveen, Nikhat..... 30, 45, 97
Paulenova, Alena..... 24, 54
Pendall, Elise..... 41, 86
Peng, Fred C. C..... 42, 89
Penner, Megan 34, 76
Peper, S.M..... 28, 62
Peterman, Dean R. 24, 27, 28, 53, 61, 62
Peyton, David H..... 30, 68
Photinos, Panos..... 39, 82
Piceno, Yvette..... 45, 100
Pikul, Joseph L..... 41, 87
Pohl, Chris..... 24, 47, 105
Poineau, Frederic 24, 53
Prasad, Shalini.... 23, 24, 47, 50, 51, 104, 105
Price, Patrick..... 23, 50
Prisament, Morty..... 17, 31, 70
Puli, Shilpa..... 34, 77
Punnoose, Alex 30, 44, 66, 94

Q

Qin, Jian 45, 99
Qin, Yurong..... 45, 99

R

Radabaugh, Andrea S..... 34, 76
Rae, Cathy..... 44, 95
Ragavan, Anpalaki J..... 39, 81
Rasmussen, Craig 25, 26, 46, 55, 56, 101
Reddy, Madhu 44, 94
Reddy, Ravikiran K... 23, 24, 47, 51, 105
Reuter, Ron 32, 71
Rice, Jenniffer..... 31, 70
Rink, Stacia M. 34, 76
Rizvi, Nisha..... 34, 76
Robbins, Alicia..... 26, 58
Robertson, Ian C. 32, 72
Robins, Colin R..... 25, 45, 100
Rodriquez, Jessica..... 23, 51
Rodstrom, R. Andrew 44, 96
Rogers, Haldre 26, 58
Rohde, Harold N. 35, 78
Romero-Prado, Marina MJ 44, 93
Rorrer, Gregory L. 24, 52
Rosentreter, Roger 32, 71
Ross, Arwen 41, 85
Rossi, Ann M. 25, 45, 100
Rosso, Kevin M. 28, 64
Rove, Kyle 27, 60
Rudin, Mark 15, 21, 49
Ruehr, Tom A. 41, 86
Ruehrwein, Jessica..... 32, 70
Runde, Wolfgang H..... 28, 62
Russell, Dale D. 23, 51

S

Sadana, Ravi 40, 42, 82, 91
Saidac, Diana 30, 45, 97
Sainju, Upendra M..... 41, 87
Saito, Hiroaki 44, 95
Salam, Omar F. Abdel..... 29, 64
Samuels, D. Scott..... 44, 93
Sánchez-de León, Yaniria 41, 87
Sandow, Johnna..... 32, 71
Sapronova, Alla..... 47, 106
Schlegel, H. Bernhard..... 28, 63
Schmitt, Nicholas C. 24, 53
Schoonen, Martin A. A..... 28, 64
Schwartz, Egbert..... 25, 26, 46, 56, 101
Scott, J. Michael..... 35, 79
Seo, Wonewoo 27, 60
Serpe, Marcelo 32, 71
Sessions, Britten D..... 40, 83
Shadle, Susan E..... 46, 103
Shallet, Todd 16

Shamberger, Patrick 26, 58
Shapiro, Pamela J. 23, 52
Shaw, Nancy L. 32, 72
Shenai, Krishna 41, 88
Shoeib, Madiha Ahmed... 29, 46, 64, 103
Shrout, Joshua D. 30, 66
Simpkins, Tyrell 30, 45, 98
Skidmore, Wesley 40, 83
Slater, Lindsay 35, 79
Slevin, Sheila 25, 55
Smetak, Katherine 41, 87
Smith, James F. 32, 72
Smolczynski, Pam 33, 74
Somarriba, Eduardo 41, 87
Sonnenberg, Jason L. 28, 63
Southwick, Richard G., III 23, 50
Sowa, John 40, 83
Sparks, Cory 24, 47, 105
Sparks, Donald L. 41, 85
Squires, Ed 39, 79
Srivastava, Shubha 41, 85
Srivastava, Sudhi 41, 85
Stahl, Peter D. 41, 46, 86, 102
Stam, Marianne 25, 56
Stanhouse, Blake E. 46, 104
Stevens, Dennis L. 30, 44, 66, 67, 93
Stillman, Amy J. 32, 72
Stubler, Craig P. 41, 85, 86
Sundby, Valerie 17, 37

T

Tabor, Gary M. 35, 79
Tam-Chang, Suk-Wah 27, 60
Tappero, Ryan 41, 85
Tate, Kenneth W. 46, 102
Taw, F.L. 28, 62
Tawara, Ken 41, 84
Textor, Robert 26, 59
Thomas, Mark W. 34, 77
Thomsen, David 29, 65
Tillotson, Richard D. 24, 27, 53, 61
Tinker, Daniel B. 41, 46, 86, 102
Tinker, Juliette K. 30, 35, 45, 77, 98
Tkac, Peter 24, 54
Tullis, Richard 30, 67
Turk, Judith K. 25, 55
Turner, Matthew 46, 104

U

Uberuaga, Blas Pedro 33, 73
Uchida, Masaki 31, 69
Uchiyama, Taketo 44, 95
Ulappa, Amy C. 32, 72
Ulrich, Bruce 24, 47, 105
Uludag, Hasan 27, 59
Urgenson, Lauren 26, 58

V

Vance, George F. 41, 46, 86, 102
Van Den Wymelenberg, Kevin 32, 70
Van Stipdonk, Michael J. 27, 61
Varnum, Susan 23, 51
Vaughan, Karen L. 25, 55
Venkatraman, Vinu L. 24, 47, 105

W

Wai, Chien 23, 52
Wall, Donald E. 28, 33, 62, 74
Wall, Nathalie A. 28, 62
Wander, Matthew C. F. 28, 64
Wang, Hua 30, 44, 66, 94
Wang, Jun 23, 51, 52
Warner, Don L. 34, 76
Warner, Lisa 31, 69
Webber, Damon D. 45, 99
Weber, William J. 33, 73
Welty, Justin L. 43, 92
Welty-Bernard, Amy 26, 46, 101
Wengel, Jesper 31, 69
Whelan, Matthew P. 41, 87
White, David A., II 55
Whitem, David A., II 25
Whitney, Tiffany J. 41, 84
Wilborn, James C. 46, 102
Williams, Amanda J. 25, 45, 100
Windes, Juliet M. 43, 91
Wingett, Denise G. 30, 44, 66, 93, 94
Winowiecki, Leigh 41, 87
Wojcik, Michael 23, 50
Wolcott, Michael P. 31, 69
Wolf, Dieter 33, 73
Wood, Lawrence H. 42, 89
Wood, Spencer H. 39, 79
Woodbury, Luke G. 44, 95
Wu, Hong 23, 51, 52

Y

Yamaoka, Tetsuji 27, 60
Yingst, Sorcha 31, 69
Yonovitz, Maureen L. 25, 45, 100
Youn, B. 30, 67
Young, Mark 31, 69
Yu, GongXin 30, 45, 97

Z

Zalupski, Peter 24, 54
Zhang, Fengyan 24, 47, 105
Zhang, Jinwen 31, 69
Zhang, Zhiyong 29, 45, 64, 99
Ziegler, Summer 23, 50
Zimmerman, Shawna 32, 71
Zou, Yuan 45, 99

Publications of the

AAAS, PACIFIC DIVISION

BOOKS IN PRINT

Symposium Volumes

Biodiversity and Taxonomy (2005; paper, 236 pp., ISBN 0-940228-62-9); **$35.00**.

Museums and Other Institutions of Natural History: Past, Present, and Future (2004; paper, 235 pp., ISBN 0-940228-60-2); **$35.00.**

Agroecosystems and the Environment: Source, Control, and Remediation of Potentially Toxic, Trace Element Oxyanions (1998; cloth, 213pp., ISBN 0-934394-12-1); **$20.00**.

San Francisco Bay: The Ecosystem (1996; cloth, 542pp., col. pls., ISBN 0-934394-11-3**)**; **$45.00**.

Genecology and Ecogeographic Races (1995; cloth, 275pp**. ,** ISBN 0-934394-10-5); **$28.95**.

Cracking Rocks and Defending Democracy: The Life and Times of Kirtley Fletcher Mather, 1888-1978 (1994; cloth, 342pp., 39 photos, ISBN 0-934394-09-1); **$31.95**.

Dietary Factors and Birth Defects (1993; paper, 410pp., ISBN 0-934394-08-03); **$28.50**.

Crater Lake: An Ecosystem Study (1990; cloth 224pp., ISBN 0-934394-07-5); **$26.95**.

Late Cenozoic History of the Pacific Northwest (1985; cloth, 417pp., ISBN 0-934394-06-7); **$28.95**.

Patterns of Evolution in Galapagos Organisms (1983; cloth, 568pp**.**, ISBN 0-934394-05-9); **$32.50**.

San Francisco Bay: Use and Protection (1982; paper, 310pp., ISBN 0-934394-04-0); **$17.95**.

Frontiers of Geological Exploration of Western North America (1982; paper, 248pp., ISBN 0- 934394-03-2); **$16.95**.

Proceedings Series

Proceedings, Vols. 1-26. Proceedings of the 63rd through 88th Annual Meetings of the Pacific Division, AAAS Vols. 1-26: Part 1: ***Program with Abstracts.*** **$10.00** (per issue).

Evolutionists Confront Creationists (Proceedings Vol. 1, Part 3, 1984; paper, 213 pp.). **$10.00**

Scientific Research and New Religions (Proceedings Vol. 2, Part 2, 1985; paper, 180 pp.). **$10.00**

California's Master Plan for Higher Education in the Twenty-first Century (Proceedings, Vol. 13, Part 2, 1996; paper, 118 pp.). **$10.00**

Address orders and/or inquiries on availability of Division publications to
AAAS Pacific Division • Department of Biology • Southern Oregon University • Ashland, OR 97520
Phone: (541) 552-6869 • FAX: (541) 552-8457 • E-mail: aaaspd@sou.edu
or visit our website, http://pacific.aaas.org

PREPAID ORDERS ONLY——ALL SALES FINAL——NO RETURNS
Add $3.25 per order for first volume, plus $1.25 for each additional for postage and handling.
Make checks payable to AAAS, Pacific Division.
CREDIT CARDS ACCEPTED. CALL OR VISIT OUR WEBSITE

Publications of the

AAAS, PACIFIC DIVISION

BOOKS IN PRINT

Symposium Volumes

Biodiversity and Taxonomy (2005; paper, 236 pp., ISBN 0-940228-62-9); **$35.00**.

Museums and Other Institutions of Natural History: Past, Present, and Future (2004; paper, 235 pp., ISBN 0-940228-60-2); **$35.00.**

Agroecosystems and the Environment: Source, Control, and Remediation of Potentially Toxic, Trace Element Oxyanions (1998; cloth, 213pp., ISBN 0-934394-12-1); **$20.00**.

San Francisco Bay: The Ecosystem (1996; cloth, 542pp., col. pls., ISBN 0-934394-11-3**)**; **$45.00**.

Genecology and Ecogeographic Races (1995; cloth, 275pp**. ,** ISBN 0-934394-10-5); **$28.95**.

Cracking Rocks and Defending Democracy: The Life and Times of Kirtley Fletcher Mather, 1888-1978 (1994; cloth, 342pp., 39 photos, ISBN 0-934394-09-1); **$31.95**.

Dietary Factors and Birth Defects (1993; paper, 410pp., ISBN 0-934394-08-03); **$28.50**.

Crater Lake: An Ecosystem Study (1990; cloth 224pp., ISBN 0-934394-07-5); **$26.95**.

Late Cenozoic History of the Pacific Northwest (1985; cloth, 417pp., ISBN 0-934394-06-7); **$28.95**.

Patterns of Evolution in Galapagos Organisms (1983; cloth, 568pp**.**, ISBN 0-934394-05-9); **$32.50**.

San Francisco Bay: Use and Protection (1982; paper, 310pp., ISBN 0-934394-04-0); **$17.95**.

Frontiers of Geological Exploration of Western North America (1982; paper, 248pp., ISBN 0- 934394-03-2); **$16.95**.

Proceedings Series

Proceedings, Vols. 1-26. Proceedings of the 63rd through 88th Annual Meetings of the Pacific Division, AAAS Vols. 1-26: Part 1: ***Program with Abstracts.*** **$10.00** (per issue).

Evolutionists Confront Creationists (Proceedings Vol. 1, Part 3, 1984; paper, 213 pp.). **$10.00**

Scientific Research and New Religions (Proceedings Vol. 2, Part 2, 1985; paper, 180 pp.). **$10.00**

California's Master Plan for Higher Education in the Twenty-first Century (Proceedings, Vol. 13, Part 2, 1996; paper, 118 pp.). **$10.00**

Address orders and/or inquiries on availability of Division publications to
AAAS Pacific Division • Department of Biology • Southern Oregon University • Ashland, OR 97520
Phone: (541) 552-6869 • FAX: (541) 552-8457 • E-mail: aaaspd@sou.edu
or visit our website, http://pacific.aaas.org

PREPAID ORDERS ONLY——ALL SALES FINAL——NO RETURNS
Add $3.25 per order for first volume, plus $1.25 for each additional for postage and handling.
Make checks payable to AAAS, Pacific Division.
CREDIT CARDS ACCEPTED. CALL OR VISIT OUR WEBSITE