IAS
Idaho Academy of Science

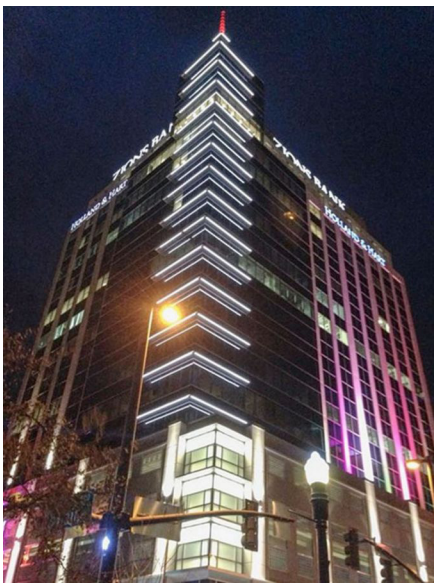
The Retort

Volume 51, No. 1, Winter/Spring 2015

IASE
Idaho Academy of Science and Engineering

"Doing business as" logo, proposed. See **Editorial**, page 11.

BSU Student Union Building



Zion Bank Building

57th Annual Meeting and Symposium
Idaho Academy of Science and Engineering
Boise State University, March 19-20, 2015

The Academy will meet jointly with the 13th Annual IEEE Workshop on Microelectronics and Electron Devices.

Tentative IASE Conference Schedule

Thursday, March 19, 2015

4:00-6:00 pm Registration:
Boise State Student Union Building (SUB), Outside Hatch Ballroom.

6:00 pm Panel, "Addressing Global Concerns" (open to Public), SUB.

7:30 pm Reception:
The Stonehouse, off campus at 709 E. Park Blvd., Boise.

Friday, March 20, 2015

7:30 am -1:00 pm Registration, SUB.

8:30 am Opening Address/Keynote, SUB.

9:45 am to 4:30 pm Mini-Symposia, (in SUB rooms) Including:
Addressing Human Disease at the Cellular Level.
New Therapeutics and Progress in Infectious Disease.
Global Challenges to Hydrosystems.
Global Challenges to Ecosystems.
Materials for Energy and Sustainability.
Physical/Chemical – Materials for Nanobiotechnology.
STEM Education – For all Disciplines.
Student Oral Presentation Sessions.

4:30-6:00 pm Poster Session, SUB.

6:30 pm Banquet:
The Conference Banquet will be held at the new Zion Bank building in downtown Boise (8th and Main Street).

Saturday, March 21, 2015

9:30 am-10:30 am Executive Committee Meeting, SUB.

10:30 am-12:00 pm Annual Business Meeting, SUB.

Higher Education News

New ISU Vice President and Dean

Idaho State University News Release

Cornelis J. (Neels) Van der Schyf, current dean of the Idaho State University Graduate School, has been named ISU Vice President for Research and Dean of the Graduate School, pending approval from the Idaho State Board of Education.

"I am excited about this new position," Van der Schyf said. "This is a logical 'marriage' of the research and graduate school components of the University. Graduate students and their mentors are, per definition, intimately involved with research. This is a model that has worked well at other universities."

He will begin in this new position on March 1.

Van der Schyf's position has been redefined; he will hold the dual titles, reporting directly to ISU President Arthur Vailas as vice president for research, and to ISU Vice President for Academic Affairs and Provost Laura Woodworth-Ney as dean of the Graduate School.

Van der Schyf replaces Howard Grimes, Vice President for Research and Economic Development, who recently accepted a job with the Idaho National Laboratory and the Center for Advanced Energy Studies.

Under Van der Schyf, the Office for Research will continue to manage intellectual property and patents for the University, and will also be involved in broader economic development activities, working with the newly established Center for Entrepreneurship and Economic Development housed in ISU's College of Business.

"These two units, the Office for Research and the Graduate School, have been aligned to improve the effectiveness between research and graduate education," Vailas said. "Neels has an exceptional background and academic credentials for this new position, and I look forward to working with him in this new capacity."

Van der Schyf joined ISU in May 2013 as dean of the Graduate School and professor of biomedical and pharmaceutical sciences.

Prior to joining, ISU he was associate dean for research and graduate studies, founding chair and professor of pharmaceutical sciences in the College of Pharmacy, and professor of neurobiology in the College of Medicine at Northeast Ohio Medical University (NEOMED).

At NEOMED he played a pivotal role in the establishment of the College of Pharmacy and was the primary author and architect in creating and establishing NEOMED's graduate program (MS and Ph.D.) in Integrated Pharmaceutical Medicine and in the creation of the College of Graduate Studies at that institution. He was also intimately involved with the planning and design of the new NEOMED Research and Graduate Education Building, a $42 million campus expansion focused on graduate research and education.

NEOMED Research & Graduate Education Building

As of February 2015, he has published 116 peer-reviewed research and review articles, 205 abstracts and presentations – many of these as invited keynote speaker; 10 book chapters, several reports to industry, and numerous journal editorials. He holds 14 patents. He is the editor-in-chief of the *Journal of Biophysical Chemistry* and is or has been a member of the editorial advisory

The Academy

The Idaho Academy of Science (IAS) is the only statewide organization that embraces all scientific disciplines. It strives to improve all levels of technical understanding: among students, teachers and researchers, and the general public. The Academy is an affiliate of the American Association for the Advancement of Science and the National Association of Academies of Science. For more information contact:

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boards for an additional 11 international research journals and an invited guest editor for one. The impact of his research is reflected by his work receiving more than 2,374 peer citations in the literature.

Van der Schyf earned his Bachelor of Pharmacy, Master of Science, Doctor of Science (Ph.D.) and DTE degrees from North-West University (NWU, formerly Potchefstroom University) in South Africa, and spent 1986-7 as a postdoctoral fellow in the Department of Medicinal Chemistry at the University of Connecticut and at the National Magnet Lab at MIT, Cambridge, Massachusetts.

North-West University, South Africa

Van der Schyf served as visiting professor in Australia, Belgium and the United States, and currently serves as Emeritus Extraordinary Professor at Northwest University in South Africa, and has extensive international experience.

In addition to serving or having served, since 2002, as a chartered and *ad hoc* member on several NIH Study Sections and many other national and international research granting agencies, he is a member of the Phi Beta Delta Honor Society and Sigma Xi, and has received several teaching and research honors, including "Teacher of the Year" and "Most Cited Paper" awards, the APSSA Upjohn Achievement Award and South Africa's highest honor in drug discovery research, the FARMOVS Prize for Pharmacology and Drug Development.

Van der Schyf is also the recipient of the 2010 Olson/Blair Award for Administrative Excellence.

Geologists Study Alamo Crater

Idaho State University News Release

Idaho State University's Leif Tapanila has spent more than a dozen years studying a "whopper of a hole" in Nevada, discovering more about the impact of a comet about 380 million years ago that left the Alamo crater, which is about 60 miles wide and two miles deep.

"It is one of the largest comet impact craters that has been discovered in the last while," said Tapanila, who is the chair and associate professor of the ISU Department of Geosciences. "Even though the area has been twisted up by mountain building, it is a great spot to look at the environment and see what it was like before and after the comet hit. We get a perfect time slice of that historic event. We've been mapping out the extent of the crater, basically starting to piece it back together."

The crater, located about 100 miles north of Las Vegas, was made by a ½-mile- to 3-mile-wide chunk of space debris that smashed into the Earth with a force of many nuclear blasts. Rocks the size of buildings were crumpled like soda cans, and the comet penetrated the crust of earth creating a crater, that was further enlarged when its edges collapsed, Tapanila said.

The body that hit was likely a comet made of "frozen ice, methane and a little bit of rock mixed in" and referred to by geologists informally as a "dirty snowball."

Piecing it back together has been a challenge, because much has changed in the landscape over many, many millennia. For one, what is now dry land was underneath water.

"The comet hit back when ocean covered Nevada," Tapanila said. "This is one of the relatively rare impacts that has been measured of a comet that has struck ocean because it hit close to shore."

Researchers estimate the comet hit close to the ocean shore in water 30 to 100 yards deep.

Piecing the crater together has also been a difficult task because the tectonic plates and other geological processes have pushed apart the crater over time.

"You just don't fly over and see a giant hole in the ground," Tapanila said. "This is one of the first projects to piece together an ancient impact site that has been pulled and twisted apart through its history. Through modern mapping techniques we were able to piece it together."

Tapanila is a co-author on a study "Post-impact depositional environments as a proxy for crater morphology, Late Devonian Alamo impact, Nevada" that has been published this month in the journal Geosphere. The co-authors are all former ISU graduate students who have worked with Tapanila.

Comet impacts on this magnitude rarely occur, only happening every "tens of thousands or hundreds of thousands years," but scientists still learn a lot from studying them.

"There are still comets passing close by the Earth and our planet will get hit by them again," Tapanila said. "Studying the Alamo crater is ancient history, but the ancient record tells us a lot about the frequency and severity of impacts and the net results of when they do happen, and that is valuable information. We can envision how a collision like this may impact the Earth today."

Leif Tapanila (front, lower left) and Field Team

New ISU Connection with NASA

Idaho State University News Release

NASA scientists like to say, "We're doing cool stuff right here on earth," and a lot more of it will now be taking place at Idaho State University, which was designated as a new NASA DEVELOP research node this month.

This new recognition will expand research opportunities for undergraduate and graduate students, not only at ISU but for others as well, said Keith Weber, director of the ISU GIS Training and Research Center and ISU advisor for the NASA DEVELOP Node.

GIS Director Keith Weber

The NASA DEVELOP National Program fosters an interdisciplinary research environment where applied science research projects are conducted under the guidance of NASA and partner science advisors.

"I'm very excited that ISU and BLM will be collaborating with DEVELOP to open this new location," said Lauren Childs-Gleason, NASA DEVELOP national operations lead. "It expands DEVELOP's impact in the West, meaning that a whole new community will engage in, and benefit from, NASA's Earth science."

DEVELOP is unique in that young professionals lead research projects that focus on utilizing NASA Earth observations to address community concerns and public policy issues.

"It opens up opportunities for students to come to ISU and participate in the NASA program," Weber said. "Students from Idaho, Montana, Wyoming, Washington, Oregon and Utah may be a lot more interested in the program now because they won't have to travel as far. It also opens up opportunities for students from other regions to come here and participate in these exciting research projects."

ISU is now one of only eight NASA DEVELOP regional nodes in the United States, one of only two in the West, and the only one located in the Pacific Northwest and Intermountain West. NASA also has six research centers nationally – none of which are located in this area of the country.

"The NASA DEVELOP program at ISU is also important because of the research it will enable us to do at ISU with NASA," Weber said. "This will strengthen our work with the BLM and other federal and state land management agencies and allow us to very quickly respond to research questions."

A DEVELOP node like this operates on a three-term system, with the year divided up in fall, spring and summer terms. Each term a cohort of participants will work on research projects collaboratively with NASA and ISU scientists.

"If we are working with the BLM, Forest Service or an Idaho agency that has a specific research question about rangeland systems, such as wildfire, we can begin addressing that question almost immediately, or at the start of the next term," said Weber.

This rapid turnout is very different from traditional grant research, which may take a year or more to be initiated.

"If there is a question we can answer using NASA satellites, which is almost always the case because of the huge portfolio of data NASA produces, we can initiate research quickly and address that question in a very timely manner," he added.

There are many environmental decisions taking place in this region that Earth observations can be integrated into with success, noted Childs-Gleason.

"The new node will take the lead in reaching out to potential end-users and participants to expand NASA's impact in the West and demonstrate the practical and innovative applications of Earth observations," Childs-Gleason said. Students participating in the program can stay for a term, two terms or a full year.

"DEVELOP is a very exhilarating opportunity for students and young professionals to gain real-world experience much earlier in their career than they may have otherwise," Childs-Gleason said. "The DEVELOP model pairs NASA Earth observations and motivated young scientists in a unique way that has the greatest potential to benefit environmental decision making."

A group of five researchers and administrators from the NASA DEVELOP program headquartered at the NASA Goddard Space Flight Center visited ISU last fall to evaluate ISU as a potential DEVELOP node. This program works to bridge the gap between NASA Earth Science and outside entities to facilitate research and provide answers to challenging research questions.

ISU and NASA Personnel and Students During Visit to ISU

ISU has a history of working with NASA on research projects, and this newest agreement will facilitate even more collaboration.

"The relationship with NASA continues to be a great experience for us at the GIS Center and a great benefit for the region, not only for wildfire research and management, but also for its benefit to students," Weber said. "We are excited about all the possibilities this new partnership provides."

For more information about NASA's DEVELOP program visit http://develop.larc.nasa.gov/about.html.

THE COLLEGE of IDAHO

Researchers Examine Bone Health

College of Idaho News Release

Talking on a cell phone or listening to a personal music player while exercising seem as natural to most people as walking or breathing. Yet most of the dozens of electronic devices we use contain the heavy metal cadmium, the culprit in a variety of maladies if ingested.

Dr. Sara Heggland

For the past decade, College of Idaho biology professor Dr. Sara Heggland and more than 40 of her students have studied how cadmium affects bone health and the onset of osteoporosis. Heggland said that better understanding how cadmium affects bone at the cellular level is crucial for doctors, scientists and public officials dealing with the health impacts of environmental toxins.

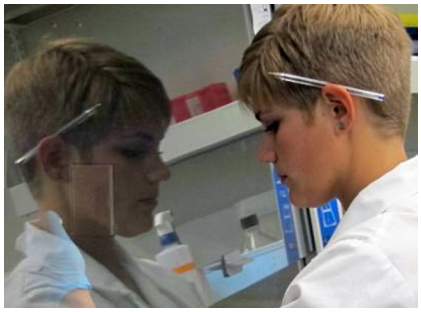
"People use cadmium every single day because it's used in almost every electronic product out there," Heggland said. "Those electronics eventually end up in landfills, and from there the cadmium can get into drinking water."

Heggland and her students – one of only a few research teams in the world studying cadmium toxicity and bone health – have already made important discoveries such as demonstrating that cadmium directly affects osteoblasts, the body's bone-forming cells, by causing the cells to intentionally destroy themselves.

"In promoting the death of bone-forming cells, it therefore promotes the development of osteoporosis," Heggland said. She and her students are now studying the cell signals involved in that process, known as "programmed cell death."

The C of I research team also has determined that cadmium gets deposited in the extra-cellular matrix of bone rather than calcium, and is looking to answer what replacing calcium does to the strength of bone cells. In addition, C of I research students have begun examining whether estrogen is connected to the potency of the heavy metal since women are affected more severely by cadmium toxicity.

Shea Wright, a senior chemistry major who joined the research project as a fellow supported by the NIH Idaho INBRE (IDeA Network for Biomedical Research Excellence) program, has enjoyed participating in the ground-breaking research.



Student Wright in the Lab

"It's exciting to be learning something you wouldn't be able to learn in a regular classroom," said Wright, who is considering a career in either medicine or research. "Being involved in the research process is teaching me a lot about perseverance and problem-solving."

INBRE Fellow Thao Ha, a junior biology major, said the research experience is benefiting her plans for a medical career.

"Medical students need to be able to work independently and they need to learn how to think critically," Ha said. "Those are skills I've enhanced working on this project."

Two trends that show no signs of reversing make the research by Wright, Ha and the rest of the C of I team particularly valuable. First, cadmium is being used in more products – from consumer electronics to children's toys and jewelry – that will wind up in landfills.

Second, the population of the United States and the rest of the world is aging rapidly. Since osteoporosis affects the elderly most dramatically, figuring out how to combat cadmium's bone-destroying afflictions would improve the quality of life for this growing age group.

"We hope this research is used to protect the public, minimize the amount of cadmium that is getting into the environment, and ultimately, to help people live healthier lives," Heggland said.

BOISE STATE UNIVERSITY

Predicting Pesticide Exposure in Diet

Kathleen Tuck, BSU Feature Article

While health-conscious individuals understand the benefits of eating fresh fruits and veggies, they may not be aware of the amount of pesticides they could be ingesting along with their vitamin C and fiber. A new study published in the Feb. 5 edition of *Environmental Health Perspectives* is among the first to predict a person's pesticide exposure based on information about their usual diet.

The study was led by Cynthia Curl, an assistant professor in Boise State University's School of Allied Health Sciences. She recently joined Boise State from the University of Washington.

Curl and her colleagues analyzed the dietary exposure of nearly 4,500 people from six U.S. cities to organophosphates (OPs), the most common insecticides used on conventionally grown produce in the U. S. OP pesticides are linked to a number of detrimental health effects, particularly among agricultural workers who are regularly exposed to them.

Results showed that among individuals eating similar amounts of fruits and vegetables, those who reported eating

organic produce had significantly lower OP pesticide exposures than those consuming conventionally grown produce. In addition, consuming those conventionally grown foods typically treated with more of these pesticides during production, including apples, nectarines and peaches, was associated with significantly higher levels of exposure.

"For most Americans, diet is the primary source of OP pesticide exposure," said Curl "The study suggests that by eating organically grown versions of those foods highest in pesticide residues, we can make a measurable difference in the levels of pesticides in our bodies."

This study included dietary data collected from participants in the Multi-Ethnic Study of Atherosclerosis, a large, multi-institutional project funded by the National Heart, Lung and Blood Institute that is investigating factors that influence the onset of cardiovascular disease.

The researchers were able to predict each participant's exposure to OP pesticides based on the amount and type of produce each participant typically ate and the U.S. Department of Agriculture's measurements of pesticide residue levels on those foods. The researchers then compared these predictions to pesticide metabolite levels measured in urine samples from a subset of 720 of these people.

While Curl's study is not the first to link organic produce with reduced pesticide exposure, the method she used may have significant implications for future research. By combining self-reported information on typical food consumption with USDA measurements, researchers will be able to conduct research on the relationship between dietary pesticide exposure and health outcomes in bigger populations, without needing to measure urinary metabolites.

"If we can predict pesticide exposure using dietary questionnaire data, then we may be able to understand the potential health effects of dietary exposure to pesticides without having to collect biological samples from people," Curl said. "That will allow research on organic food to be both less expensive and less invasive."

"The next step is to use these exposure predictions to examine the relationship between dietary exposure to pesticides and health outcomes, including neurological and cognitive endpoints. We'll be able to do that in this same population of nearly 4,500 people," she said.

One way people can reduce their pesticide exposure, said Curl, is to eat organic versions of those foods that are listed on the Environmental Working Group's "Dirty Dozen" list, which ranks fruits and vegetables according to pesticide residue level.

Co-authors of the published study, "Estimating Pesticide Exposure from Dietary Intake and Organic Food Choices in the Multi-Ethnic Study of Atherosclerosis (MESA)," are Shirley Beresford, Richard Fenske, Annette Fitzpatrick and Joel Kaufman (University of Washington), Chensheng Lu (Harvard University) and Jennifer Nettleton (University of Texas).

Professor Curl

This research was supported by the Environmental Protection Agency's Science to Achieve Results (STAR) Fellowship Program, the National Heart, Lung and Blood Institute, the National Institute of Environmental Health Sciences and the Department of Environmental and Occupational Health Sciences in the University of Washington School of Public Health.

Cheatgrass is Changing the Landscape

Kathleen Tuck, Boise State University
Feature Article

America is the home of countless species of plants introduced from the far corners of the globe over the past century or more. While many have served to beautify and enhance our lives, one particular species – *Bromus tectorum*, more commonly known as cheatgrass – has found itself unwelcome, crowding out native plants from coast to coast in a relatively short period of time.

Research by Boise State biology professor Steve Novak and colleagues has traced the spread of this invasive annual grass across the United States and Canada, including the year it was first noted and where it originated. Results show that the invasion was "rapid, multi-directional and genetically diverse."

Professor Novak in the Field

Results of the study were published in the January issue of *Biological Invasions*. "Invasion of *Bromus tectorum* into California and the American Southwest: rapid, multi-directional and genetically diverse" was authored by Angela Pawlak, a Washington State University graduate student who gathered her data in Novak's lab. Coauthors on the paper include Novak, Jeremiah Busch and Richard Mack.

Their research looks at the plant's range introduction and expansion in North America.

"In terms of controlling cheatgrass, we need to better understand the pathway of introduction and spread so we can try to do things that will curtail that spread," Novak said.

B. tectorum was first noted in the United States in Pennsylvania's Lancaster County in 1790. Genetically, it matched a variety still found in Europe. That first plant variety was joined by others as newcomers poured into the land of opportunity. As the population moved west, cheatgrass stowed away in a variety of ways ranging from wagon wheels to contaminated seed stashes.

In the late 19th century, new varieties entered the country through Western seaports like San Francisco and Seattle, and dispersed eastward. Cheatgrass was first noted in California in 1899 and varieties of the plant are now found in every state except Florida.

So what's the big deal? It has to do with how cheatgrass grows. It germinates early in the season, well before most other plants. It spreads easily, crowding out native vegetation, such as bunchgrass and sagebrush, and the roots grow down deep, depleting moisture from the soil. It then dries up in mid-summer and becomes incredible fodder for wildfires.

Large stands of cheatgrass provide fuel for intense range fires. The problem is so pervasive that it has altered the fire cycle, leading to almost total eradication of some native plants in affected areas. Where a normal fire cycle could be every 60-100 years, scientists now are seeing cycles as tight as 3-5 years. And fingers of fire pushing through the sagebrush, allowing some plants to survive, have been replaced by a wall of fire decimating the landscape.

"If we can knock back the density of cheatgrass, we can perhaps control the intensity of the fire," Novak said, noting that, "we still need to replace it with native species."

Novak said that monocultures of cheatgrass often stand in areas once populated by sagebrush, bunchgrass and other native plants. Today, cheatgrass has filled in areas where livestock overgrazed and firestorms wiped the landscape clean.

Another problem with the pervasive plant is that it is palatable to livestock only in the early growing season when it's green. Once it starts to reproduce it creates awns (bristly appendages), which can puncture the mouths (and sometimes even the stomachs) of cows.

And a single plant can produces hundreds of seeds. Add to that its ability to self-fertilize and self-pollinate and it's easy to see how it has spread so quickly.

While Novak believes it may be too late to totally eradicate the species in North America, he does hold out hope that determining its origins can help to control it.

"If we understand its genotype and can trace it to its native range, we can discover how the plant is controlled classically," he said. "Then we can look at the possibility of using that method to control the plant here."

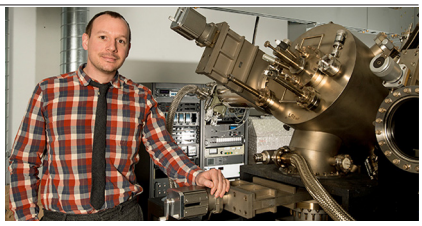
Novak currently is working on a book chapter combining the results of several studies of cheatgrass. Patterns described in the chapter are based on the analysis of 10,150 individuals from 312 North American populations of cheatgrass.

Molecular Beam Epitaxy

Kathleen Tuck, BSU Feature Article

Paul Simmonds looks at his molecular beam epitaxy (MBE) system the way other guys do a candy apple red Porsche. The sci-fi looking machine used to design and create new materials at the atomic level lights his eyes with pure joy.

MBE is a cutting-edge technique that allows for the design and creation of completely new materials that don't exist in nature. By creating extreme vacuum and temperature conditions, the instrument forces atoms to combine into unique nanoscale crystal layers. By adding additional layers of designer crystals, new materials can be created with specific or unusual properties.



Dr. Simmons and the MBE System

Simmonds, a Cambridge graduate, came to Boise State in October from University of California, Los Angeles, where he managed the Integrated Nano-Materials Lab. Before that, he spent time as a post doc at Yale. He now is an assistant professor in both the Department of Physics and the Department of Materials Science and Engineering.

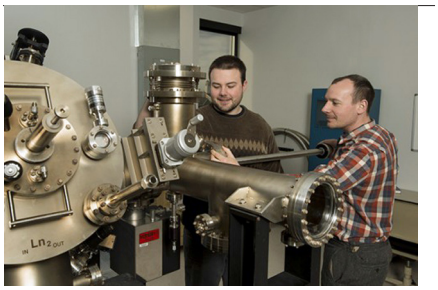
A key negotiation during the interview process was his ability to purchase an MBE system for his Boise State lab. While he didn't get a brand spanking new model, which costs more than a million dollars, he did find one that had been used by the Air Force and affiliates and he has been refurbishing and customizing it in his lab.

While there still is a lot of work to be done to get it fully up and running, it will be a valuable new resource available to Boise State faculty and students, and to industry members who want to collaborate with Simmonds in their research.

"MBE enables us to control the properties of new crystals with exquisite precision, right down to the atomic level," Simmonds said. "We can grow nanomaterials with features just a few billionths of a meter across, and even control how many electrons they have inside them."

In a nutshell, here's how it works.

The machine is a bit like an atomic spray painter. Various "arms" are loaded with elements like germanium or aluminum, which are then beamed as atoms onto a substrate surface in a vacuum chamber. The atoms on the surface eventually sort themselves into a pattern, and continue to do so until a solid surface is formed. A new layer is then started and the process repeats itself until, sometimes many hours later, the final product is achieved.



Simmonds with Student

"The strength of this is that it's so versatile," Simmonds said. "You can make all kinds of materials – metals, oxide materials, semiconductors …"

The process also controls for the purity of the material. There are faster methods, but they cannot compete with the material, quality, resolution and control offered by MBE.

Simmonds plans to build on previous research he did on a family of semiconductor nanostructures called III-V quantum dots. Quantum dots are useful for turning light into electricity, or electricity into light. His first project will use this technology to create a new kind of device to harvest waste heat and turn it into useful electricity. An example of waste heat would be a power station that loses a percentage of its heat energy generated by gas, coal or nuclear power.

"If we can capture this heat that is otherwise lost and turn it into electricity using our devices, then the overall efficiency of the power station goes up significantly," he said. He is currently seeking grants to fund this line of research.

Simmonds said MBE systems are used in labs all over the world to push back the boundaries of physics, materials science, electrical engineering, chemistry and more.

"The number of things they can do is huge," he said, "and they are highly interdisciplinary."

The molecular beam epitaxy system is expected to be fully functional later this semester. To explore collaborating on a project using the MBE system, contact Simmonds at paulsimmonds@boisestate.edu or 426-3787.

Lewis-Clark STATE COLLEGE

Connecting Learning to Life

LCSC–CWI Transfer Agreement

News Release, College of Western Idaho and Lewis-Clark State College

On Tuesday February 3, College of Western Idaho (CWI) and Lewis-Clark State College (LCSC) signed an agreement to expand a transfer partnership between the two institutions. The partnership is aimed at providing opportunities for CWI students transferring to LCSC with Associate of Art (AA), Associate of Science (AS), or Associate of Applied Science (AAS) degrees.

The articulation agreement designates that upon completion of an AA or AS from CWI a student will be recognized by LCSC as core certified. Meanwhile, students completing an AAS at CWI are eligible to transfer into a Bachelor of Applied Science or Bachelor of Applied Science in Applied Technology degree program at LCSC with junior standing.

As part of the new agreement LCSC has designated a pair of scholarships specifically for CWI graduates, in addition to transfer scholarships available to any transfer student who meets the criteria and applies by the March 1 deadline. LCSC will also continue to provide on-campus support for CWI students with admission, registration, financial aid, advising, and credit transfer questions.

"Idaho is one state and we have one publicly supported education system," says LCSC President J. Anthony Fernández. "This agreement between LCSC and CWI is another fine example of this fact. We look forward to expanding the higher education opportunities for Idahoans so ably served by CWI."

Since 2010, 63 students have transferred to LCSC from CWI. The growing collaboration has been most apparent

LCSC and CWI Presidents Shake Hands on the Agreement

in recent years as 52 percent of those students have transferred in just the past three semesters.

"At College of Western Idaho, we are proud to be a gateway to postsecondary education for southwest Idaho and encourage our students to continue their education beyond their success at CWI," states CWI President Bert Glandon. "We are thrilled to formalize an enhanced commitment with our partners at Lewis-Clark State College. Additional opportunities to access such a fine institution will be a great advantage for our students."

University of Idaho
A LEGACY OF LEADING

Grant for NMR Spectrometer

University of IdahoNews Release

University of Idaho researchers will soon have a new tool for understanding the world at the molecular level, thanks to a grant from the MJ Murdock Charitable Trust and a major gift from a private donor.

The trust awarded UI chemistry professor Richard V. Williams and his co-investigators $360,000 to purchase a nuclear magnetic resonance, or NMR, spectrometer, which uses a powerful super-conducting magnet to determine molecular properties. The NMR is expected to be installed on campus in April.

Vandal alumnus John S. Townsend of Moses Lake, Washington, also donated $100,000 toward the NMR. Townsend, who studied chemistry at UI, is the former owner of Western Polymer, which produces starch for the food and paper industries.

The NMR fills a vital need for researchers in the UI Department of Chemistry and other departments across the university, including geological sciences; plant, soil and entomological sciences; forest, rangeland and fire sciences; and chemical engineering.

"It is the preeminent instrument used in chemistry for structure determination, which is important in every branch of science," Williams said.

The NMR will serve research projects by characterizing compounds that may be useful to create drugs to fight cancer and other diseases, understand soil structure to find out how it effects plant growth, and study useful materials made from waste such as potato peels. It also will support research into fundamental scientific questions, such as Williams' work in controlling molecular properties.

In addition, Murdock awarded UI $38,000 to seed new research projects and give new users access to the NMR. Researchers can use these funds to purchase supplies needed to take advantage of the instrument's power.

The chemistry department already owns two NMRs – one teaching-level instrument and an aging research-grade spectrometer, which is nearly 20 years old and can no longer be updated. The old machine will be reconfigured to analyze solid samples, while the new NMR will allow researchers to obtain detailed information about materials in solution.

The new NMR also will increase UI's capability to serve outside partners who contract with the university to provide NMR data and help defray the operating costs of the facility. Partners include the University of Montana, the Smithsonian Tropical Research Institute, Argonne National Laboratory, and U.S. Department of Agriculture sites in Dubois and Kimberly, Idaho.

"The generosity of the Murdock Charitable Trust, Mr. Townsend and other donors has enabled the university to make this important investment for our present and future research," said Jack McIver, UI vice president for research and economic development. "This new equipment allows researchers across campus, working both in their fields and in interdisciplinary teams, to explore the molecular structure of materials at a more detailed level than ever before at the University of Idaho."

About the Murdock Charitable Trust

The M.J. Murdock Charitable Trust was created by the will of the late Melvin J. (Jack) Murdock, who was a co-founder of Tektronix, Inc. of Beaverton, Oregon. Since its establishment in 1975 with a bequest of about $90 million, the Trust has focused its grant making efforts primarily in five states of the Pacific Northwest: Alaska, Idaho, Montana, Oregon and Washington. The Trust's current assets are valued at about $800 million and it has distributed more than $658 million through grants. Jack was an idealist as well as a realist and a lifelong seeker of new insights. He believed in science as a main source of knowledge, and knowledge as a key to resolving issues and addressing the needs of the world.

Insects, Agriculture, and Discovery

Bill Loftus, *Here We Have Idaho,* University of Idaho.

An entomologist, University of Idaho faculty member Sanford Eigenbrode focuses on interactions between common insect pests and major crops on the Palouse that surrounds Moscow and throughout the state. His work that reveals how plants use waxy coatings on leaves and stems as defenses against insect earned him international recognition as an expert.

More recently, with fellow UI entomologist Nilsa Bosque-Pérez, he deciphered how plant viruses manipulate both their host plants and the aphids that transport viruses from plant to plant.

Collaboration defines Eigenbrode's approach to teaching and scholarship. Eigenbrode and UI entomologist Mark Schwarzlaender study chemical signals that ensure insect biological control agents target invasive weeds. They also seek the chemicals *brassica* [mustard family] crops use to repel insect pests.

Professor Eigenbrode

He and UI molecular biologist Joe Kuhl explore how viral mutations can affect their interactions with plants. He and researchers at Germany's prestigious Max Planck Institute for Materials Research investigate how insects attach to plant surfaces.

"There is nothing as exciting as discovering new horizons in the nexus between different areas of knowledge and expertise," Eigenbrode said, and credited the University of Idaho for fostering an academic culture that helps facilitate these kinds of cross-disciplinary explorations.

With project leader Bosque-Pérez, he was part of the team that landed two prestigious National Science Foundation Integrative Graduate Education and Research Traineeship (IGERT) grants, the first in 2001 and a renewal in 2009. The program, which aims to prepare future

interdisciplinary scientists, recruited more than 40 doctoral students to work in teams in Idaho and Costa Rica.

The exploration of cross-disciplinary research that was central to the IGERT projects led Eigenbrode to partner with then-UI philosopher Michael O'Rourke. They worked together to create a workshop-style approach based on the philosophical "toolbox" to help research teams understand members' vocabularies, approaches and assumptions within their collaborations.

Their inquiry resulted in another National Science Foundation grant that

Professor O'Rourke

funded an international symposium, some 130 workshops based on the toolbox, and an edited volume on the challenges of communication in interdisciplinary research.

"Sanford is one of those rare faculty members who thinks beyond the confines of his discipline," said Jack McIver, UI vice president for research and economic development.

"While his focus is on the future, he is respectful of all points of view. He has recognized the necessity for interdisciplinary training for students and approaches to the complex problems facing the state and the region."

Evolution of a Scientist

When Eigenbrode graduated from Cornell University in 1970, the world was in flux. Equipped with a degree in neurobiology and behavior, he and several classmates paid $13,000 for a 125-acre farm near Cornell, and Ithaca, New York. They shared chores on the farm, but pursued different interests, too.

While some farm residents helped to found Ithaca's Moosewood Restaurant, of "Moosewood Cookbook" fame, Eigenbrode worked as a custodian and shop teacher at Ithaca's Alternative Community School. There, founder and principal Dave Lehman and his staff employed the philosophy of A. S. Neill, the Scottish educator of Summerhill fame. Students chose topics to explore and formed a democratic educational community.

"It was all new and exciting," Eigenbrode said. "In addition to regular classes, students would work in groups to spend a week or more studying one topic deeply." His school duties included leading weeklong bicycle trips with students, teaching banjo and guitar, and teaching special topics in biology.

That experience sparked a career and lifelong interest in research and education. An entomologist at Cornell, David Pimentel, influenced Eigenbrode's path. Pimentel continues to focus on organic and other non-conventional approaches to agriculture and societal issues that range from pesticides, tillage, energy, sustainability and immigration.

"I was fortunate to return to Cornell just as people there were helping to shape the emerging field of agroecology," Eigenbrode said. Pimentel sought a holistic view of agriculture and to apply the scientific method to organic agriculture. "He looked at the whole community, the whole production system."

His time at Cornell led Eigenbrode to a doctorate in entomology in 1990. From there, he followed the post-doc path to the University of California, Riverside, then to the University of Arizona at Tucson. He joined the University of Idaho faculty in 1995.

Eigenbrode's work as a scientist has evolved, from looking at problems in an integrated way at the community level during his master's degree training training, to focusing on specific topics for his doctoral work related to leaf waxes and insects.

He worked with plant breeders and found that changing one gene controlled the amount and type of wax present on leaves and other plant surfaces. Later, he and collaborators showed how one change affected the whole community of insects, pests and predators alike.

"Eventually, during my years on the UI faculty, I returned to the broader systems-level thinking and a desire to contribute to agricultural sustainability that got me into science in the first place," he said. The shift could have occurred because he had satisfied the desire to know as much as possible about that one thing. "Or maybe it's because that's what I was hearing from producers, and they were more integrative."

That landscape-level perspective was consistent with the UI IGERT grant's approach. Students formed tight-knit interdisciplinary teams to pursue their graduate educations and to better understand community- and landscape-level topics from Palouse prairie remnants near Moscow to coffee production in Costa Rica.

The work on insects, plant defenses and ecological communities led to a number of collaborations, including the ongoing and fruitful one with fellow entomologist Bosque-Pérez.

That work led to a new understanding of how plants and insects are part of complex interactions involving the major wheat threat, Barley yellow dwarf virus; potato pathogen, Potato leafroll virus; and two viruses that affect legumes.

In short, aphids seek out plants infected with virus because the virus infection causes the plants to send out attractive chemical signals. Once they have acquired the virus, however, the aphids seek out healthy plants, rapidly spreading the virus and the disease it causes.

A Broad REACCH

Eigenbrode's grand collaboration so far is the REACCH project, or Regional Approaches to Climate Change in Pacific Northwest Agriculture The U.S. Department of Agriculture-funded climate change project includes researchers from three land-grant institutions, UI, Oregon State University and Washington State University, and the USDA Agricultural Research Service.

Announced in 2011 as a coordinated agricultural project by the USDA National Institute of Food and Agriculture, REACCH tackles how climate change may affect wheat production. Worth some $2 billion annually to the three states, wheat is big business. It is also complicated.

Entering its fourth year, the five-year project coordinates efforts by scores of scientists with disciplines that range from climate science to agricultural education. Project researchers study how projected climate changes may affect wheat production in the interior Northwest's several agroecological zones. Others examine how farming practices may influence climate change, how to help the region's farmers incorporate climate-friendly farming practices, and how high school teachers throughout the region can incorporate climate science and agriculture into their classes.

In his role as REACCH project director, Eigenbrode welcomed National Institute of Food and Agriculture (NIFA) Director Sonny Ramaswamy to the UI campus in July for meetings with researchers, students and others. Ramaswamy, as agriculture dean at Oregon State in 2010, had helped support the REACCH partnership along with then Deans John Hammel at UI and Dan Bernardo at WSU. As NIFA director, Ramaswamy now oversees a $1.3 billion budget that is a major federal funding source for agricultural research.

Eigenbrode took that opportunity to suggest that REACCH's expected conclusion in 2016 should be seen as the beginning of long-term integrative, landscape-level research, education and extension to support Northwest agriculture.

Idaho National Laboratory

Summer Institute Registration

INL Feature Article

Idaho educators have an opportunity to take summer courses in science, technology, engineering and math-based topics with information on how to use the information in their classrooms during six low-cost workshops held around the state in June.

Nearly 700 educators are expected to attend this year's i-STEM Teacher Institutes, which will be held:

- June 15-18 at North Idaho College in Coeur d'Alene
- June 15-18 at Lewis-Clark State College in Lewiston
- June 16-19 at Eastern Idaho Technical College in Idaho Falls
- June 22-25 at Idaho State University in Pocatello
- June 22-25 at the College of Southern Idaho in Twin Falls
- June 23-26 at the College of Western Idaho in Nampa

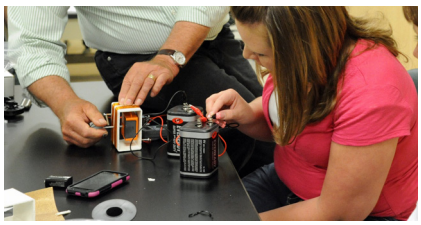
The workshops are organized by the Idaho STEM (science, technology, engineering, mathematics) initiative, or i-STEM – a partnership of educators, government agencies, organizations and private companies working to improve STEM education in the state. i-STEM members include Idaho National Laboratory, universities and community colleges, Idaho State Department of Education, Idaho State Board of Education, Hewlett Packard, Intermountain Gas, Micron and Idaho Power. More information is available at www.sde.idaho.gov/site/istem.

This is the sixth year i-STEM has sponsored the K-12 teacher professional development summer institutes. Since 2010, the number of workshops has expanded from two to six, and hundreds of educators and administrators have participated.

"The i-STEM program helps educators enhance their STEM content knowledge through context," said Anne Seifert, executive director of i-STEM and INL's K-12 education coordinator. "We are proud to support a wonderful team from across the state that is helping sponsor and support this important professional development opportunity."

During the workshops, participants choose a specific topic to study such as energy, aerospace, space, sustainability, food safety, computer science, manufacturing, robotics, environment, agriculture, gold mining or health care. They attend sessions taught by STEM experts. Educators also participate in general sessions to learn how to integrate STEM, 21st century skills, career awareness, and the practices of the Idaho Core Standards into all the subjects they teach. Participants receive continuing education credits and resource kits.

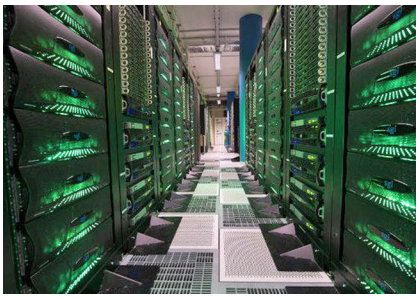
The i-STEM institutes are funded and supported by a state of Idaho Math and Science Partnership Grant; Idaho's state-run universities, community colleges and technical schools; Northwest Council for Computer Education; DEQ; and industry partners like Micron, Hewlett-Packard, Idaho Power, Intermountain Gas, Simplot, Battelle Energy Alliance and others.



New INL Supercomputer

INL News Release

Idaho National Laboratory is enabling researchers to leverage their work with a newly acquired supercomputer. The 16,416-processor Silicon Graphics International Corporation (SGI) supercomputer known as "Falcon" will allow INL researchers to build more complete scientific models and better predict outcomes for a variety of nuclear and energy-related issues.



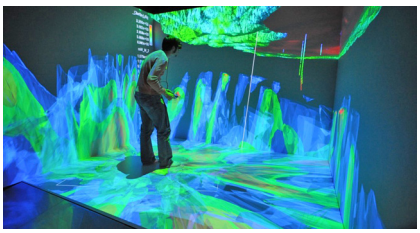
SGI Multi-Processor Supercomputer

"We're excited about the acquisition of Falcon," said Jeff Staffon, director of Scientific Computing at INL. "Partnering with Intel® through its 'Early Adopters Program' allowed us to get this highly anticipated architecture early in the release cycle to meet an important milestone. Our expectations are high that this addition to INL's high-performance computing capabilities will further enhance modeling and simulation of complex systems and processes."

INL awarded a contract to ComnetCo, Inc. for the new supercomputer, which is more than five times faster than its predecessor, Fission, which came online in 2011.

Initial Falcon benchmarks, a SGI ICE-X™ supercomputer based on Intel Haswell™ processors, has demonstrated a floating-point performance in excess of 500 teraflops, which means it can perform over 500 trillion floating-point calculations per second. Its Top500.org ranking of the 97th fastest supercomputer in the world was announced at this year's Supercomputing Conference, SC14, in New Orleans.

"Nearly all physics in nuclear power applications are interdependent," said Dr. Richard Martineau, director of INL Nuclear Science and Technology Modeling and Simulation. "Thus, modeling and simulation efforts of INL's Nuclear Science & Technology Directorate are primarily focused upon efforts to resolve coupled phenomena."



Supercomputer Simulations Allow Visualization of Complex Processes

Reliable and capable high-performance computing (HPC) resources are required when solving nuclear fuels performance, radiation transport and nuclear physics, and thermal fluids phenomena associated with INL programs, he said. The SGI Falcon supercomputer will bring a new level of capability in meeting these INL missions.

"This computer acquisition positions the laboratory for continued leadership in modeling and simulation which is tightly coupled to both national scientific user facilities and nationally recognized experimental expertise," said Eric Whiting, director of INL Applied Computing and Visualization. "Falcon and other INL compute resources enable laboratory science and engineering staff to innovate highly creative modeling and simulation capabilities which produce relevant results."

Denise Stephens, INL chief information officer, believes that high-performance computing to support INL's modeling and simulation capability and core research mission is vital to supporting INL's vision.

"A modern, high-performance computing capability is a resource that must be available to today's researcher," Stephens said. "With the rate of technology change, a continued and strategic investment in high-performance computing is imperative to support INL's missions."

Other Idaho Organizations

Sage Grouse Initiative

Contributed by Tate Walters. Published in the Society for Range Management, Idaho Section Newsletter

The Natural Resources Conservation Service (NRCS) launched The Sage Grouse Initiative (SGI) in 2010, using Farm Bill funding to target lands where sage grouse habitat is intact and sage grouse numbers are stable.

Private lands are the primary focus of the initiative because up to 40 percent of sage grouse dwell on private lands. Many of the critical wet meadows and riparian areas that sage grouse broods depend upon are privately owned.

In 2010, the U.S. Fish & Wildlife Service found the sage grouse merited listing under the Endangered Species Act, but other declining species ranked higher in priority. The Service will decide whether to list the species in 2015.

A listing decision will have drastic impacts on our way of life on western rangelands affecting ranching, energy production, mining, recreation and other services provided by these lands.

The Sage Grouse Initiative is taking a proactive approach to achieve conservation in the right places to avoid the need for listing the bird. NRCS and partners are committed to long-term conservation of sage grouse as well as the other wildlife species that inhabit

the same range, while maintaining the western way of life and securing the nation's food and energy needs.

My personal work with the Sage Grouse Initiative has been with in Owyhee County, Idaho where there is the largest expanse of core sage grouse habitat left in Idaho, along with a good population of birds.

The most destructive and highest priority threat to sage grouse is large wildfires that remove the existing sagebrush cover that sage grouse rely upon for nesting cover and winter feed. These sagebrush sites are often prone to invasion by invasive annual weeds (cheatgrass, medusahead, etc.) and can take many years to provide good sagebrush cover for sage grouse to utilize.

The other main threat to sage grouse habitat in this part of Idaho is the encroachment of western juniper into core sagebrush habitat. The juniper encroachment is a result of aggressive wildfire control during the last 100 years. In the past low intensity fires were allowed to burn naturally and this kept the juniper tree expansion in check. These fires would kill the small trees that were encroaching on the site and kept juniper confined to rocky ridges and shallow soils where fuel wasn't able to build up and allow fires to burn through very often.

Juniper Incroachment on Sagebrush

Western juniper is a very competitive plant and once it enters a site it soon starts to outcompete the native grasses, forbs and shrubs for limited nutrients and moisture. Juniper can dewater springs and meadows that are so important in the early stages of a bird's life. Research has shown that sage grouse will tend to avoid areas where trees are present because it allows hawks and other predators a spot to perch and hunt from.

Check out more about SGI online at http://www.sagegrouseinitiative.com.

Editorial and Other Thoughts

Editorial Comments

A word first about the "dual" logos on this issue. As you may recall from the last *Retort*, the Executive Committee decided to "do business as" the Idaho Academy of Science and Engineering.

This puts our title more in line with our long-standing interest in all areas of STEM (science, technology, engineering, and math). It also sets up a potential merger or other affiliation with state engineering organizations.

However, a formal change to that approach has not been presented to, or approved by the general membership. The *Retort* is one of two official publications of the Academy specifically defined in the IAS Constitution. (The other is, of course, the *Journal of the Idaho Academy of Science*.)

We do not know the legal ins-and-outs of the "doing business as" formalism. Hence, we decided to stick with the old official name and logo for the time being … but also show the possible new name and logo.

Aside from that, this is a pretty "standard" version of the *Retort*. We lead with an overview of the Annual Symposium. We hope lots of you are planning to attend.

Other than that, there is no over-riding "theme" for the issue. Four articles relate, loosely, to science education: a new vice president and dean at ISU, a formalized transfer mechanism between College of Western Idaho and LCSC, and registration for a series of summer institutes for teachers sponsored by the INL.

The fourth item describes the research and educational link-up between ISU and NASA. The program provides students as well as faculty access to the vast amounts of data collected by NASA instruments and missions.

There are also three articles about instrumentation: a new supercomputer at the INL, a grant for a research-grade NMR at UI, and acquisition of a Molecular Beam Epitaxy (MBE) system at BSU. Materials production by MBE is not a technique we're particularly familiar with, but it looks very interesting.

We also have three articles in the general environmental area, two of them somewhat related. One is a discussion of how invasive cheatgrass negatively impacts native plants, and other more desirable flora. What makes that extra interesting is the item about how invasive species – cheatgrass, western juniper, and others – degrade habitat for the native sage grouse. We hope the "Sage Grouse Initiative" can succeed in stabilizing grouse habitat, and therefore numbers, so the species does not have to be listed as endangered.

The other articles are equally interesting and informative. As we have mentioned to some of you, this is likely to be our last issue as Editors of the *Retort*. Thus, we wanted to give you something good … and we think we have done that.

Retort Residue

Why do overlook and oversee mean opposite things?

How come you don't ever hear about gruntled employees?

You never really learn to swear until you learn to drive.

Puritanism: The haunting fear that someone, somewhere ... may be happy.

Beauty is in the eye of the beer holder.

"I am" is reportedly the shortest sentence in the English language. Could it be that "I do" is the longest sentence?

For every action there is an equal and opposite criticism.

You know you're an Internet junkie if: When filling out your driver's license application you give your IP address.

"A modest little person, with much to be modest about." -- Winston Churchill (about Clement Atlee).

Did someone eat an extra bowl of stupid this morning?

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The IAS Journal Needs Papers

The *Journal of the Idaho Academy of Science* needs you to consider submitting an article to *JIAS*. We will review submissions in all fields of science or science education (including psychology and other social sciences) which relate in some manner to the state of Idaho and have not been published elsewhere. Please also encourage your colleagues to consider submitting an article to *JIAS*. Articles will be reviewed by scientists working in the same or a closely related field.

If you have any questions about submissions contact:

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