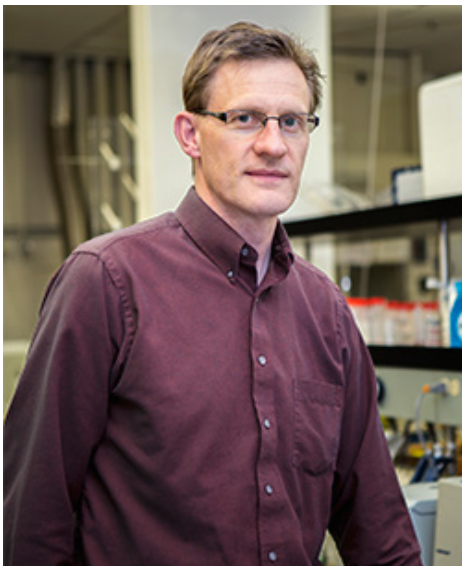
April | 2014

FACULTY newsletter

CPMS Physical and Mathematical Sciences

Decoding Disease



Above: Dr. Adam Woolley is currently working with Dr. Milton Lee and Dr. Aaron Hawkins of the Departmen of Electrical and Computer Engineering to create nanofluidic devices to predict and detect disease based on proteins in the blood.

If you have ever had any blood work done, you understand the hassle of drawing blood and filling a separate tube for each criterion to be tested, which each require time-consuming analysis. Imagine, instead, only giving one drop and having your results instantaneously.

Dr. Adam Woolley and Dr. Milton Lee of the Department of Chemistry and Biochemistry along with Dr. Aaron Hawkins of the Department of Electrical and Computer Engineering have been working together for ten years, creating nanofluidic devices that can predict and detect diseases based on the proteins present in blood.

These devices are made from engineering tools typically used to make computer circuits, but the team has adapted them to make fluidic structures through a similar process of thin-film microfabrication.

"This is in the title of the paper," Woolley said. "It's called 'Thin-Film Microfabricated Nanofluidic Arrays for Size-Selective Protein Fractionation'. [The process] basically entails adding or subtracting little, thin layers on a surface, and, using light, you pattern the layers to get to two dimensional and three dimensional patterns which make up the device."

The device works by filtering the sample through nanochannels — measured in billionths of a meter — that run parallel to each other, but differ in height throughout the device. The array of channels acts like a sieve, allowing the contents of the sample that don't fit through the channels to be analyzed using fluorescence to determine acceptable levels and sizes of the tested protein.

"An application for this is to put the fluid sample in the one side, and then it flows through the channels and fills by itself," Woolley said. "Then you do a simple readout step where you see how much is trapped at this interface

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Condensing Years of Study into Twelve Minutes at the SRC

Students, faculty, and sponsors gathered in the Jesse Knight Building on Saturday, March 15, for the 28th annual Student Research Conference (SRC) sponsored by the College of Physical & Mathematical Sciences. While there, students had the opportunity to present their undergraduate and graduate research and learn from their peers.

The SRC, which began twenty-eight years ago as a small gathering of students and professors in only two classrooms, has now expanded to occupy an entire building. This year, the conference hosted over 400 student presentations on everything from chemo-resistance in cancer to hive mind in honeybees.

One of the primary purposes of the SRC is to give students valuable experience presenting in a professional atmosphere to their professors, peers, visitors, and members of the CVLC (College Volunteer Leadership Council), who participated in the conference as session chairs.

Presentations can be a challenge. Students, who work in labs during the week on research, must synthesize all of their data and draw conclusions in order to present to a crowd who know nothing about their research. The students are given only twelve minutes to present, which requires them to carefully select points from their research and hone their presentation skills.

Benjamin Smith, an undergraduate physics student from upstate New York, presented on the shape of electron orbits around an atom. He appreciated the opportunity to dig deeper into his research and share it with his peers.

"The thing I like the most about it is that it gives me a chance to learn about what I am researching," Smith said. "Sometimes you just do things, go

Above: Over 400 students presented their research at the 2014 Student Research Conference on March 14.

through it, and you are just kinda lost. But this has really forced me to think about what I am doing, get a better understanding of what I am doing, and be able to talk about it to somebody else."

Robert Bodily, an undergraduate neuroscience major, also presented at the SRC. He appreciates that the SRC is a great venue for practicing presentation skills on a friendly and interested audience.

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Tug of War is Not the Answer

To measure the speed with which cells move within a living organism, most scientists focus on how hard cells push and pull against each other. But Dr. John Dallon, a professor in the Department of Mathematics, has discovered a different, more effective way.

Years ago, when Dallon began this research, he focused on simpler "rounded cells," but now he focuses on more dynamic, star-shaped cells. "Recently, I've been much more interested in the forces involved in how cells pull and tug on their environment. In wound repair, cells pull and tug on the tissue as they repair the wound," Dallon explained.

Dallon saw that these cells would play a sort of tug of war, pulling and pushing on each other and on the cell substrate as their adhesion sites attach and detach. To better understand this interaction, Dallon developed a new model using mathematical formulas. What he discovered from his model was not what he expected.

"It became obvious to me that sometimes these attachment sites will release and then that long stretched-out arm will quickly retract. I became interested in these attachments and understanding them better," Dallon said.

Most previous research on this topic has focused on measuring the force of the pushing and pulling of cells, but Dallon says that scientists should instead pay more attention to when they grab onto and let go of things.

"It's the dynamics of how the cell grabs on to things as opposed to how hard it pulls on them that determines its speed," Dallon explained.

By focusing on the attachment activity instead of the pulling and pushing, scientists can better control the speed at which cells move. Discovering the mechanisms for cell motion is important because it is easier to change the cell's speed if the process is understood.

"The main point of this [study] is to say, if I want to slow a cell down, I don't change the forces on the cell; I change how it's attaching and detaching to the substrate," Dallon said. "Altering the attachment and detachment dynamics of cell adhesion is more effective at changing cell speed than altering cell force. So understanding those dynamics is key."

For example, if people have a tumor or growth in their body, treatment is easier when the cells remain localized.

Above: Dr. John Dallon is currently studying how cells play a kind of "tug of war" as they repair tissue.

When they start to move and go to other parts of the body it is more life threatening. If the cell mobility could be slowed down, these diseases would be simpler to manage and treat. There are many reasons scientists and doctors are interested in speeding up or slow-

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Clark Snelgrove: The Demonstration Lab Specialist

If you were to walk into N-182 of the ESC, you would probably wonder what so many trinkets, pipes, drills, wood slabs, and other miscellaneous items were doing in the same room.

Clark Snelgrove is the manager of the demonstration lab and works with his team of assistants to provide demonstrations for faculty and their students.

"There's a little bit of clutter, as you can see, but we're trying to clean it up and turn the clutter into actual usable demonstrations and eliminate some of the clutter that isn't usable," Snelgrove said.

It wasn't always in Snelgrove's plan to be at BYU. After he received his bachelor's degree in physics from BYU in 1985, he was a classroom teacher for fifteen years. During that time, he completed a master's degree in physics from the University of Utah. In 2002, Snelgrove moved to Virginia with his wife and six sons where he worked at Virginia Tech developing a new physics teaching facility. After that project was completed, he did two years of work on a PhD in STEM education and then returned to the public school classroom for one year. An opportunity arose to work in the technology industry as a microwave test engineer, and he did that for four years. That was when another opportunity presented itself.

His company in Virginia was expanding to North Carolina, and at the same time he discovered he'd be transferred to North Carolina, Snelgrove received an email from BYU's Wayne Peterson, who was the demonstration coordinator at the time. Peterson asked Snelgrove if he knew anyone who would like to apply for his job. Snelgrove said to himself, "I think I might like to apply."

"I guess we're supposed to be here. It all kind of happened all of the sudden and I'm enjoying it here very much," Snelgrove said.

Running the demonstration lab is not a typical office job. There is never a normal day for Snelgrove and his six-student team. It always depends on what kind of demonstration is requested. Faculty members request standard demonstrations and also come in with new ideas of something they've seen or ask if he and his team can come up with something new.

A couple weeks ago, the lab developed two new demonstrations: one for the Society of Physics Students (SPS) and another one for Dr. Bart Kowallis' Physical Science 100 class. For the SPS demonstration, Snelgrove explained, "We took some old cordless electric drills with bad batteries. Then, we put some crank handles on them and converted them into little generator/motor systems that we're going to give to the

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Upcoming Events

CPMS Faculty Teaching and Learning Workshop

Thursday, April 17 from 12:00 p.m. to 12:50 p.m. in the Hinckley Center Assembly Hall. Lunch will be provided. Topic: "Teaching Issues in Non-First Year Courses." Must have sent in an RSVP to attend.

April Commencement

Thursday, April 24, at 4 p.m. in the Marriott Center. Faculty will line up north of the ASB at 3:15 p.m.

April Convocation

Friday, April 25, at 8 a.m. in the WSC Ballroom. Faculty will line up at 7:30 a.m. in the Garden Court.

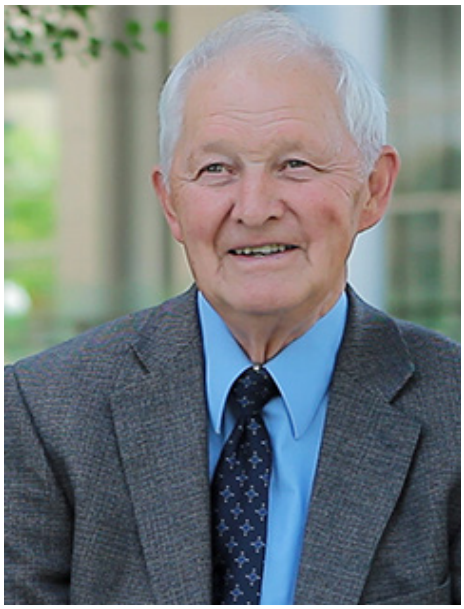
Chem Open Lab Day

Saturday, May 10
Saturday, May 17
W140 Benson Building
10 a.m. to 12:45 p.m.
All students in grades 7-12 are invited

Astrofest

Saturday, May 17
10:00 a.m.–4:00 p.m.
Eyring Science Center

Hearing the Music of Science



Above: Emeritus professor Dr. Bill Strong received the Silver Medal in Musical Acoustics from the Acoustical Society of America.

The College of Physical and Mathematical Sciences is proud to congratulate emeritus professor William Strong on receiving the Silver Medal in Musical Acoustics for a lifetime of acoustical research excellence.

The Silver Medal is the second highest honor presented by the Acoustical Society of America (ASA) and is only awarded when the board determines that a nominee has provided significant and long-lasting contributions to science. Strong is the ninth person in the history of the ASA to receive the Silver Medal in Musical Acoustics.

"The award was fully unexpected," Strong said. "But it's an honor. An unexpected honor."

Unexpected, but not at all unmerited.

Physics was a favorite subject of Strong's beginning in high school. This interest continued when he attended BYU in the 1950s where he was exposed to a broad range of physics topics.

"Then I took an acoustics course taught by Dr. Harvey Fletcher toward the end of my studies at BYU and I decided that's the thing that really appealed to me," Strong said.

After completing his undergraduate education, Strong entered into a doctoral program in physics at Massachusetts Institute of Technology (MIT) where he joined a musical acoustics research group. His research there centered on the synthesis of wind instrument tones. It was at MIT where he observed and grew close with professors, something that sparked his interest in pursuing a career in academia.

"When I was at MIT, I had a couple of professors that I very much enjoyed, and the idea of becoming a professor appealed to me more and more," Strong said. "Working in the university environment combines the best of all worlds because you can teach, you can do research, you get to interact with students, you get to interact with colleagues, [and] you get to do some travel. It's an exciting environment."

Once he finished his PhD from MIT in 1964, Strong had to complete his mandatory military service that had been postponed by an education deferral. Strong's advisor at MIT had contacts at the Air Force Cambridge Research Laboratories and arranged for him to start there as a civilian. He then was able to stay on for three years on active duty for the United States Air Force and fulfill his military obligation.

"It was good fortune that I was able to serve my active duty at the research laboratories," Strong said. "It was more than good fortune—it was a blessing.

My time in the Air Force was actually very profitable from an acoustics point of view. When I was in the Air Force, I had the opportunity to do work on speech acoustics, which was complementary to the research on musical acoustics done at MIT. And so when I came to BYU, my emphasis was on both of those areas."

Strong enjoys the opportunity to experience sound and music from a scientific perspective.

"Unfortunately, I do not have serious musical talent," Strong said. "I tried to play clarinet during a couple of years in high school, and I'd say I had tin ears and a tin clarinet, and that didn't bode well. But I enjoy music, particularly classical and semi-classical, and so pursuing questions of how musical instruments produce their sound and so on was natural for me."

BYU wanted Strong to continue the acoustics program since Dr. Fletcher was retiring, so in January of 1967, Strong joined the BYU faculty and took over the acoustics research program. He spent thirty-four years as a member of the physics faculty with emphasis in acoustics. During that time, twelve students completed doctoral dissertations

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Disinfecting Space

If your spaceship crashed on Mars, what would survive? Perhaps not you, but the bacteria on your hands might.

Dr. Daniel Austin of the Department of Chemistry and Biochemistry and Brandon Barney, one of his PhD students, are currently experimenting with accelerating charged bacteria to very high speeds and crashing them onto dense targets. So far, the experiments have shown that bacteria can survive these crashes even at speeds of 120 meters per second or almost 270 miles per hour.

These bacteria are so resilient, in fact, that Austin and Barney had a hard time trapping the bacteria long enough to get a measurement because the bacteria were bouncing everywhere.

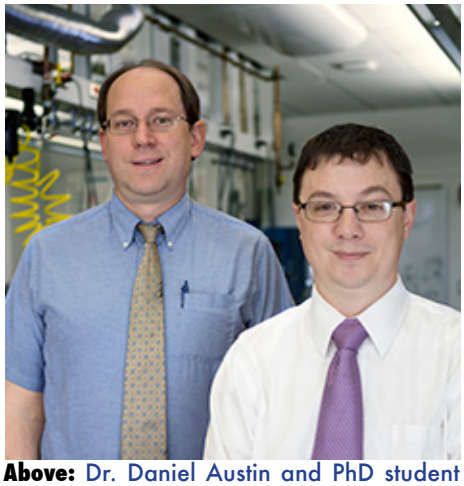
"We had a lot of trouble with bouncing initially; they were bouncing right out of the container," Austin said. "Only later did we realize why we weren't getting any results–they were all bouncing out!"

Now that Austin and Barney can effectively test the speeds at which germs can survive a collision, NASA is interested in applying the research to find out whether bacteria would be able to survive a spacecraft crash and grow on a foreign planet.

"For example," Austin explained, "Not all spacecraft that have been or are going to Mars are completely sterilized. They still contain viable bacteria that could be released to the Martian surface. Even if the mission is successful, we don't want to detect signs of life that are a result of things that we brought with us." Preventing this contamination is what NASA calls "planetary protection."

Equally important is the question of reverse contamination–that we make sure nothing harmful is brought back to earth on a sample return mission, if microbial life exists on Mars or elsewhere in the solar system.

Austin and Barney will soon submit their findings to the planetary science journal Icarus. In the future, Austin hopes this research will be able to tell other scientists whether potential life found on other planets was original to that planet or whether it was brought from earth.



Above: Dr. Daniel Austin and PhD student Brandon Barney are experimenting with charged bacteria to test whether they would survive a spacecraft crash.

"They want to be able to say, 'We see signs of life and we are confident this is not life we brought with us from Earth, because of how careful we've been,'" Austin said. "We want to keep the planets in their natural environment."

by Meg Monk

Scientists Find New Way to Upgrade Natural Gas

Above: Dr. Daniel Ess is part of a group of researchers who have discovered a new way to turn natural gas into upgraded liquid alcohol fuel.

America's current energy boom may take a new direction thanks to the discovery of a new way to turn raw natural gas into upgraded liquid alcohol fuel.

In the March 14 issue of *Science* magazine, chemists from Brigham Young University and The Scripps Research Institute detail a process that could reduce dependence on petroleum.

The most unexpected breakthrough in the paper was that ordinary "main group" metals like thallium and lead can trigger the conversion of natural gas to liquid alcohol. The research teams found that natural gas to alcohol conversion occurs at 180 degrees Celsius – just a fraction of the heat needed with traditional "transition metal" catalysts (1400-1600 degrees Celsius). BYU professor Daniel Ess, one of the study authors, used chemistry theory to understand how and why this process works at low temperatures and under mild conditions.

"This is a highly novel piece of work that opens the way to upgrading of natural gas to useful chemicals with simple materials and moderate conditions," said Robert Crabtree, a chemistry professor at Yale who is familiar with the new study.

The discovery comes at a time when natural gas production is booming in America – a trend that is expected to continue for the next 30 years. The new process cuts out an entire step of the process for fuel production. Ordinarily the three main parts of raw natural gas – methane, ethane and propane – are separated before they are turned into fuels or other useful chemicals.

"Hardly anybody actually tries to do reactions on a genuine mixture that you would get from natural gas," said Ess. "Turns out we can just directly use the mixture of what comes out of natural gas and convert all three of them together."

The potential benefits aren't limited to the production of fuel, Ess said. Many chemicals derived from natural gas, such as methanol, are also important in manufacturing.

"Whether you use methanol to burn as a fuel or as a chemical commodity for products, this process cuts down energy usage," Ess said.

This is the second time in 2014 that Ess has seen his research appear in Science, which consistently ranks as one of the top two scientific journals in the world. In January, the journal published another paper he co-authored about synthesizing molecular compounds. He's also teaching organic chemistry to 150 undergraduate students at BYU this semester.

by BYU News

Three Ways to Sustain Hydraulic Fracturing

Above: This year's Quey Hebrew lecturer was John McClellan of the University of Utah.

At this year's Quey Hebrew lecture, BYU geologists listened to John McClellan speak about the sustainability of hydraulic fracturing, sometimes called "fracking," which requires the pumping of millions of gallons of water into the ground each day.

Even though fracking has been used in the oil industry since the 1940's, the technique had to be modified so that it could be used in shale deposits, which contain a large percentage of the world's oil and gas. Shales typically have a permeability lower than concrete, but with the development of new hydraulic fracturing techniques that work well in shales, geologists and engineers have been able to extract additional natural gas and oil from these "tight" reservoirs. Prior to this new development, oil and gas reserves had been dwindling and long-term forecasts for continued production of these important resources were questionable.

"Times have changed for the better because with the discovery of these shales and the exploitation of these shales, they have dramatically increased our resources and frankly our reserves as well," said McClellan.

At locations where oil and gas reservoirs in shales are discovered, two types of boreholes are drilled: injection boreholes and production boreholes. At the injection wells, fluids are forced into the subsurface rocks at high pressure creating hydraulic fractures. These fractures create pathways for the oil and gas to escape from the shale and flow into one of the production boreholes where they can be extracted.

"We are obliged to use hydraulic fracturing but we have to take into account some of the consequences of hydraulic fracturing and deal with the effects of that technology," he said.

Though hydraulic fracture is necessary for extracting oil from shale, the operation is high maintenance and may have significant effects on the environment. In order for fracking to provide a continued, sustainable source of oil and gas, McLellan mentioned three necessary elements.

"First of all, we have to have a role of environmental stewardship in this business. Second, this has to be economically appropriate. It has to make sense to produce natural gas or oil in this fashion," he said. "And third, it needs to be providing the public an energy supply that is geopolitically secure."

McLellan said that the industry has twisted the arms of its suppliers and has bargained prices down as much as possible, and now the industry must focus on developing new technologies to continue cost reduction to keep oil and gas affordable.

"Now the costs have to go down by developing new technologies and changing the methodologies for producing. That's the first element of this sustainability," he said.

Technology can also help to reduce the industry's footprint on the environment and thus its environmental impact. One of the examples McLellan mentioned was directional drilling. Before about 1980, oil and gas wells were typically drilled straight down, so for each new well more pads for drilling rigs were required. Now, directional drilling (the capability to drill diagonally and horizontally) has reduced the amount of land needed; some rigs have as many as fifteen wells drilled from a single pad.

The last element of sustainability involves geopolitical security. Prior to the development of extensive shale fracking, the United States was highly dependent on unstable suppliers around the world to keep energy supplies replenished. This, at times, caused dramatic swings in oil and gas prices, which in turn caused economic problems. Hydraulic fracturing of shales has helped to largely eliminate these problems, but in order to sustain the flow of oil and gas using these techniques the public and their associated politicians need to be assured that the energy supply is safe, will not significantly damage the environment, and that its production can be counted on for many years to come.

Although the technology continues to improve and the yield from oil and gas reservoirs has dramatically increased due to hydraulic fracturing, much work remains for engineers and geologists alike. That is the opportunity McLellan mentioned to the audience, and it will be exciting to see what improvements come next.

by Madison Parks

SRC continued from page 1

"I think (presentation skills) are very valuable because it is a way of convincing others," Bodily said. "This is what you want to do if you go into academia, you want to convince others that your research is valid and worthwhile."

From the hundreds of students who presented their research, forty-nine papers were selected as the 2014 SRC Session Winners.

In addition to attending presentations, students were also able to meet with representatives from the SRC's corporate sponsors: Active Care, Adobe, Goldman Sachs, Moxtek, Microsoft, National Instruments, Paulo Alto Networks, and Turner Innovations.

These representatives discussed potential career opportunities with students that may be available to them after they graduate. Students who participated in the SRC have the advantage of demonstrating their research and presentation skills to these potential future employers.

by Mackenzie Brown

Decoding continued from page 1

versus how much got through to the end, and that gives you an idea of how many of the particles are bigger than that height step or smaller. The size is related to a bunch of useful things, like risk for heart disease or determining if a protein drug is still useful."

The design of these devices requires some iteration to fine-tune them for a specific application. Currently, each device takes about a week to make. If testing suggests that the device needs to be a nanometer taller, it takes another week to make the modified device.

The newest discovery for this project is that the amount of salt added to the sample changes the way these particles see these height steps, which offers the potential for tuning the devices after they have been made.

"The way it changes is called the electrical double layer, and basically we are looking at ways that we can adjust the thickness of the electrical double layer to modify the height as we go just by adding salt or other means that will influence this electrical double layer,"

by Caroline Smith

Snelgrove continued from page 2

SPS so they can set it up for planetarium visitors to look at."

The new demonstration for PS100 will help bring to life the mechanics of an earthquake and the friction that is involved.

"When they're talking about earthquakes, it's things slipping against each other, so we created a friction demonstrator. With the help of our shop staff we built this demonstration. It's mostly finished. It basically drags a concrete block across a surface and you can put different surfaces together and it has springs in it so that tension will build up and it will slip and slide, kind of like an earthquake does. It can be used to demonstrate general friction principles," Snelgrove said.

These demonstrations are helpful because students can visualize concepts that they learn in the classroom. Snelgrove tries to better understand what professors do with the demonstration by attending lectures. This helps him to have a good idea of what faculty expect from the demonstrations that are created in the shop.

When Snelgrove isn't working on projects in the demonstration room, he is working on projects at home with his family. "My wife and I spend our time working on projects. . . . We don't have a lot of recreational hobbies," Snelgrove said.

One of those projects is gardening on a vacant lot next to their home. "We have a lot of empty space to do raised-bed gardening. I've been collecting scrap material to make the raised beds out of. My wife bought some chickens. I built a pen for them, but they'll be happier when they can run around between the raised beds in the garden," Snelgrove said.

Whether it's on campus or off campus, Snelgrove is a project enthusiast. To see how the demonstration lab can help your lectures, visit the demonstration area in N-184 ESC and the demonstration team would be glad to show you around.

by Madison Parks

Strong continued from page 3

and twenty-one students completed master's theses. Several of these students have gone on to achieve international recognition.

Strong can't get enough of BYU. After retiring in 2001 he stayed on and taught one course for a couple of years and continues his involvement with the Acoustics Research Group in the department.

"It's fun to stay on," Strong said. "I just enjoy the students and the faculty members in the acoustics research group, so that's a nice opportunity to keep involved there."

In a career full of impressive accomplishments, publications, and awards, Strong still designates the students he has met as the best part of his career.

"I think the highlight of my career has been the interactions with fellow faculty and students, and always seeing the students succeed," Strong said.

by Caroline Smith

Tug of War continued from page 2

ing down cells.

While they have a basic understanding of the current model, Dallon and his peers had to make many simplifying assumptions and they look forward to strengthening their results by making more realistic formulas with fewer assumptions.

"Eventually what would be nice is if you tell me how the forces on an adhesion site affect its dynamics, [then] I can tell you how the cell will move. Then by changing the dynamics in the right way we can control how the cell moves," Dallon said.

If Dallon and his team could solidify this, it would lead to new achievements in potentially treating diseases.

"That's sort of a lofty goal, but that's where I want to go because then you have more control over these cells," Dallon said. "And if you understand how to modify those adhesion dynamics and how that affects the overall motion of the cell, that would be quite useful."

Being able to slow down cells would be useful in situations such as disease because it would give patients an upper hand on their own "tug of war" with their illness. Any advantage science can give to patients is always a good thing.

by Madison Parks

College Publications

Chemistry and Biochemistry

P. Aggarwal, V. Asthana, J.S. Lawson, H.D. Tolley, D.R. Wheeler, B.A. Mazzeo, M.L. Lee, "Correlation of chromatographic performance with morphological features of organic polymer monoliths", *Journal of Chromatography A*, 2014, volume 1334, pp. 20-29.

N. Taylor, K.N. Mckay-Bishop, R.L. Spencer, P.B. Farnsworth, "A novel approach to understanding the effect of matrix composition on analyte emission in an inductively coupled plasma", *J. Anal. At. Spectrom.*, 2014, volume 29, pp. 644-656.

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E. A. Sagredo, S. Rupper, T. Lowell, 2014, "Sensitivities of the equilibrium line altitude to temperature and precipitation changes along the Andes." *Quaternary Research*, 81(2), 355-366.

J. C. Hoopes, J. H. McBride (corresponding author), E. H. Christiansen, B. J. Kowallis, T. J. Thompson, D. G. Tingey, A. O. Okojie-Ayoro, and J. R. Yaede, 2014, "Characterizing a Landslide Hazard along the Wasatch Mountain Front (Utah)," *Environmental & Engineering Geoscience*, Vol. XX, No. 1, February 2014, pp. 1–24.

J. H. McBride, R. W. Keach II, E. E. Wolfe, H. E. Leetaru, C. K. Chandler, S. R. Greenhalgh, 2014, "Investigating fault continuity associated with geologic carbon storage planning in the Illinois Basin," *Interpretation*, 2(1), SA151–SA162. doi: 10.1190/INT-2013-0109.1

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Sharon Anne Garthwaite, Paul Jenkins, "Zeros of Weakly Holomorphic Modular Forms of Levels 2 and 3", *Math. Res. Lett.* 20(4), 2013, pp. 657-674.

Avner Ash, Darrin Doud, "Galois representations and the homology of GL(3,Z)", Internat. Math. Res. Notices. 2014(5), 2014, pp. 1379-1408.

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S.R. Jones, "Adding it all up: Reconceiving the introduction of the integral," *Mathematics Teacher*, 2013/14, volume 107/issue 5, pp. 372-377.

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K.R. Leatham, B. E. Peterson, "Talking about Pedagogy, students and mathematics," In M.V. Martinez & Castro Superfine (Eds.), *Proceedings of the 35th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*, 2013, pp. 629-636. Chicago: University of Illinois at Chicago.

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Physics and Astronomy

N. Taylor, K.N. Mckay-Bishop, R.L. Spencer, P.B. Farnsworth, "A novel approach to understanding the effect of matrix composition on analyte emission in an inductively coupled plasma", *J. Anal. At. Spectrom.*, 2014, volume 29, pp. 644-656.

Statistics

P. Aggarwal, V. Asthana, J.S. Lawson, H.D. Tolley, D.R. Wheeler, B.A. Mazzeo, M.L. Lee, "Correlation of chromatographic performance with morphological features of organic polymer monoliths", *Journal of Chromatography A*, 2014, volume 1334, pp. 20-29.

CPMS
BRIGHAM YOUNG UNIVERSITY

Research Development Bulletin

College of Physical and Mathematical Sciences

April 2014

Research Development (RD) supports faculty efforts to find and secure research funding. To that end, this "RD Bulletin" provides news about research funding opportunities (including proposal deadlines) targeted to the research interests of the college. The bulletin also lists recent awards received and proposals submitted by college faculty.

For additional information about finding and securing research funding and about the Funding News items below, click on the titles (they are links), go to the RD Website or contact Conrad Monson (conrad_monson@byu.edu; 801-422-7722).

RD Website

Latest Funding News
How to Get Started
Request A Funding Search
Find Funding Sources
Funding Opportunities
Write an Effective Proposal
Market Ideas
Review Faculty Research
Review Additional Resource

Funding News

New RD Proposal Budget Preparation Checklist

The "Proposal Budget Preparation Checklist" can be used to ensure all the elements of a budget have been considered in preparing the budget section of a proposal.

Upcoming RD Events

Research Development will be hosting another Speed Networking event in late August. The last two events have been very successful (see Faculty Research page for information about those events). Also, look for upcoming "colleague reviews" for NIH specific aims (Bill Pitt-led review; usually once each semester), NSF and other funders as well as a "Proposal Tips and Best Practices from Experts" seminar this summer.

NSF Grants Conference June 23-24, 2014, Denver

These conferences provide an overview of NSF programs and policies, instruction on writing proposals for NSF and briefings about each directorate. The conference is geared for an audience that includes new faculty and faculty new to NSF. The grants conference is also a time to talk with NSF program officers. Conrad Monson has attended before and found the conference to be very informative and useful. Follow this link for more information: http://www.nsf.gov/events/event_summ.jsp?cntn_id=129608&org=NSF

DARPA Biotechnology Office

DARPA has consolidated its biological research into a Biotechnology Office with a mission to "harness the power of biological systems by applying the rigorous tools of engineering and related disciplines, and to design next-generation technologies that are inspired by insights gained from the life sciences" To learn more about opportunities in this office, go to http://www.darpa.mil/Opportunities/Solicitations/DARPA_Solicitations.aspx#BTO

Funding News (continued)

The Department of Energy's Biotechnology Incubator

The Office of Energy Efficiency and Renewable Energy (EERE) in the Department of Energy will issue, on behalf of the Bioenergy Technologies Office (BETO), a Funding Opportunity Announcement (FOA) entitled Bioenergy Technologies Incubator. BETO's mission is to engage in research and development that transforms renewable biomass resources into commercially viable, high-performance biofuels, bioproducts and biopower that enable biofuel production. To learn more about this opportunity, go to DE-FOA-0000974: Bioenergy Technologies Incubator

Dear Colleague Letter: Submission of I/UCRC Proposals in Areas Related to Engineering Biology and Cellular Biomanufacturing

In emerging areas of technology at the interface between fields such as the engineering of biology and cellular biomanufacturing, including the field of synthetic biology, there is an even greater need for collaborative precompetitive research. In particular, research that contributes to the establishment of standards for production; provides tools for the assessment of quality, robustness and stability of the process and product; and develops metrics that will facilitate risk assessment associated with a regulatory framework, will be essential for the eventual commercialization of products from the engineering of biology. (To read more, click here).

Cybersecurity Prize

Cisco and NineSigma are inviting proposals from the global security community for innovative solutions to secure the "Internet of Things": that will deliver intelligent cybersecurity solutions for the real world, addressing threats before, during and after an attack. Specific focus areas for the challenge include: malware defense, security credential management, and privacy protection. Deadline for responses is **June 17th, 2014**. Information about the prize can be found at www.ninesights.com.

USAID Innovation lab

The Global Development Lab, a just-announced science and technology initiative from USAID, will be like a DARPA for global development--a breeding ground for technologies that tackle some of the most vexing problems around the globe. The biggest gains in development for health have been driven by new science, new technology, and new business models. The Lab will start out focusing on a handful of key problems, including agriculture, maternal health, child survival, energy access, sustainable water solutions, and child literacy. USAID already invests in innovative technologies related to all of these issues, but this is different: the organization is doubling its investments (up to $608 million from $254 million) and working with a vast network of partners who can help with research and development, supply chain logistics, and general knowledge of developing economies. Information on this announcement can be found at USAID: News

Proposal Deadlines

Follow links below to view additional funding opportunities within BYU as well as a table of selected funding opportunities from various government agencies.

Internal BYU Funding Deadlines

External Agency Funding Deadlines

Awards Received

Congratulations to the following faculty who received research awards in March totaling ***$60,795***

Investigators	Sponsor	Title
Chemisty and Biochemistry		
Buskirk, Allen	Yale (NIH)	Mechanisms of Ribosomal Reactions: Peptide bond Formation and mRNA Cleavage

Proposals Submitted

The following faculty submitted research proposals in March totaling ***$75,000***

Investigators	Sponsor	Title
Chemisty and Biochemistry		
Watt, Richard	The National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIA-MS)	The Effect of Metformin On the Skeletal Muscle Iron Dysregulation Caused by Doxorubicin Treatment