

Volume 5, Issue 1

www.sonoma.edu/scitech

October 15, 2015

Welcome to the Fall 2015 Science and Technology's Newsletter.

The halls of Darwin, Nichols, Salazar, PE, and Schulz are once again filled with students. The excitement of our new freshman and the confident presence of our returning students energize the campus. Our enrollment bumped up again this year to just over 9400 students with the School of Science and Technology (SST) providing 2261 FTES (think of this as 2261 students taking 15 units each). Computer Science is experiencing a surge in majors with nearly 300 students (double the number in 2010) pursuing software engineering studies. Our impacted Biology, Kinesiology, and Nursing programs attract more students than we can accept. For example, over 1000 students applied for 50 seats in our pre-nursing track. Our other in-demand departments – Chemistry, Engineering, Geology, Math and Physics & Astronomy – continue their incredible work educating our students for a rewarding life and the profession of their choice.

This August, SST welcomed six new permanent faculty and two visiting professors – Drs. Mackenzie Zippay (Biology), Gurman Gill (Computer Science), Owen Anfinson (Geology), Kurt Sollanek (Kinesiology), Rachel Napoli (Nursing), Derek Decker (visiting Engineering), Thomas Targett (Physics & Astronomy), and Jeff McLean (visiting Math & Statistics). We look forward to the many contributions and achievements that are sure to come from this talented cohort. Some of our most treasured faculty fully retired this past year – a bittersweet farewell and an open invitation for their continued engagement with SST.

Our big university news is that after 24 years, President Ruben Armijaña is retiring at the end of this academic year. Under his leadership, Sonoma State University has embellished its reputation so that it is now considered a standout campus among the 23 CSUs. The selection of a new President is underway with an Advisory Board of

student, faculty, staff, administrative, and community representatives. This board is advisory to the CSU Board of Trustees, which makes the final decision. We thank President Armijaña for all that he has done for SSU and wish him and his wife Marne Olsen the very best now and always. By spring, our new President should be known –exciting times!

In this issue, you will find stories showcasing many of our programs. As you read, I hope you get a sense of why our student, faculty, alumni, community partners, and generous donors are proud members of the School of Science and Technology. We are involved in education as passionate explorers, thinkers, and active contributors to our campus and community.

I invite you to learn more about our busy School by exploring the pages of this newsletter and joining us for our public events. I hope you will also be inspired to join forces with our supporters to help enhance SST's existing strengths and expanding the reach of our impact in STEM and health-related fields. You can be a part of educating California's future workforce. If you would like more information on our programs, attending School events, volunteering, or making a donation, contact me at stauffer@sonoma.edu or (707) 664-2171.

Warm regards for a wonderful fall,

Lynn Stauffer, Dean
School of Science & Technology

New Faculty in the School of Science & Technology



Owen Anfinson, Ph.D. — Dr. Anfinson joins our school as an Assistant Professor in the Department of Geology. His Ph.D. is in geology from the University of Calgary. Before joining us, he conducted postdoctoral research at the University of Texas. His research focuses on reconstructing the past locations of our tectonic plates (paleogeography), with a focus on the paleogeography of the Arctic region.



Derek Decker — Mr. Decker joins Engineering Science as a Visiting Professor. He received an M.S. and a B.S. in Electronic Engineering from Cal Poly in San Luis Obispo, CA. He also has an M.S. of Optical Science from the University of Arizona in Tucson and is pursuing a Ph.D. in biophysics at UC Davis. In addition to over 25 years of research and development experience in government, academia, and industry, he coauthored two peer-reviewed papers, eleven patents and one R&D100 award. His interests include automation, mechatronics, biotechnology, 3D printing, microfluidics, and technologies to enhance imaging and education.



Gurman Gill, Ph.D. — Dr. Gill joins our school's Department of Computer Science as an Assistant Professor. He received his M.Tech in Mathematics and Computing from the Indian Institute of Technology before receiving his Ph.D. from McGill University in Canada. He completed postdoctoral research at the University of Iowa in Electrical and Computer Engineering. His research centers on object detection and machine learning.



Jeff McLean, Ph.D. — Dr. McLean is a Visiting Professor in the Department of Mathematics & Statistics. He received his MS in Mathematics from the University of Connecticut. He earned his Ph.D. in Mathematics Education from Syracuse University. His research is in statistics education, specifically informal inferential reasoning and modelling.



Rachel Napoli, Ph.D. — Dr. Napoli joins the Department of Nursing as an Assistant Professor. She received her Doctor of Nursing Practice through the California State University Doctor of Nursing Practice, Northern Consortium joint program offered through San Jose State University and CSU Fresno. Her research focuses on skin-to-skin care and breastfeeding. Her passion lies in women's health and

breastfeeding.



Sean Place, Ph.D. — Dr. Place joined our school last year as an Assistant Professor in the Department of Biology. He received his Ph.D. in Biology from UC Santa Barbara. Before coming to SSU, Dr. Place was an assistant professor at the University of South Carolina. His research centers on mechanisms of organismal response to environmental change and molecular adaptations to extreme environments.



Martha Shott, Ph.D. — Dr. Shott returned to our school last year as an Assistant Professor in the Department of Mathematics & Statistics. Before this, Dr. Shott served as a visiting professor in the department. She earned her Ph.D. in Applied Mathematics from UC Davis. Her research interests are in mathematical models of traffic flow for elemental freeway networks and controlled intersections.



Kurt Sollanek, Ph.D. — Dr. Sollanek joins our school as an Assistant Professor in the Department of Kinesiology. He received his Ph.D. in Applied Physiology and Kinesiology with a specialization in Exercise Physiology from the University of Florida (Gainesville, FL). His research interests focus on hydration assessment, adaptations to heat, and various aspects of human performance.



Thomas Targett, Ph.D. — Dr. Targett returns to us as an Assistant Professor in the Department of Physics & Astronomy. Dr. Targett earned his Ph.D. in Astrophysics from the University of Edinburgh. He has postdoctoral research experience from the California Institute of Technology and the Universities of Birmingham, British Columbia, and Edinburgh. He has a broad interest in galaxy evolution.



Mackenzie Zippay, Ph.D. — Dr. Zippay returns to our school as an Assistant Professor in the Biology Department. She received her Ph.D. from UC Santa Barbara in Molecular, Cellular, and Developmental Biology. Her research centers on organismal physiology and the impacts of climate change.

Adventures in Belize

Dr. Fran Keller, Department of Biology

Last summer, Dr. Fran Keller, Department of Biology, participated in field research in Belize. The project goals were to create a major entomology collection housed in Belize, and to conduct bat inventories while there. The base of operations was the Toucan Ridge Ecology and Education Society (TREES, treesociety.org), a scientific organization dedicated to the study of biological and cultural diversity of Belize. Her experience was so extraordinary she decided to develop and propose a field course in Belize to be offered by SSU in the summer of 2015.

Dr. Keller and her colleague David Wyatt created the curriculum for two courses, Tropical Biodiversity and Tropical Ecology and Behavior, to be taken concurrently in Belize for a total of 8 units. Eighteen students signed up. To say that this was a tremendous amount of work would be an understatement. However, as a field biologist, Dr. Keller knows that field trips and field classes have a unique role and hold tremendous value for students long after they leave college. Keller and Wyatt wanted to provide students with hands-on experience with wildlife and the tropics. The team also planned lectures on creating a résumé related to biology field careers and how to work towards a career in biology after university.

The classes were a huge success. Students had to work very hard with morning readings and lectures, followed by field work, then afternoon lectures and readings, and then more fieldwork. At night, the group would be out in the field trying to find snakes and frogs, or mistnetting for bats and blacklighting for insects. They would be up early the next morning at 6 am to do bird counts or mistnet for birds. There were individual projects as well: an insect collection, group research projects, and group presentations.



They found time to balance the hard work with some cultural and physical activities, though: they climbed the Mayan ruins on a tour of Xunantunich; visited the Belize Zoo to see all the large mammals they didn't want to encounter in the wild; snorkeled on the second largest barrier reef in the world while learning a bit of reef ecology; and took a night riverboat tour to hunt for crocodiles, iguanas, and any other nocturnal animals they could find.

All in all, the trip was a great success. As with any class, the experience either solidified a student's educational and career plan or it confirmed that they did not want to be a field biologist. Many said that it "was the best class" they have taken at SSU, and it was most certainly for all a life changing experience. And, for Dr. Keller, it was the best teaching experience she's ever had.

Summer Math Research in Thailand

Two Sonoma State math students, Ericka Chavez and Travis Hayes, spent six weeks in Chiang Mai working on research projects this summer. Their trip was made possible by the CSU Louis Stokes Alliance for Minority Participation (LSAMP) Global Awareness Program, an NSF-supported program that sends 8 CSU students to study abroad in Thailand. The program pairs each participant with a faculty mentor at Chiang Mai University to conduct a mini-research project in the student's field of interest. At the end of the six-week program, the students present their results to a general science audience at the university.



Ajahn Nattapol Ploymaklam, Travis Hayes, and Ericka Chavez.

Chavez and Hayes worked under the same faculty mentor, Ajahn Nattapol Ploymaklam, but pursued fairly different topics. Chavez identified a way to compute high powers of conjugate numbers using recursive sequences (such as the Fibonacci sequence), whereas Hayes developed an algorithm that partitions a graph into two disjoint graphs by removing a set of edges with maximal weight. In addition to their math research, the two took advantage of weekend sight-seeing trips, night bazaars, and interactions with Thai students in order to learn more about the country and its culture. Highlights from the summer include a visit to an elephant sanctuary and a hike to the highest peak in Thailand.

You can read more about the experience and Travis Hayes' own account at [Sonoma State's NewsCenter](http://sonomastate.edu/newscenter).

Additional information about the LSAMP chapter at SSU can be found on [LSAMP's webpage](http://lsamp.org).

—Dr. Martha Shott, Department of Mathematics & Statistics

Burgess Shale 2015: A Geological Lesson from Canada's Shrinking Glaciers

Dr. Matthew J. James, Department of Geology

I hear and I forget, I see and I remember, I do and I understand.
~ Confucius, 450 BC

Tell me and I forget, Teach me and I remember, Involve me and I will learn.
~ Benjamin Franklin, 1750

There is an intimate and necessary relation between the process of actual experience and education.
~ John Dewey, 1938

On August 19, 2015, eleven SSU geology majors stepped back in time by thousands of years. They hopped off a boulder onto the ice at the toe of the Athabasca Glacier high in the Canadian Rockies in Jasper National Park and jumped into the past. The hard glacial ice under their crampons and hiking boots was actually ancient snow that fell thousands of years ago. The snow slowly compacted over time from the overlying weight of subsequent yearly snowfalls, adding to the mass of the glacier. The snow fell silently and the ice crystals slowly formed their interlocking solid matrix several miles uphill from where the SSU students got their first taste, literally and figuratively, of glaciers and glacial geology. Water melting off the glacier and running over the surface in numerous rivulets is perfectly safe to drink and refreshingly cold. The water is as pure, some would say, as driven snow. In the years when forest fires erupt in the nearby area, the glacial melt water takes on a smoky taste. Steven Adam Woodall, BS '16, said, "I enjoyed drinking this refreshing water straight from the runoff creeks while standing atop the glacier. At this moment I felt both proud and humbled."

The 11 students participated in this year's Burgess Shale Paleontology field trip, the second collaboration between co-leaders Professor Matt James, a paleontologist, and department technician, Phil Mooney, a structural geologist. The Athabasca Glacier hike was their first full day in Canada, after flying from San Francisco to Calgary in Alberta, then driving west into British Columbia.

The students' padded parkas protected them against possible rain and certain wind. They hoisted backpacks stuffed with water and food to consume along the way during the six-hour hike. Everyone brings hats, sunscreen, and sunglasses for protection against the intense direct and reflected sunlight at high elevation. Looking more like the members of a Shackleton expedition to the South Pole, the geology majors were bundles of enthusiasm as they set off on a physically and intellectually rewarding part of their undergraduate education. Eli Messinger, BS '18, said, "Hiking the glacier was like exploring a whole new planet." We geologists hiked uphill for three hours, then back down for three hours, from the tourist-filled gravel parking lot to the upper reaches of the first icefall, far from the madding crowds and noises of civilization. The 13-person Sonoma State group followed single-file behind their experienced mountaineering guide, Peter Lemieux, and his faithful dog, George. Each step of the way they found themselves surrounded by the simple and beautiful elements of nature: blue sky, white ice, gray limestone mountains towering on all sides, scattered white clouds, and a brisk wind. They hungered for adventure and for knowledge.

Along the way before reaching the ice, Peter Lemieux showed the group several "fingerprints" that glaciers leave behind, providing geologists with evidence of long ago activity, like detectives and crime scene investigators piecing together evidence of a crime. But this case wasn't a crime, but the natural phenomenon of glaciers forming, growing, sliding downhill under the pull of gravity, and eventually receding. Students could see first hand, and lay their hands directly on, several of these diagnostic fingerprints. One of the most noticeable features is a series of scratches in the bedrock caused by stones frozen into the very bottom of the glacier. As the glacier moves downhill, the stones scratch parallel lines, or glacial striations, into any rock in their way, like miniature furrows in a plowed field. The ice itself also polishes the bedrock while etching the striations, resulting in glacial polish, another clue. The slow grinding action between ice and rock also results in very

fine sediment, or glacial flour. When suspended in water, glacial flour gives lakes in the area an otherworldly emerald green color due to the refraction of light by the tiny particles. The final pieces of glacial evidence, and perhaps the most noticeable even to the untrained eye, are massive piles of rock and dirt, sometimes hundreds of feet high. The ice bulldozed these glacial moraines at both the edges of the glacier and at the downhill toe of the glacier. Moraines resemble the material a bulldozer would pile up if the bulldozer did its work and then left the scene without cleaning up the mess. And it would have to be a really huge bulldozer. These glacial clues are textbook ideas, and the Athabasca provides excellent textbook examples to supplement what the students would otherwise just read about, or watch in a darkened classroom in a PowerPoint presentation, or view online.

Over time, the Athabasca ice, and that of all glaciers, flows inexorably downhill at a measurable pace that can only be described as, well, glacial. The Athabasca Glacier is noticeably shrinking in both total length and total thickness, something that I have seen first hand since my first annual trip to Canada with SSU students in 2003. The glacier has retreated 1300 feet (400 meters) horizontally, nearly a quarter of a mile, and become over 250 feet (80 meters) thinner vertically during those 12 years. The geology students discovered a graphic example of the annual thinning. Back in the 1980s, Canadian researchers drilled several aluminum pipes from the surface through the glacier to the bedrock. Each summer hiking season when Peter Lemieux and his other guides start their public hikes, they wrap green electrical tape around the poles right at the level of the ice. By the time the SSU geology students arrive to hike in late August or early September, the green tape is 15 to 20 feet off the ice, showing the amount of melting, or ablation, that has occurred in just a few months. Such a demonstration causes more than a few jaws to drop.

Each year new snow falls in the winter, adding to the glacier, but the overall story of the Athabasca confirms net shrinkage from melting, not of growth. The half-mile road to the parking lot where the glacier hike starts has prominent signs documenting the position of the toe of the glacier in ten-year increments going back to the late 19th century. Photographs taken from the exact same vantage point for nearly one hundred years provide some of the most incontrovertible evidence of the shrinking of the Athabasca Glacier. The receding of glaciers worldwide is a pervasive, sustained, and accelerating global trend. On the Athabasca Glacier, they experienced global warming in person.



Not only is the glacier physically shrinking, documenting scenarios of global climate change, but it also contains air bubbles trapped in the ice that provide actual data on the amount of CO₂ in the past atmosphere. The geology students broke off chunks of ice, popped them into their mouths and joked about enjoying "the ancient air" as they chewed on the ice. Part of our attraction to the Athabasca Glacier for the SSU geology group derives from the ease of access to it. You can see the glacier from highway 93, the monumentally scenic Icefields Parkway, running from Banff National Park up through Jasper National Park. The Athabasca Glacier is part of the much The grandeur and scope of the mighty glacier embedded in the Canadian Rockies serves as a highly relevant, hands-on outdoor *(continued on next page)*

Standout Scholars in SST

Two of the School of Science & Technology's professors were recognized by the university this year for their outstanding achievements in scholarship. Drs. Lynn Cominsky and Suzanne Rivoire were both honored with the [Excellence in Scholarship Award](#). This recognition is bestowed on two members of the Sonoma State community each year who not only show an

exceptional commitment to their academic research, but to the inclusion of students in said research. Congratulations!



Dr. Joe Lin, Department of Biology, is the recipient of the [2015-16 Sonoma State University Excellence in Teaching Award](#). The Excellence in Teaching Award is given to two members of the Sonoma State community each year. Dr. Lin's work with advanced molecular and cellular biology students as well as his commitment to students pursuing careers in the health professions through the [Health Professions Advisory Program](#) (HPAP) are outstanding.



**Excellence in
Teaching**

classroom, teaching geology majors more in six hours than they could learn in six days, or six weeks, in the confines of Darwin Hall. For geologists, the entire world is our outdoor classroom. No location on Earth lacks an underlying geological story. Every geology field trip results in a demonstrable increase in each student's core competency, knowledge, and confidence, and they grow personally and professionally. On the Canada trip they found themselves immersed in the hydrosphere, the lithosphere, and the atmosphere. For most students, this weeklong trip to Canada is their only international field trip during their undergraduate education. Students traveling internationally, even if just to Canada, affords an educational innovation only available in the Geology Department within the nine departments in the School of Science and Technology at SSU. Brandon Carroll, BS '16, said, "Having the opportunity to travel internationally meant a lot to me. Meeting, networking, and learning from experts in the fields of geology, paleontology, and glaciology made the trip particularly memorable." From classroom, to laboratory, to spectacular field destinations, the SSU Geology Department is renowned for innovation and educational excellence. The Burgess Shale trip is a prime example.

Beetle Mania!

Dr. Nathan Rank, Department of Biology

As the Earth's climate becomes warmer and more variable, characteristics that help organisms cope with stress will become increasingly important. This summer, SSU Biology professor Nathan Rank and his collaborator at Santa Clara University (SCU), Professor Elizabeth Dahlhoff, completed the first summer of research based on a new grant they received from the National Science Foundation to investigate willow beetles living at high elevation in the Sierra Nevada Mountains of California. They are working with a collaborator at Stockholm University, Professor Christopher Wheat, on a project that is a synthesis of genomics, physiology, and natural history. The research provides a unique opportunity to understand how organisms cope with environmental change.



Back row: Alyson Lumley (SCU technician), Ihu Erundu (SCU undergrad), Brynn Sargent (SCU undergrad), Jared Deyermin (SSU undergrad), Richard Regello (SSU Undergrad), Kevin Roberts (SSU grad). Front row: Hollynd Boyden (SCU undergrad), Jackie Leary (SSU undergrad), Victoria Dahlhoff (Bates College Undergrad), Elizabeth Dahlhoff (SCU professor), Nathan Rank.

This work represents the 19th summer where Rank and Dahlhoff have brought SSU students and SCU undergraduates to eastern California to study montane leaf beetles and their interactions with the environment. The research has been supported by the National Science Foundation, the California State University Program in Education in Research in Biotechnology, SSU, and SCU. The project offers students opportunities to conduct research and provides them with marketable skills for post-graduate careers. Undergraduates who have participated in this program have worked in natural resource management and have gone on to PhD programs such as UC Davis or UC Berkeley. By now, some have gone on to become researchers and professors at research universities. Rank and Dahlhoff are looking forward to bringing more students to eastern California in upcoming summers.



Transition into Practice (T2P)

Dr. Deborah A. Roberts



Dr. Deborah A. Roberts, Chair of the Department of Nursing at Sonoma State University, lead a third successful year of the Transition into Practice (T2P) program, expanding into three counties (Sonoma, Marin, and Napa), and offering 109 internships for new nursing graduates. In partnership with Sutter Santa Rosa Regional Hospital, Santa Rosa Memorial Hospital, Novato Community Hospital Sutter Health, Petaluma Valley Hospital, Queen of the Valley Medical Center, Marin General Hospital, and Kaiser Permanente Santa Rosa Medical Center, graduates were offered a ten week certificate program in numerous specialty areas with the guarantee of employment upon successful completion. These internships allow for bridging of the education to employment gap and provide each resident with a one-on-one preceptor in his or her unit of choice. The program began in the summer of 2013 with 38 residents in partnership with Sutter Santa Rosa Regional Hospital. This past summer the program received over 250 applications. Plans for the summer of 2016 include expanding the program with more partners and number of interns.

SSU Education and Public Outreach Group Selected by NASA to develop Community College Curriculum

Dr. Lynn Cominsky, Department of Physics & Astronomy

Building on the success of the SSU Education and Public Outreach group's Small Satellites for Secondary Students rocketry payload curriculum, the group has recently been notified by NASA that their team was selected to develop a one-semester course as part of the Minority University Research Education Partnership program. In partnership with 10 Hispanic Serving California Community Colleges, the new "Rising Data" course will include an introduction to building sensor-based payloads that will be flown on rockets and unmanned aerial systems (drones). The flight vehicles will also be built by the students as part of the class. The program will sponsor summer internships for selected students from each participating institution at NASA centers including Ames and Armstrong, as well as with NASA-funded research groups at SSU, CSU Fresno's Center for Unmanned Aerial Systems, and selected UC campuses.

SPS Receives Outstanding Chapter Award

Sonoma State's Society of Physics Students (SSU SPS) chapter has achieved a huge milestone by receiving the Outstanding Chapter award from the SPS national organization. A select few highly active chapters each year receive this award, and this year's recent activities have led to this national recognition.

SSU SPS has won numerous grants over the past years. The Marsh W. White Award for outreach has been won three years running, and this past year we were recognized for the most unique outreach idea for this award. SSU SPS reached out to the Santa Rosa Junior College, as well as their own campus, and invited all students interested in physics and astronomy to a Night of Astronomy at Sugar Loaf State Park and an overnight camping trip. Those in attendance viewed the local observatory and enjoyed talks by professors in SSU's Department of Physics and Astronomy. The chapter also won the Future Faces Award for two consecutive years and has been able to start a series of skills labs for MESA students. Skills labs are a series of student-led labs designed to give students the skills required for research so that more time can be used on experiments. Two years ago the SPS club won a research grant that allowed them to build a ground station to communicate with Cubesats launched by SSU and others. The club has also done extensive outreach with the community by helping at multiple elementary schools as well as volunteering for numerous events held on campus.

SSU has also produced two Associate Zone Councilors: Aman Gill (2014-15) and Demitri Call (2015-16). There are 18 zones across the country, and SSU is part of zone 18. Zone 18 consists of over 61 schools including all of California, Nevada, Hawaii, Singapore, the Philippines, and a school in China. The Associate Zone Councilors are voting members of the SPS National Council, which is the governing body for SPS focused on undergraduate physics students across the nation and is the only body of its kind. All of these factors and more have contributed to receiving the Outstanding Chapter Award.

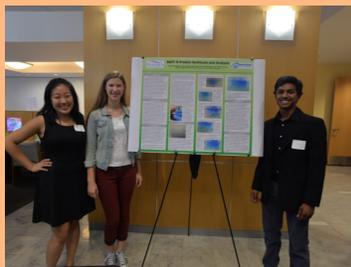
The club aims to continue increasing SSU SPS's reach by being even more involved in the campus community. They welcome participation by all STEM majors as well as anybody interested in physics and astronomy. —*Demitri Call*

Smooth Sailing for SHIP

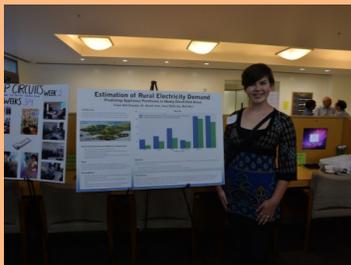
This past summer marked the eighth anniversary of SST's [Summer High School Internship Program](#). This year, fifteen of Sonoma County's exceptional high school students were selected for paid internships to work with faculty mentors from the Departments of Biology, Chemistry, Computer Science, Engineering Science, Environmental Studies and Planning, Kinesiology, Mathematics and Statistics, Nursing, and Physics and Astronomy. In addition, three volunteers participated in the program. This was the first year we had a department outside of SST involved (Environmental Studies and Planning), and the first year we had interns from Credo and Piner High Schools.

At the annual SHIP Symposium held in September, interns and volunteers presented posters and talks about the research they conducted over the summer. The Symposium was extremely well attended, with interns' families, teachers, principals, and members of the SSU community there to support the students. The level of research and commitment shown by the interns and volunteers foretells successful futures; we can't wait to see what they do!

The School of Science & Technology is extremely grateful to our generous donors whose support makes SHIP possible. We are also thankful to Dr. Suzanne Rivoire who coordinates SHIP, and Dean Lynn Stauffer who founded the program and provides continued support. —Cory Oates



Taylor Wang, Nicole Gregori, and Ram Goli.



Fiona Hall-Zazueta.



Gabe Schoenbach.



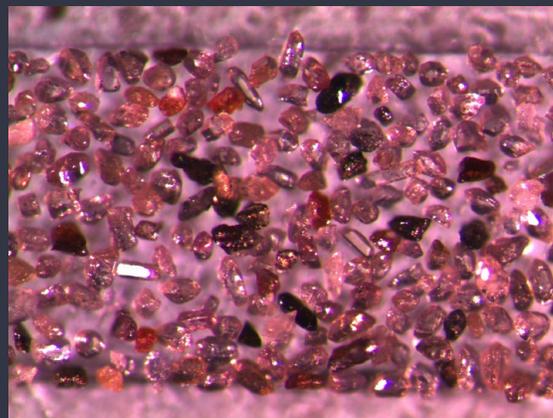
Dean Stauffer, Sami Von Gober, Suzanne Rivoire, and Chuck Williamson.

To See the World in a Grain of Sand

Dr. Owen Anfinson, Department of Geology

"To see a World in a Grain of Sand
And a Heaven in a Wild Flower,
Hold Infinity in the palm of your hand
And Eternity in an hour" – William Blake

Poet William Blake envisioned a world inside a grain of sand, but his generation lacked the technology to unlock the true secrets of that beautifully complex world. These sand grains hold a rich and deep story that may hold the key to reconstructing the tectonic history of our planet. In the world of geology we are becoming increasingly effective at unlocking the immense amount of information contained within a single mineral grain. These mineral grains are weathered out of rocks to become the sand of our beaches, rivers, and deserts. We call these sand grains "detrital minerals", and the heavy, or high-density, detrital minerals have been my trade for the past 11 years.



Zircon grains.

I was first introduced to the power of detrital heavy minerals at Washington State University while tracking sediment deposited by catastrophic glacial floods at the end of the last ice age. I became increasingly involved in the use of a particular detrital heavy mineral, zircon. Detrital zircon is taking its place as a mineral juggernaut in the world of geology. By incorporating uranium (U) into its crystal structure, while excluding lead (Pb), zircon can be dated with a very high level of precision and accuracy utilizing the U-Pb decay system. Zircon is just the tip of the *(continued on next page)*

iceberg; there is a vast array of other heavy minerals that are easily dated through various geochronologic techniques. These heavy minerals have allowed us to date thousands of rock units worldwide and provide constraints on when and where rocks were formed throughout earth's history.

Now to be fair, heavy mineral geochronology is nothing new; we have been able to radiometrically date material since the early 1900s. However, what is new is the speed that we can obtain dates (as many as 100 zircon U-Pb ages can be obtained within 2 hours on a single mass spectrometer), the increased precision and accuracy of our dating methods, and our ability to simultaneously obtain geochemical signatures from the dated material that allow us to determine the genesis of the mineral grain. The information database generated from these dates and geochemical fingerprints provides us with a tool to compare rocks from around the world. By tying these rock units back to a specific time and place of formation we can determine where our tectonic plates have been through geologic time.

Although we do not have the ability to analyze these detrital heavy minerals here at Sonoma State University, for that we will need to travel to other nearby universities, we are in the processes of constructing the laboratory used to separate out the minerals from their host rock. In the basement of Darwin Hall, our geology students will now have the capability of separating out heavy minerals from any rock they choose. They will use this information to fit pieces into the complex tectonic puzzle of our world, and gain a better knowledge of the world that truly exists in a grain of sand.

Bringing RNA into View

Profile of Dr. Monica Lares, Department of Chemistry

Dr. Monica Lares in her lab.



Dr. Monica Lares is an assistant professor that has recently joined the Department of Chemistry at Sonoma State University. She has started an active research program involving undergraduate students and developing exciting new curriculum in her area of expertise: RNA.

The majority of people understand that we have DNA and proteins in our bodies and they play some important roles. A lot of people understand that DNA carries the genetic code that is passed every time a cell divides and that proteins have specialized structural and catalytic functions in our body necessary for our survival. People also recognize that a mutation in our DNA or proteins could lead to serious consequences. However, many people don't appreciate the role of RNA. This has led to an RNA revolution in the scientific community, and Dr. Lares feels it is crucial that students at Sonoma State are on the forefront of understanding this exciting field.

Many traditional 'rules' are being rewritten as the diverse functions of RNA emerge. Often, RNA is limited to the roles of mRNA (carries the message of DNA out of the nucleus), tRNA (translates the mRNA into protein), and rRNA (make up the machinery necessary for synthesis of proteins). Scientists have established that RNA can have catalytic functions (ribozymes). RNA has been shown to have diverse functions in activating and repressing genes, and it has now been accredited with being responsible for catalyzing protein synthesis in the ribosome. There is also a theory that our world was once an "RNA world." Scientists have a dilemma in explaining what came first: DNA or protein. You need DNA to code for protein and you need protein to synthesize DNA. So, what came first? The current theory says neither—it was RNA. Since RNA is capable of encoding genetic information and catalyzing reactions, it may have been the preface to more specialized molecules like DNA and proteins.

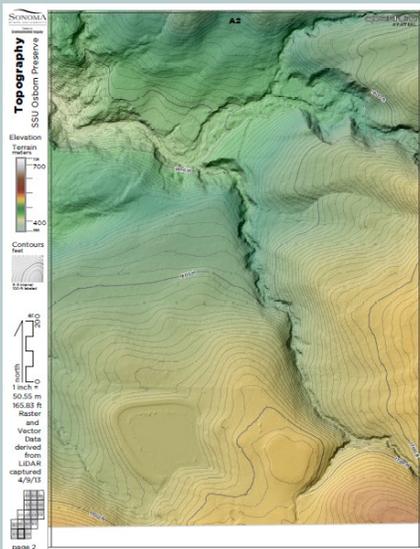
Dr. Lares' research group uses RNA to target B-cells affected by Non-Hodgkin's lymphoma. RNA can be used to target these cells because RNA is able to form a variety of three-dimensional structures that recognize cell surface receptors. This type of targeted cancer therapy has recently been investigated for therapeutic advantages over antibody-based approaches. Characterizing this RNA would allow for increased specificity thus reducing off-target effects and facilitate this therapeutic approach through clinical trials.

Dr. Lares is effectively incorporating her research into the curriculum allowing for broad dissemination of the RNA world into our local community. She is doing this by both working directly with undergraduate SSU students in her lab and teaching macromolecular crystallography concepts in the classroom.

Dr. Lares explains, "As an undergraduate I was never exposed to the diverse roles of RNA, but understanding these roles become foundational for my understanding of the chemistry that occurs in our cells." —*Dr. Carmen Works, Department of Chemistry*

Get Outside, Get Plugged In...to the Nature!Tech Collaborative

Dr. Claudia Luke, Director, Center for Environmental Inquiry



Donated data are 20 times more detailed than other available data and create unique opportunities for research at extremely small scales. Topography, vegetation and other data are available to faculty and students in easy to use formats.

The Center for Environmental Inquiry, in partnership with Engineering Science, has launched a new collaboration in environmental technology: the Nature!Tech Collaborative. A \$115K donation to the collaborative from Pacific Gas & Electric (PG&E) supports research and student training and provides unparalleled datasets for study of preserve lands. The Collaborative is actively seeking participation from SSU faculty, students, and community partners.

The Nature!Tech Collaborative was established this year to give students skill-building experiences in environmental technology. At the heart of the Nature!Tech Collaborative is an environmental sensor network installed at the Center's Fairfield Osborn Preserve. The sensor-to-screen network includes on-the-ground sensors (weather station, cameras) as well as remote-sensing data, providing students first-hand experience with a variety of real-world technological challenges.

“The Osborn Network is an outdoor laboratory for students and faculty to design new technologies as well as gather data on the environment,” says Center Director Claudia Luke. “We are excited about expanding the network to create more opportunities to get students from all disciplines engaged.”

The PG&E donation includes an ultra high-density remote-sensing data set and engages students in research on vegetation biomass (Matt Clark, Geography), wildlife movements (Chris Halle, Engineering Science), Sudden Oak Death (Nathan Rank, Biology) and pollinator abundance (Pollinator Partnership).

The Center for Environmental Inquiry was launched by SSU this year to give students the skills, experience and passion they need to engage with environmental challenges, no matter what their degree. In addition to Nature!Tech, the Center supports collaborations in watershed management (WATERS), education and the arts. The Center encourages faculty and students to visit 4,200 acres of SSU's three preserves in Sonoma and Mendocino counties. To find out more about the center, see the introductory [video](#) or visit the [website](#).



Mountain lion at the Osborn Preserve this May. The image is part of Chris Halle's (Engineering Science) research project to automate processing of wildlife trip camera images.

Game

Programming

Dr. Gurman Gill is teaching Game Programming this fall semester using a powerful, state-of-the-art game engine called Unreal (recently made available freely by Epic Games, Inc.). He has recently joined us at the start of the Fall 2015 semester and has previously worked in an independent gaming company “Behavior Interactive” at their studio in Montreal, Canada. Dr. Gill's students are learning core algorithms and techniques used in game programming such as those related to graphics, cameras, physics and AI. By building games ranging from "third person shooters" to “platformers” on a professional game engine, students are gaining experience suitable for working in the competitive gaming industry.

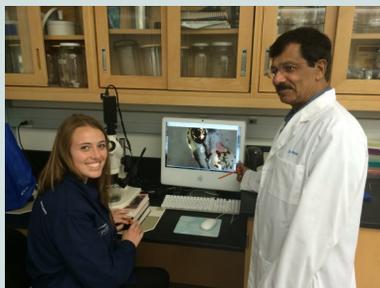
SSU's First Autonomous Golf Cart

In collaboration with Sebastopol's [Switch Vehicle](#), SSU Engineering Science students have kicked off their work on designing an autonomous vehicle, called the SSU Autonomous Golf Cart. “Our goal in the next several months is to modify the golf cart so it can be fully controlled via an Android smartphone,” explains senior Electrical Engineering student Tyler Spot, who is acting as the project lead. “This is a great way to promote an industry-supported interdisciplinary project and we hope we can get participation from students in other departments, such as the Art Department,” added Dr. Farid Farahmand. For more Engineering Science news, visit the department's [website](#).

Undergraduate Summer Research

Solving unscripted problems and addressing important challenges facing the world today motivate our School's commitment to research. Research experience is also a proven high impact practice encouraging undergraduates in Science, Technology, Engineering and Math (STEM) disciplines to persist in their challenging studies. With the support of the National Science Foundation (STEP grant #1068445) and other generous donors, Science & Technology is proudly supporting undergraduates in their research efforts. This summer, the STEP grant funded students working on six research projects: Developmental Stage Specific Effects of Phenanthrene on Zebrafish Embryos; Synthesis and Characterization of Chromium Complexes and Reaction with the Metal Transport Protein, Transferrin; Environmental Sensor Network at the Fairfield Osborn Preserve; Data Visualization; S4 Rocketry Program; and Hybrid Water Harvesting Prototype.

Michelle Soulé, under the mentorship of Dr. Murali Pillai, Department of Biology, spent the summer testing the effect of phenanthrene, a polycyclic aromatic hydrocarbon composed of three fused benzene rings, on zebrafish development. She postulated that the effect of the phenanthrene is developmental stage specific and that the severity of its teratogenic effect is dose dependent. Ultimately, Soulé found that zebrafish who were exposed to phenanthrene at different developmental stages exhibited bradycardia and cardiac edema, as well as other stage-specific conditions such as scoliosis and abnormal somite development. The research Soulé conducted over the summer formed the basis of her senior thesis which she will be working on this academic year.



Soulé and Dr. Pillai.

In an effort to better understand chromium, a dietary supplement, and how it relates to insulin resistance reduction, Patricia De La Torre, working with Dr. Carmen Works, Department of Chemistry, conducted research focusing on the supplement and its means of absorption and transport into cells. De La Torre had two specific objectives in her research: test for chromium transfer from a possible supplement to transferrin, an iron transport protein, and to evaluate any resulting cell toxicity. Results from her research show that due to solubility and stability concerns, chromium *acetate* complexes may not be a viable source of chromium; however, chromium *citrate* complexes stay in solution and transfer chromium ions to transferrin. Moreover, chromium



Solid chromium citrate: an aqueous solution of 500M transferrin, 60mM bicarbonate, reacted with 100mM chromium citrate in TRIS buffer.

varies in toxicity based on the form of chromium cells are exposed to: acetate, citrate, and chromium chloride. Further research is planned in which an equilibrium

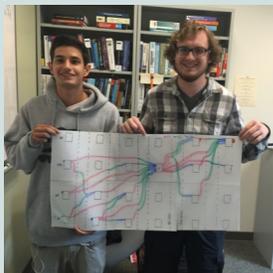
constant of the chromium complexes and transferrin reaction is quantified.

Four Engineering Science students, Jarrett Baglietto, Jason McGuire, Feng Wang, and Jiajun Zhong, worked with Dr. Christopher Halle on three different sub-projects with the goal of making the electronic backbone of the Center for Environmental Inquiry's environmental sensor network at the Fairfield Osborn Preserve more robust. Jason McGuire spent the summer working on end-to-end data systems. Among his many accomplishments, the web page he developed will serve as the template for the official CEI Network Data web page. McGuire will continue his research by investigating and developing low-cost, wireless enabled microclimate stations; he will also be teaching the technology portion of CEI's Naturalist Training Program. Jarrett Baglietto and Feng Wang addressed the improvement of the solar supply system, the foundation of the electronic backbone, for the wireless network and observation tower. In addition to examining the charging system, the team also designed a structure to protect the panels and components. Moreover, Baglietto developed a solution to permanently installing the panels and protecting the wires and hardware. Jiajun Zhong implemented and extended a numerical method for detecting false positives in trail camera images on the Fairfield Osborn Preserve. These trail cameras are used to examine the effect of the PG&E right-of-way on animal movement and distribution. False positives, which can be triggered by moving trees, grass, and shadows, are a time consuming task to sort through. Methods developed by Zhong will be used to develop a more robust classification system and have garnered the interest of other agencies.

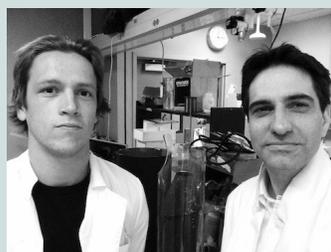
Computer Science majors Chad Vink and Zach Thurston worked with Dr. Ali Kooshesh, Department of Computer Science, on a data visualization project. Simply put, data visualization is the presentation of data in a pictorial or graphical format. Data visualization is especially useful when looking at large sets of data. It can show patterns that may not be apparent when looking at spreadsheets, and it can aid in recognizing frequently occurring patterns. Vink and

Thurston used a tool called D3, or Data-Driven Documents. D3 is a JavaScript library that helps with data manipulation and visualization; it enables users to create customizable graphs and provides users with a powerful interactive data visualization tool. Vink and Thurston used D3's library and tools to create a program written in JavaScript that is capable of displaying a student's path through any given major at SSU. The program is given a file containing information about students and the classes they've taken; from this, it creates a graphical representation of the data, with nodes for each class in each semester and lines drawn between them showing the transition of all the students from course to course. Vink and Thurston plan to continue work on this project through the fall with the goals of achieving better data visualization, which will make the end product clearer and cleaner, and modularizing the code, which will make it possible for more department to use the program.

Vink and Thurston.



Casey Lewiston spent the summer working with Dr. Lynn Cominsky and SSU's Education and Public Outreach (E/PO) group. Lewiston primarily assisted with the S4 rocketry program, in which high school students use E/PO's electronics to launch experimental payloads via small rockets and interpret the data received. Over the course of the summer, Lewiston built two of his own rockets. The first one he built he used in the Black Rock Desert competition in Arizona; this rocket successfully earned him Level 1 certification. The second rocket he built gained him Level 2 certification, which will help him in the ongoing S4 operations. In addition to rocketry, Lewiston also redesigned portions of the S4 website and wrote blogs detailing the group's rocketry adventures. Lewiston also worked supporting Cominsky's i3 grant by learning the relevant programming language and making videos to teach students and teachers said language.



Working with Dr. Jeremy Qualls, Department of Physics & Astronomy, and a few SHIP students (see page), Justin Hoijer developed a passive and hybrid water collection system. A passive water collection system harvests water present in the atmosphere and could potentially solve a number of global water shortage issues. The system developed is capable of harvesting clean water without the use of harmful chemicals or external energy sources. It combines cold surface collection, a technique that uses a cold surface to cool surrounding water vapor until reaching its dew point; a solar absorption refrigerator, a refrigeration system wherein an evaporator works with an absorbent and an absorbate pair in a daily cycle to create ice; and a desiccant collection system (desiccants naturally absorb water from the atmosphere and are used in humidity control).

Justin Hoijer and Dr. Qualls. Designed to function on a daily cycle, the combined system should work in any biome or reasonable environment. The research conducted over the summer focused on maximizing the three collection systems and creating a functional prototype.

—Cory Oates, Dean Lynn Stauffer, Patricia De La Torre, Dr. Christopher Halle, Justin Hoijer, Casey Lewiston, Michelle Soulé, Zach Thurston, Chad Vink.

Learning by Making Curriculum Rolls Out at Six Mendocino County High Schools

This fall, students at six Mendocino County High Schools began "Learning by Making" – an integrated STEM curriculum that has been developed by SSU's Education and Public Outreach group under the direction of Prof. Lynn Cominsky. More than one year in development, the new curriculum has been approved by the UC/CSU system as one of the two "D" laboratory science courses required for admission to either system. After basic skill building in computer programming and electronic circuit design, the course focuses on hands-on investigation and experiments exploring a variety of environmentally-themed subjects such as heat diffusion, microbial fuel cells and environmental quality monitoring. Students are working together with their teachers to customize the experiments to vary conditions, test hypotheses, model the data and argue from evidence about the results. These are all key skills mandated by the Next Generation Science Standards, along with the implementation of scientific and engineering design practices.

The project has also recently received important donations from Keysight Technologies (where personnel built 30 of the SSU-designed boards needed by the students to run experiments) and from Fluke Corporation (which donated 10 digital multimeters). Additional important contributions to the project's success include the considerable donated time and expertise by Project Technical Manager Dr. Garrett Jernigan, as well as software help from Brian and Barry Silverman, and from Andru Luvisi. The Learning by Making program has been funded by the US Department of Education's Investing in Innovation fund, Principal Investigator Susan Wandling. —Dr. Lynn Cominsky, Department of Physics & Astronomy

2015 Science Symposium

This past May, the School of Science & Technology in partnership with the WATERS Collaborative hosted its third annual [Science Symposium](#). As in past years, the event was kicked off with the 2014-15 Science 120 cohort presenting talks on the research project they conducted over the past year. This year many of the students also presented posters. We had a record number of 81 posters presented from departments across campus highlighting the work of 193 students.

President Armiñana and Provost Rogerson welcomed students, faculty, staff, family, and community members in attendance. In addition, they presented Drs. Lynn Cominsky and Suzanne Rivoire with the university's Excellence in Scholarship Award. Sonoma County Supervisor Efren Carillo presented the WATERS Award to recipient Richard Regello (advisor: Dr. Nick Geist, Biology); Dean Lynn Stauffer presented the Dean's Excellence Award, the People's Choice Award, and the Best Overall Award to Daniel Vieira (advisor: Dr. Matty Mookerjee, Geology), Hong Mai and Shoua Lor (advisor: Dr. Nick Geist, Biology), and Clayton Piatt (advisor: Dr. Jeremy Qualls, Physics & Astronomy), respectively. Judges were once again impressed with the level of research undertaken by the students and the depth of knowledge about their research subject expressed in speaking with them. —Cory Oates



Ways to be involved with the School of Science & Technology at SSU:

- ◆ Be an ambassador and spread the word about SSU.
- ◆ Mentor or tutor students.
- ◆ Speak in classes or as part of a lecture series.
- ◆ Host tours or visits at your organization.
- ◆ Hire our students for projects, internships, or as full-time new hires.
- ◆ Serve on an advisory committee.
- ◆ Volunteer as a Naturalist at Fairfield Osborn Preserve
- ◆ Attend or sponsor our events.
- ◆ Invest in science programs, research, and scholarships.

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