Welcome to the second issue of Discovery magazine. We study science because we are curious about the world around us. That curiosity inspires scientific inquiry which results in discovery. That’s why we use “discovery” as our tagline and the title of our magazine.

On the pages of this magazine you’ll find many examples of the exciting journey of discovery that our students and faculty are taking. As you read their stories you’ll see the polytechnic learn-by-doing philosophy in action. The College of Science is a dynamic community where intellectual pursuits are valued, questions are asked, and ideas are born.

Whether its solving the problem of big data security or improving STEM education in elementary schools, our campus community is engaged with the local, national, and global community and making a positive impact.

Our graduates are now working at Google, Boeing, Microsoft, Amgen, JPL and Yahoo, just to name a few. Other graduates have furthered their education with master’s and Ph.D. degrees. Our College of Science graduates have gone on to successful careers and we are very proud of them. I invite you to be a part of our discovery. That’s why we use “discovery” as our tagline and the title of our magazine.

President’s Discovery Fellows Blaze new Trails of Discovery Using Geology

An Interest in Science Grows in This Garden

Inspiring the Next Generation of Women in Physics

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X-ray Diffractometer Opens up new Research Opportunities for Students

Undergrads get Experience with Big Data Security Thanks to NSF REU Grant

Research into Food’s Effect on Circadian Rhythms may Have Uncovered a “Fat Switch”

An Interest in Science Grows in This Garden

Distinguished Alumnus Alex Cheng

Keep Calm and Develop Heartfulness

Professor Robin Wilson Fights the Good Fight for Math Literacy

Events

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Alison Baski, Dean
President’s Discovery Fellows Blaze new Trails of Discovery Using Geology

Gunslingers hired to protect settlers in a hostile land. The future mayor of Los Angeles shot by a poison arrow but saved in the nick of time. Two settlements on the bank of the Santa Ana River wiped off the face of the earth by a flood. Sound like a new Western coming soon to a cineplex near you? Actually, it’s part of the Inland Empire’s history that the Department of Geological Sciences is helping to uncover.

At Cal Poly Pomona a new National Institutes of Health (NIH) SCORE grant is helping to answer the question, “What makes our internal clock tick?” The grant will support research into how food may affect circadian rhythms. Much research has been done on how light impacts our biological clock but the research being done at Cal Poly Pomona is looking at the connection between the timing of meals and wakeful activity. The term Food Anticipatory Activity (FAA) describes the wakefulness and activity that animals exhibit in anticipation of scheduled meals. Mice show FAA even when their meal schedule is modified to take place during normal sleeping hours suggesting that food as well as light affects circadian rhythm.

The principal investigator on the grant is Assistant Professor Andrew Steele. Steele’s lab currently includes eight undergraduates and three graduate students. The NIH grant will allow them to continue their important work which addresses the question, “How are activity and physiological rhythms entrained by feeding?” Steele said “our work suggests that the neurotransmitter dopamine is crucial to establishing food entrained circadian rhythms and that it is acting via dopamine receptor 1 neurons in the dorsal striatum. This research problem has important biomedical implications for obesity and anorexia as well as basic science interest in circadian time keeping and the neurobiology of behavior.” If researchers can understand how food timing affects metabolic clocks it will lead to a better understanding of how the brain controls behavior.

This research at Cal Poly Pomona was initially supported with a grant from the Whitehall Foundation. The NIH SCORE grant will ensure that the research can continue. SCORE is a capacity building program that supports institutions with a stated mission or history of training nationally underrepresented students in the biomedical sciences. In the lab, researchers have deleted genes from mice in a cell specific manner, allowing them to remove the type 1 dopamine receptor. It has been found that animals that lack the D1 receptor (DIR) fail to show food anticipatory activity. Another amazing, yet still preliminary finding is that the mice without DIR did not gain weight when placed on a high fat diet as compared to a control group. The hypothesis is that the DIR expressing neurons provide critical inputs to the circadi-

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The ranch, located in Riverside, is believed to be the site of San Salvador, once the largest settlement between New Mexico and Los Angeles on the Old Spanish Trail. Located on the banks of the Santa Ana River, the two communities that made up San Salvador were La Placita de Los Trujillos and Agua Mansa. The leader of the men hired to protect the settlers was Lorenzo Trujillo. Plans to develop the land led Trujillo’s descendents, Nancy Melendez, to reach out to Professor Jascha Polet at Cal Poly Pomona. Polet, who is the project’s research advisor said, “This will be the first time the Geological Sciences department has used geophysics for an archeology project.”

The team is using Ground Penetrating Radar (GPR), an electromagnetic profiler, and a magnetic gradiometer. The GPR will allow imaging up to 5 meters below the surface and the other tools will detect metallic objects closer to the surface.

Lead researcher Sutkowski overflows with enthusiasm. She said, “It’s exciting, like something from Indiana Jones.” The goal of the research team is to discover whether structures or artifacts are present at the site. It will take four to five months to cover the 200 acre site that straddles Colton and Riverside, and another five to six months to analyze the data.

Another President’s Discovery Fellow from the Department of Geological Sciences is graduate student Stacey Petrashek (pictured top right). She is using geophysics to solve a different mystery which is to find out what is happening to water that once fed the San Andreas Springs Oasis in the Dos Palmas Preserve. Her team includes undergraduate geology students Raul Contreras and Nathan Pulver. Under Petrashek’s leadership they will survey the land looking for faults and potential obstacles that might be preventing water in fresh ponds from reaching the springs. Their work will result in an accurate picture of the groundwater and faulting in the area which would be costly if done by traditional drilling and observational methods.

Professor Polet, who is also advisor on this project, points out that Petrashek and her team are the first to conduct geophysical research in that particular area. The team will use a magnetometer to “map field anomalies which correspond to rock units offset by faulting,” Petrashek said. Using that data they will select areas for Very Low Frequency (VLF) profiles and resistivity assessment. This project will also make use of aerial satellite images such as Light Detection and Ranging (LiDAR) to view small ridges and rocks that might indicate fault lines.

Both of these projects fit well into the President’s Discovery Fellows program which seeks to use what’s being learned at Cal Poly Pomona to solve real world problems. In addition to service to the community these projects provide research educational opportunities for both undergraduate and graduate students. The fellowships provide between seven and eight thousand dollars to each team which allows students to pay for expenses associated with their research.

In addition to these geology students, the College of Science has President’s Discovery Fellows in physics – Bianca Cruz, Anthony Oceguera, and research partner Panik Moradian (Chemical Engineering), and in Biology - Benjamin Soto (Biotecnology).
Stressed out? I would like to introduce you to Alane Daugherty because meeting her can be a calming experience. She is a full time lecturer at Cal Poly Pomona and founder of the Mind and Heart Research Lab which she started and coordinates with Professor Kristine Fish who does online outreach.

Daugherty has been at Cal Poly Pomona for 29 years and teaches courses in stress management, aerobics, yoga and meditation in the department of Kinesiology and Health Promotion. She’s probably one of the few faculty at Cal Poly Pomona who can boast that she grew up on campus. That distinction comes by way of the fact that her father, Ray Daugherty, was a coach for Cal Poly’s football and wrestling teams.

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The slogan, "Keep Calm" which first appeared in 1939 to bolster British citizens facing an impending war is a directive that is easier said than done. Meditation is often an important part of stress management. Most forms of meditation use a singular focus, nonjudgmental awareness or mindfulness to achieve a state of calm. The essence of Daugherty’s book, “From Mindfulness to Heartfulness” and the focus of her teaching is that mindfulness is only half of the equation. What she advocates is a deeper understanding of the emotions that are contributing to stress and anxiety. From that place of understanding steps can be taken to replace negative emotions with more positive and life affirming ones.

For Daugherty the “heart” connection refers to both the metaphorical source of emotion and the actual physical effect on the heart that takes place during stress or strong emotion. During her doctoral program she worked with an organization called Heartmath and one of their projects taught self-calming techniques to 1,600 high school students. More current work includes a study on compassion fatigue in animal care workers and a new project at Western University’s College of Osteopathic Medicine on compassion fatigue in physicians.

Daugherty writes that heartful awareness “is an integrated sense of harmony with our body, psyche, spirit and outer world. And, physiologically speaking, because what we continually experience, especially states that are deeply felt, become the way we function in the world we begin to live this existence.”

That may sound metaphysical but her work is grounded in science. Perceptions that influence our behavior and therefore our physical well-being are not only the result of memories of past experiences but are influenced by the entire limbic system which also houses the subconscious. “The amygdala, hippocampus and anterior cingulate are associated with meaning making and emotional perception. These three structures and in particular the amygdala are responsible for storing emotional or implicit memory,” Daugherty writes.

Her doctoral work on emotional healing and the mind/body connection included research into the neuroplasticity of the brain. It’s believed that the emotional responses associated with past experiences often trigger similar responses even though the present situation may be different. By first recognizing these triggers and then actively cultivating healthier responses one can replace unhealthy emotions and responses with healthy ones. In turn this practiced experience will reprogram the brain at a biochemical level.

The Mind and Heart Research Lab employs scientific methods in the form of biofeedback to help students on their journey toward a less stressful, more connected existence. The Lab has EmWave to measure heart variability, an EEG to measure brain activity, an EMG that measures facial muscle activity and a GSR to measure skin conductivity.

The Mind and Heart Lab also offers free weekly meditation group sessions on Tuesdays from 12:10 to 12:45 which are led by Venerable Andrew or an associate monk from Dhammakaya International Meditation Center in Azusa.

Daugherty is currently working on details for a lecture series with Alumnus Dr. Habil Sadeghi (’94, Biology) who has provided an endowment for the College of Science to promote the psycho-social needs of university students. She wrote an endorsement for Sadeghi’s book, “The Clarity Cleanse: 12 Steps to Finding Renewed Energy, Spiritual Fulfillment, and Emotional Healing” which included endorsements from Demi Moore and Anne Hathaway. Sadeghi and his wife Dr. Sherry Sami founded the Be Hive of Healing which is an integrative medical and dental center in Agoura Hills. They also founded the Love Button movement which fosters loving acts of kindness. The holistic approach of Doctors Sadeghi and Sami is in harmony with Daugherty’s work to find healing and transformation through better integration of the mind and body.

Emotion is something that Alane Daugherty finds hard to control when speaking about the transformation she’s seen in her students. Tears well up as she describes one young man who was so overwhelmed with anxiety that he was losing his hair and suffered from high blood pressure. His biofeedback stress management sessions had to be cut short because his palms routinely sweat so much that the equipment would stop working. Over time the student was able to manage his anxiety, reduce his blood pressure and lead a more normal life.

Heartful awareness “is an integrated sense of harmony with our body, psyche, spirit and outer world”
Cal Poly Pomona’s College of Science partnered with Harvey Mudd College and Pomona College to host the American Physical Society’s (APS) Conference for Undergraduate Women in Physics (CUWiP). The three day conference is held simultaneously at 12 sites across the U.S. and Canada. The conference Cal Poly Pomona participated in had the highest attendance of the 12 sites with over 200 women attending and our site streamed the keynote speaker, Patricia Burchat (Stanford), to the other 11 sites. The conference took place Friday, January 12 through Sunday, January 14 and Cal Poly Pomona hosted the Sunday activities which included a panel on careers in physics, a career exploration fair and breakout sessions on a wide variety of career options. The keynote on Sunday was Associate Professor Hille Schlichting (UCLA) whose work is focused on understanding planetary origins. The day concluded with a science show and ice cream made with liquid nitrogen.

What’s unique about this year’s conference is the cooperation of the three colleges. None of it would’ve been possible without the hard work of Professor Nina Abramzon and the unwavering support of the Physics and Astronomy department and the College of Science. With former Physics department chair, Professor Emeritus Steven McCauley’s support, Abramzon and Professor Emerita Mary Mogge began planning the event with a contact at Pomona College. After those discussions took place, Harvey Mudd College joined too.

Abramzon was instrumental in acquiring sponsorships and brought in JPL/Naas as a platinum sponsor and General Atomics and Lawrence Livermore National Labs as silver sponsors. The CPP Office of Undergraduate Research participated as a bronze sponsor. Early on in the event planning she enlisted the help of third year Cal Poly Pomona physics student, Sara Margala, who was able to bring the perspective of an attendee into the planning of the 2018 event. Margala is the president of the women in physics club on campus. Her duties at the conference included overseeing about 20 volunteers and she was grateful for the support of her male colleagues from the physics club who also helped. Margala sees physics as a good foundation for any STEM field and is interested in condensed matter and materials. She’s part of Abramzon’s plasma research group and is investigating how cold plasma affects the surface energy of metal. Two of the CPP alumni who volunteered at the event were also part of Abramzon’s plasma research group. One was Yasmina Rouan (’16, physics) who liked the research because she felt it added practical application to the theory she was learning. The conference was her third, and Rouan, who works as an electrical technician at a power plant, drove in from the central valley to volunteer and serve on the panel, “Is Industry for Me?” The other alumni was Jase Nosal (’17, physics) who represented his company, Supply Chain Optics, at the career exploration fair. Both cited CPP’s physics program and learn-by-doing philosophy as essential to preparing them for their careers. Their advice to current students is to get involved outside of class, don’t be afraid to ask for advice, diversify your interests, and seek the support and help of your colleagues.

One attendee and volunteer who found ample support from her colleagues at the CUWiP conference is third year Cal Poly Pomona physics student, Bianca Cruz. She attended last year’s conference and said it was life-changing. Cruz’s interest in physics began with a near fatal electrocution she endured as a teen. The experience and subsequent medical treatment inspired her to learn about the physics behind what happened. As her interest in physics grew she found what many women in the field find, that as they progress in their education they find themselves in classrooms dominated by male students. This experience caused her to question herself. She wondered whether she was good enough and relates many women in the field find, that as they progress in their education they find themselves in classrooms dominated by male students. This experience caused her to question herself. She wondered whether she was good enough and relates.

The percentage of women who earn bachelor degrees in STEM disciplines is less than 40% but in physics that number is less than 20%. In terms of doctoral degrees, women attain slightly more than 50% overall but in physics that number drops back down around the 20% mark. It’s clear that more needs to be done to encourage women to pursue degrees and careers in physics and CUWiP is a good start.

For more information and updates on future conferences visit: www.aps.org

(R-L) Physics & Astronomy Chair Hector Mireles, Sabrina Feldman, JPL, event organizer Professor Nina Abramzon, Cinzia Zuffada, JPL/Caltech, Dean Alison Baski.
An Interest in Science Grows in This Garden

By fourth grade (age 10) elementary school students have already decided whether they like science and feel they’re smart enough to pursue a career in the sciences. That’s what recent research tells us and yet science isn’t a state tested subject until the fifth grade. The Center for Excellence in Mathematics and Science Teaching (CEMaST) at Cal Poly Pomona is making a difference in early science and math teaching through partnerships with local schools. One program the Center manages is the Prete Fellowships which places Cal Poly Pomona students with the Pomona Unified School District.

The Prete Fellowships were funded by the Ernest Prete Jr. Foundation which allowed 15 Fellows to be placed at Kellogg Polytechnic Elementary School in Pomona during the 2017-2018 school year. The CPP students provide up to 10 hours a week of support to the teachers which includes using an existing garden at the school to integrate urban gardening lessons into the curriculum. They learn about gardening, nutrition, and how certain crops complement each other and affect the soil. The lessons educate students about their families’ health and about broader ties can become scientists, “ Minhas said. “The program gives Cal Poly Pomona students an opportunity to make a profound impact on the lives of these students.”

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Assistant Professor of Computer Science Tingting Chen acquired a National Science Foundation (NSF) grant which allows Cal Poly Pomona to provide research experience for undergraduates (REU) over the summer. She will also serve as the REU site coordinator. In addition to Chen, Associate Professor of Computer Science Mohammad Husain, and Associate Professor of Computer Information Systems Ronald E. Pike (College of Business Administration) will serve as faculty advisors.

The NSF REU program funds a large number of sites that provide research opportunities for undergraduates. Most sites host about ten undergraduates for eight to ten weeks who work on research that the hosting institution is working on. Each student works closely with faculty and other researchers on a specific project. The students receive stipends that may include money for travel and housing.

Site coordinator Chen said, "Our REU program engages undergraduate students in big data security and privacy research, particularly on genomic data privacy, secure multiparty cloud computation and hybrid data center security." The research is part of a three year endeavor that includes a total of eight projects from which students may choose. This June there will be four Cal Poly Pomona students and four students from other institutions participating.

Chen will serve as advisor on three of the eight projects. Her specialty is data security for medical information. In the field of medical information security there are two central concerns or problems, one is sharing data between agencies in a way that's not only secure but usable. The latter concern arises from the fact that one database may need specific information from another but sharing only that information and nothing else is a challenge. That challenge will be met with homomorphic encryption which preserves patterns of the original data. It looks random but still allows for extraction of data with matching attributes. The challenge of encrypting and decrypting big data, such as genomic data, will be addressed with specially written GPU coding on the platform that utilizes the parallel processing of a GPU to speed things up.

Associate Professor Husain's research opportunity has a government focus which differs from Chen's in that the data is big because of the quantity of entries. It also involves cloud environments. His work addresses similar concerns in relation to the sharing of two or more datasets but will develop extensions of Hadoop (MapReduce/ HBase) to solve the challenge of revealing some but not all information to other agencies in need of that information.

Associate Professor Pike's research opportunity deals with the enormous challenge of maintaining data security when public and private cloud environments need to exchange information and when data is migrated to a new platform. One of the unique goals of his research is to develop a way to create a dashboard or visualization that will display measurements of security compliance during migration.

Chen added that, "This program provides students with an immersive research environment and we teach students research skills through training sessions, hands-on experiments, and interactions with experienced researchers. The interdisciplinary nature of this site exposes students to different perspectives of big data security, from theory to application. The faculty members have exceptional expertise in cybersecurity research enabling them to provide high quality REU activities."

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The College of Science recently acquired an X-ray Diffractometer (XRD). The equipment was funded by a Department of Defense (DOD) grant and the principal investigators are Assistant Professors of Chemistry and Biochemistry Chantal Stieber, Kathryn McCulloch, Bohdan Schatschneider, Alex John, and Physics and Astronomy Department Chair, Hector Mireles. The grant is made possible because large percentage of students in the College of Science are from underrepresented groups and because the planned use of the device aligns with the goals of the Army Research Office in relation to chemical sciences and polymer chemistry.

This XRD is able to analyze both crystals and powder. It’s an important piece of equipment because it gives investigators a three-dimensional view of a material’s atomic structure. Without an XRD on campus, researchers must send samples to a lab which is costly and can be risky when samples are fragile.

One of the primary uses of the device in the field of chemistry will be to analyze catalysts used in making plastics. Catalysts have a metal center which makes them difficult to characterize by other methods. Creating a crystal purifies the material and allows it to be analyzed by an XRD. While the catalysts are created through chemical processes, analyzing the unique structure of the catalyst at an atomic level helps us to better understand it.

The device has uses in other disciplines as well. In biochemistry, crystals of protein are grown so they can be analyzed using the XRD. For geology researchers the XRD provides a reliable tool for mineral identification. The equipment will allow the Physics and Astronomy department to study materials for electronic devices.

The addition of an XRD to the College of Science provides Cal Poly Pomona students with practical experience on equipment that is the standard in industry and academic research. Students will gain a marketable skill and the opportunity to conduct a more thorough investigation of questions related to their chosen discipline. This experience will also prepare them for graduate work or a career in industry.

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MAKE A DIFFERENCE

Generous gifts from alumni, faculty, staff, and friends of the university allow the College of Science to enhance the quality of our educational programs and provide valuable experiential learning opportunities. These experiences, provided by our highly trained faculty, reach far beyond the classroom and leave lasting impressions on the intellectual and professional growth of our students, preparing them today to solve the problems of tomorrow.

We invite you to partner with us in training the next generation of scientists, educators, and industry leaders. One way to get involved is to provide a financial gift to the College of Science, one of the seven departments, or to one of the top priorities for the 2018-2019 school year, which include:

Undergraduate Research
A demonstrated high-impact practice that dramatically improves the student experience is undergraduate research, either during the academic year or as a summer experience. The opportunity for students to conduct research, acquire and analyze data, and communicate their findings can be transformational in their development as scientists. We currently have more students than ever interested in conducting research one-on-one with a faculty member. Additional support would fund stipends for students to conduct research.

Science for All
The Center for Excellence in Mathematics and Science Teaching (CEMaST) promotes STEM teaching at all levels. One program they manage is the Prete Fellowships which places Cal Poly Pomona Science students in elementary schools where they develop and teach science curriculum alongside elementary school teachers. This enhances the learning of the elementary students and teaches Cal Poly Pomona students important interpersonal skills. Additional support would allow us to continue and expand STEM education in the community.

Student Scholarships
Over 75 percent of our student body receive some form of financial aid. Student scholarships alleviate what may be a barrier to education, allowing students to focus on their studies and career aspirations. There are a variety of department-based scholarships that you can support, or you can create a new named scholarship.

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Director of Development
College of Science
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Gifts can be made in all forms, including cash, securities, equipment, or through a planned gift. For more information please visit give.cpp.edu/science or contact:

There are many ways to reconnect, stay involved or support the College of Science.

Become a Bronco Mentor. Interested in mentoring a student? Connect with students and share your academic, career and industry experience. Visit the Bronco Mentoring website at cpp.edu/alumni/mentoring for more information.

Participate in Professor for a Day. Come back to campus as a guest lecturer in class. Our students want to learn from you. For more information and to sign up visit cpp.edu/alumni/professorforaday.

Become a Giving Day Ambassador. Giving Day is a campus-wide fundraising activity. College of Science ambassadors share their enthusiasm for the College with their colleagues, family, and friends.

Dining with Broncos. Host a group of students and socialize over dinner. Students are matched by major, industry, career goals, location and interests. For more information and to sign up visit www.cpp.edu/alumni/student-alumni-association/network-dinner.shtml

We are CPP. Watch videos and read profiles of other successful alumni. Share your achievements online and see how our Bronco family is making an impact around the world. Visit weare.cpp.edu for more information.

“'I've always believed in social responsibility and I want to do something about it by helping and encouraging the less privileged students particularly in the field of computer science which has very low minority representation. Sponsoring technology projects with my employer and senior CS students with internship potential plus creating a few scholarships is a great way to give back to my alma matter.'

María Alvarez ('95, M.S., computer science)
Partner Director of Shared Engineering Services, AI Product Division, Microsoft

Much of what we do is only possible because of the generosity of our donors.
College of Science Research Symposium

The Research Symposium showcases undergraduate and graduate student research projects. The 2018 Symposium was one of the largest in its 13 year history, featuring over 100 submissions. All seven departments in the College of Science were represented and over 300 people attended. The 2019 Research Symposium will take place in late April. Alumni are welcome to attend.

2018 marked the last commencement before semester conversion. The College of Science 2018 Julian A. McPhee Scholar and Valedictorian was Shunto Kobayashi who graduated with a 3.99 GPA in Applied Mathematics.

College of Science Facts 2017 - 2018

- Biological Sciences: 1,449
- Computer Science: 1,021
- Kinesiology and Health Promotion: 665
- Mathematics and Statistics: 575
- Chemistry and Biochemistry: 411
- Physics and Astronomy: 226
- Geological Sciences: 124

Total: 4,471

- 898 Bachelors Degrees Awarded
- 107 Graduate Degrees Awarded
- 124 Tenure Track Faculty

For more information visit: www.cpp.edu/alumni/events