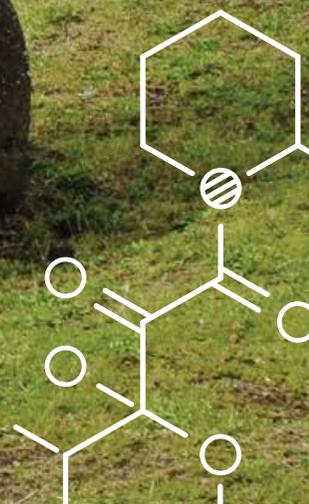
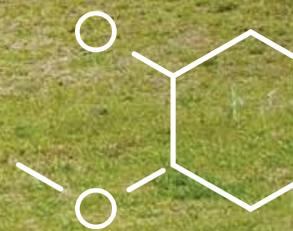
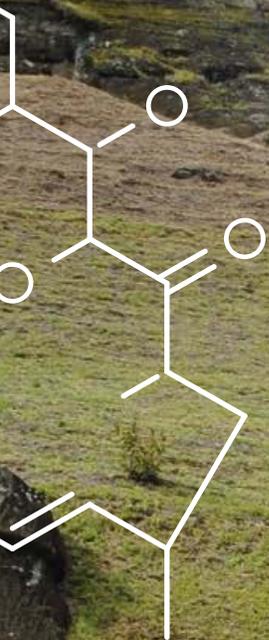


Spring 2018 50 Years of Biochemistry and Biophysics

# CATALYST



Oregon State  
University

# CATALYST

## Spring 2018

**Editor**  
Debbie Farris

**Writer**  
Katharine de Baun

**Designer**  
Sharon Betterton

**Department of  
Biochemistry &  
Biophysics**  
P. Andrew Karplus, Head

**Publisher**  
Department of Biochemistry  
and Biophysics  
2011 Agricultural and Life  
Sciences Building  
Oregon State University  
Corvallis, OR 97331

### On the cover

Easter Island — with its iconic statues that are threatened to disappear due to rising ocean levels caused by climate change — is where the anti-aging compound rapamycin was first discovered in a soil sample 30 years ago. Viviana Perez recently discovered a second way in which this amazing drug works to prolong youth and vitality. Read how on p. 11.



**Oregon State University  
College of Science**



science@oregonstate.edu



OSUScience



2



4



7



10



14

## Contents



### 8 Feature

**2**  
**Best & Brightest**  
Our talented faculty

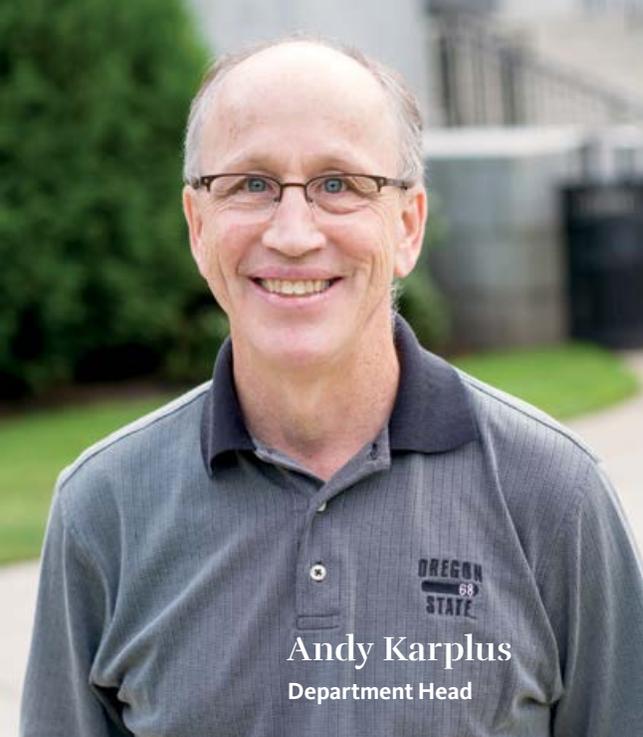
**4**  
**On the move**  
Students going  
above and beyond

**7**  
**Outreach**  
Science opens doors

**8**  
**50 Years**  
of Biochemistry & Biophysics

**10**  
**From the labs**  
Ground-breaking  
innovation

**14**  
**Making us proud**  
Alumni + Friends



**Andy Karplus**  
Department Head



# FROM THE HEAD

**Welcome to the annual Department of Biochemistry and Biophysics newsletter.** I am delighted to share how we are developing and educating our students, creating new knowledge through research and mentoring the next generation of molecular life scientists. Such vital work invites reflection. We hope you'll enjoy the many faces, stories and updates in this issue.

A major highlight from last year was our department's 50<sup>th</sup> anniversary in October. Faculty and alumni from across the years joined us to celebrate, including a handful who were here when our program started in 1967! The evening became especially meaningful when each alumnus described his/her post-graduation path and shared how well their biochemistry and biophysics studies prepared them for it. Each story confirmed the strength of our community, highlighting how our accomplishments can only be possible with the help of our alumni and friends. We are proud to be a part of Oregon State University as it celebrates its 150<sup>th</sup> anniversary. Go BEAVS!

At 50 years old, our department is as strong as ever and moving in new directions, including introducing last fall a new and already very popular biochemistry and molecular biology degree. The class of 2017 was our largest ever, with 27 bachelor's, one master's and seven Ph.D. degrees. In 2018, we are expecting to award nearly 40 bachelor's degrees. As you will read in these pages, our stellar students continue to receive local, regional and national recognition.

Our renowned faculty also shine brightly and received many University and College advising, teaching and research awards last year. We welcomed two new faculty this year, Drs. Maria Clara (Maca) Franco and Alvaro Estevez, who deepen our strength in the increasingly important area of neuroscience. Innovative and impactful research and teaching continue across diverse arenas, including genetic code expansion and intrinsically disordered proteins. We established a biomolecular NMR research center and received new NIH funding, both for delving into the molecular causes of Alzheimer's disease and for developing vitamin D-infused sutures to promote wound healing. We also completed a strategic planning process and have adopted key goals for the next five years.

Our alumni continue to make a difference out there in our communities around the world. Thank you to all who pay their gratitude forward through regular gifts supporting our BB Excellence Fund and investing in scholarships and fellowships. We are grateful for your support!

Wherever you are, please stay connected and, when you visit the area, stop by to say hello. Our faculty, students and I would love to see you!

## Upcoming Events

### What do the Nobels Mean?

*April 30, 6:30 – 8:00 p.m., Corvallis-Benton County Public Library.* Faculty Elisar Barbar and David Hendrix will present short talks on the 2017 Nobel Prizes in Chemistry and Medicine/Physiology, respectively, as part of the College of Science's "What do the Nobels Mean?" on April 30. Alumni and friends are welcome to this evening event showcasing the scientists and research that garnered the world's most prestigious award.

### Graduation Dessert Celebration

*June 15, 7:00 – 9:00 p.m.*  
*Memorial Union, Room 13.*

### Biochemistry Summer Camp

*June 25-28.* Our department is hosting an annual summer camp for middle-schoolers.

### Genetic Code Expansion Workshop

*August 2-8. (see p. 13)*

### Genetic Code Expansion Symposium

*August 9-11*

## Friend us on Social Media!

Keep up with the latest biochemistry and biophysics news and join our online community! Facebook: @OSUBB



# BEST & BRIGHTEST

## Recognizing excellence

**Michael Freitag** received the Milton Harris Award in Basic Research for his outstanding research on how chromatin proteins shape eukaryotic genomes and how epigenetic mechanisms regulate DNA transcription in filamentous fungi model systems.

With 105 peer-reviewed papers in prestigious journals such as *Proceedings of the National Academy of Sciences*, *Genome Research*, *Science* and *Nature*, Freitag has received more than 8,500 citations for his work in the last 10 years. Colleagues describe him as among “the most respected scientists in the field of fungal biology.” Go BB Team!

A team comprising **Elisar Barbar**, **Afua Nyarko**, **Viviana Perez**, physicist **Weihong Qiu** and **Peter Eschbach** (Electron Microscopy Facility) won the College of Science Impact Award, a new \$10,000 award which seeds an early-stage research or innovation effort that advances the College’s

strategic goals and addresses a pressing 21st century issue. Through their respective research domains, Barbar and team are rapidly establishing an internationally recognized hub focused on elucidating the multiple essential roles of intrinsically disordered proteins (IDP). Increasingly important in biological research, IDPs are central to a range of cutting-edge research at OSU, from motor proteins and the mitotic spindle (Barbar, Qiu), cancer invasion and tumor progression (Nyarko) to aging (Perez). The award recognizes how this team is establishing OSU’s reputation as a global leader in IDP research.

For the second consecutive year, **Kari van Zee** won the Olaf Boedtger Award for Excellence in Academic Advising for her tireless support, efforts and advocacy on behalf of undergraduate students. Andrew Drake, a biochemistry and molecular biology senior, presented the reward to van Zee, who received a multitude of effusive nomination letters from her students.

## Moving on up

**Michael Freitag** was promoted to full professor.

**Viviana Perez** was promoted to associate professor with tenure.

**Colin Johnson** was promoted to associate professor with tenure.

**Kari van Zee** was promoted to senior instructor and lead advisor.

*Top: Winners of the College of Science Impact Award. Below: Milton Harris Award winner Michael Freitag with Department Head Andy Karplus; and Kari van Zee with Olaf Boedtger, for whom her advising award was named.*



“Kari’s dedication to her students never fails to impress me. Despite long days in which she is responsible for supplying large lab courses, lecturing and advising, she still manages to make time for students when they need her. I have found her guidance to be practical and extremely valuable. OSU is a better place every day because of her efforts,” wrote one student.

Van Zee continues to be heavily involved in outreach to Oregon high school students and teachers. She is program coordinator of STEPs (Scientists and Teachers in Education Partnerships). We are extremely proud of her dedication and the caring mentoring that she provides to our students.

**Kevin Ahern** received two prestigious awards this year, the Elizabeth P. Ritchie Distinguished Professor Award, OSU’s highest teaching award, and the Best Mentor/Advisor award by the Oregon State University Phi Beta Kappa Society.

Throughout the years, Ahern, who teaches many survey courses in the life sciences, has been on the forefront of making education more accessible by expanding the use of technology in the classroom and offering many courses through OSU’s Ecampus. He is retiring after 32 years this December.

Ahern and his wife, senior biochemistry and biophysics instructor **Indira Rajagopal**, have published three free electronic textbooks for online learners worldwide. Ardent advocates of using technology and digital media to enhance deep scientific learning and engagement in the classroom, Ahern and Rajagopal have made significant steps towards expanding access and cutting costs for students.



## Welcoming new faces

**1 Maria Clara Franco** joined the department as a research assistant professor last summer. Born and raised in Buenos Aires, Argentina, Dr. Franco earned her bachelor and master’s degrees in molecular and cellular biology and a Ph.D. in biological chemistry at the Universidad de Buenos Aires, where she was an instructor of microbiology and immunology. She completed a Goldsmith Postdoctoral Fellowship at Cornell’s Burke Medical Research Institute in New York, and then joined the faculty at the University of Central Florida as an assistant scientist.

Now at Oregon State, Franco’s research focuses on the role of redox signaling in the regulation of cell metabolism in tumors of the nervous system. A New Investigator Award from the U.S. Department of Defense Neurofibromatosis Research Program supports her work on oxidatively modified proteins that regulate tumor growth and are not present in normal cells. She hopes to identify novel targets for the development of drugs to treat solid tumors.

**2 Alvaro Estevez** joined the department as an associate research professor in 2017. He earned his bachelor’s, master’s and Ph.D. degrees from the Universidad de Buenos Aires, performing his Ph.D. research at the Instituto de Investigaciones Biologicas Celeme

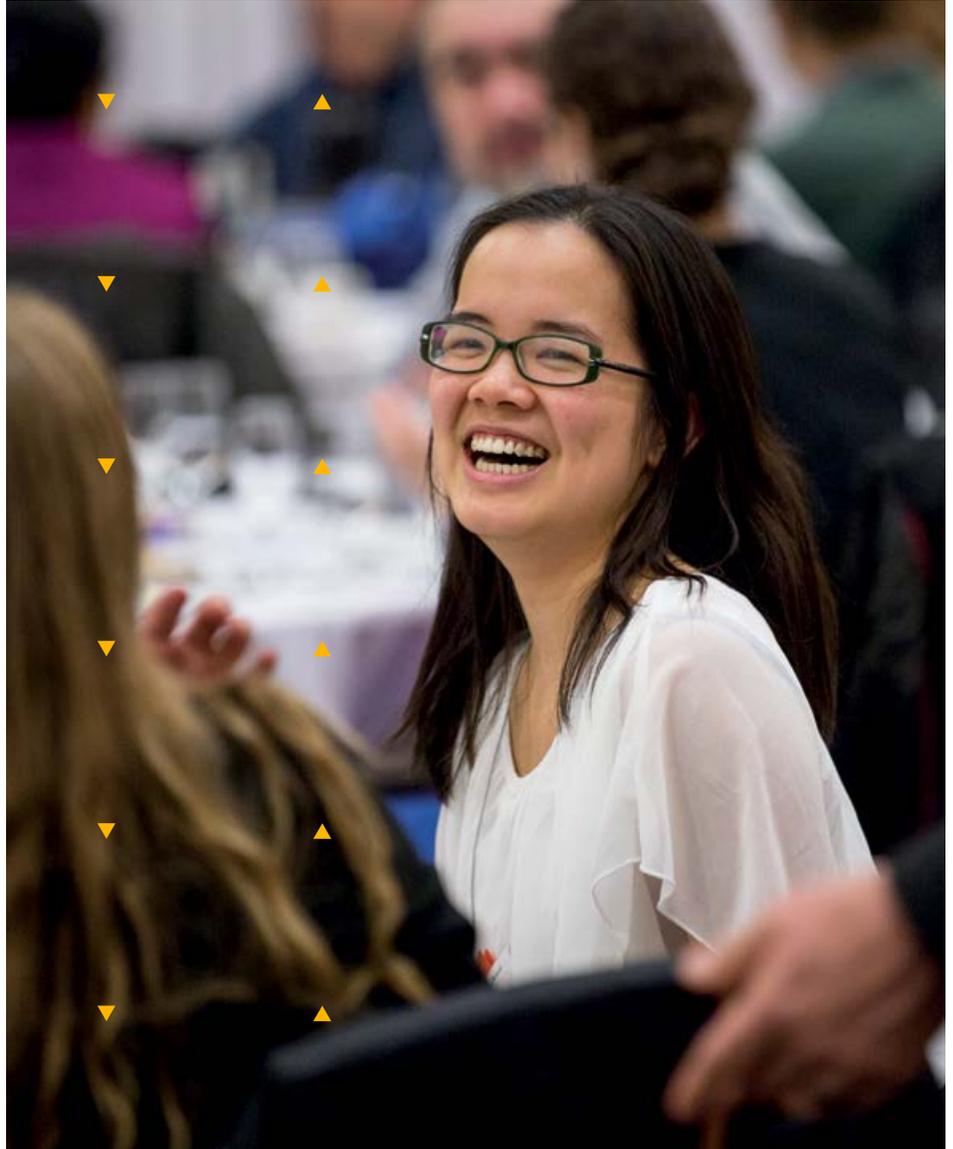
Estable in his native Uruguay under Luis Barbeito. He completed post-doctoral research in Joe Beckman’s lab at the University of Alabama at Birmingham (UAB). Estevez then joined the faculty at UAB, at Cornell University’s Burke Medical Research Institute, and finally at the University of Central Florida.

Estevez is pursuing research on the mechanisms of neuronal death induced by reactive nitrogen species and the interactions between motor neurons and glial cells in the pathology and therapeutics of amyotrophic lateral sclerosis (ALS). His lab’s approach is to culture astrocytes and motor neurons differentiated from human neuroprogenitor cells generated from fibroblasts of healthy controls and ALS patients. The lab employs multiple cellular and molecular tools, including microscopy, qRT-PCR, protein purification and analysis using mass spectrometry, western blot and dot-blot to develop antibodies, among other methodologies.

**3 Mike Albrich**, who just retired after 40 years as an ER doctor in Portland, has joined the department to work with Jim Hurst and undergraduate students in Joe Beckman’s lab. Albrich exemplifies the impact of undergraduate research on one’s life. Decades ago, he worked in Jim Hurst’s lab as an undergraduate at Washington State University. All things research come full circle!

# ON THE MOVE

Students going  
above and  
beyond



**Trisha Chau**, a biochemistry and molecular biology senior, received a 2017 Tunison Scholarship from OSU's chapter of the Phi Kappa Phi honor society for her impressive scholarly achievements. Phi Kappa Phi awards this scholarship to two outstanding juniors every year to support their senior year at Oregon State.

Chau lives life to the fullest in college. She is a member of the Taekwondo Club, plays the piano beautifully, and is pursuing minors in both music and chemistry. In a study abroad program last year, she served as a public health

teacher at an elementary school in Bali, Indonesia. She is also a volunteer math and science tutor at Corvallis High School. On top of that, Chau maintains a near-perfect GPA.

Chau works in Colin Johnson's lab, where she investigates the protein FerL-6's role in muscle development in zebrafish. She was a pediatric cardiology summer research intern at Oregon Health & Science University, where she characterized and compared vortex flows in normal and abnormal hearts. Chau hopes to pursue a career in medicine and serve underdeveloped parts of the world.

**True Gibson**, currently an Honors College senior in biochemistry and biophysics, won a 2017 Goldwater Scholarship, the top undergraduate award in the country for sophomores and juniors in STEM fields. Awardees must demonstrate an outstanding level of academic accomplishment and demonstrate a high ability to pursue a research career.

Born and raised in Eugene, Gibson started searching for research opportunities in a lab since day one on campus, finding a seat in Ryan Mehl's unnatural protein lab as a freshman. He quickly rose in the ranks to become the only synthetic chemist in the lab, a role with many responsibilities, which enabled him to contribute in vital ways to the lab's research activities. He now trains other new students in the necessary synthetic chemistry techniques and leads a team of synthetic chemists who create new and useful products for the lab.

He is currently assisting Mehl on a National Science Foundation-funded project that involves the controlled modification of amino acids to develop an ideal reaction unaffected by biological conditions. The goal is to introduce the synthesized protein into living and non-living cells to produce specific and controlled reactions that will yield many new bioengineering applications. Gibson is interested in pursuing a Ph.D. in neuroscience after graduation.



## A passion for research

by Nadjalisse Reynolds,  
biochemistry and biophysics senior

**Delaney Smith**, an Honors College junior in biochemistry and biophysics and pre-education, received a 2017 Goldwater Honorable Mention and was recently initiated into the prestigious Phi Kappa Phi honor society. Even before attending Oregon State, she was involved in research as an intern in a behavioral neuroscience laboratory at Oregon Health & Science University.

During her internship, Delaney was drawn to Dr. Angela Ozburn's work on the neurobiology of addiction, particularly how circadian genes influence the biological clock as well as the wiring of addiction in the brain and many other biological processes. She began working in Ozburn's lab, helping demonstrate that chronic alcohol consumption dampens the rhythmic expression of a major circadian gene called *Period 2* in the nucleus accumbens, also known as the reward center of the brain. She is currently testing the effects of a pharmacological inhibitor to try

to "reset" the circadian molecular clock and see if this reduces binge-like drinking in mice.

Delaney believes that research is the best way for her to contribute something meaningful and unique to society. "My experience in research has arguably taught me more than any course, and the people I've met through these experiences have become cherished mentors and close friends."

Delaney continues her research in Dr. Ozburn's laboratory during summers and academic breaks, but during the school year she can be found doing research in Jeff Chang's botany and plant pathology lab here at Oregon State. As part of Chang's team, she studies the ecological role of a toxic protein delivery system encoded by a plant pathogen called *Agrobacterium tumefaciens*.

After graduation, Delaney plans to hike the Appalachian Trail and then attend graduate school, potentially a combined M.D./Ph.D. program. She looks forward to having a career conducting biomedical research, teaching and practicing as a physician.



Congratulations to doctoral student **Isabelle Logan** who was selected as the 2017-18 Christopher and Catherine Mathews Graduate Fellow. This endowed fellowship, established in 2015 through the generosity of Chris and Kate Mathews, helps recruit and retain top-notch graduate students for the biochemistry and biophysics doctoral program.

Isabelle was born in Leuven, Belgium. Upon moving to the United States, she settled in central Oregon and earned her bachelor's degree in chemistry at Portland State University, where she successfully identified the kinetics and products of oxidation of a tuberculosis drug in her honors thesis. At Oregon State, Isabelle is working in the Gombart Lab to discover natural compounds to prevent and/or treat obesity and metabolic syndrome. She is also studying the role of vitamin D, the immune system and microbiota composition on gut barrier function, inflammation and obesity/metabolic syndrome.

**John Gamble**, a doctoral student and researcher in Julie Greenwood's lab, received a best poster award for his work on imaging cancer cell invasion in a brain microenvironment at the

2017 Microscopy Society of America Microscopy and Microanalysis meeting held in St. Louis.

Nine of the 31 2017 SURE (Summer Undergraduate Research Experience) science scholars were biochemistry and biophysics students! Congratulations to **Nicholas Brown, Richelle Castro, Mark Geisler, Blake Hakkila, Sam Hester, Youngmin Park, Miles Rouches, Mason Rouches** and **Delaney Smith**, who spent last summer actively engaged in research while working alongside faculty for an engaging, hands-on learning experience. The 2017 SURE Scholars also enjoyed a new series of three professional development workshops on team dynamics, scientific writing and presentations and informal science communication.



## Meet our new graduate students!

**1 Aiden Estelle** graduated from Oberlin College and has wanted to be a scientist since he spent time in his dad's plant hormone lab as a kid. He has worked on plant development in both *Arabidopsis* and newer model species *Setaria viridis*. Aiden's combined interest in molecular biology and organic chemistry has led him to study structural biology. In his free time he enjoys reading, writing and cooking.

**2 Kayla Jara** completed her undergraduate degree at the University of Northern Colorado and gained organic chemistry research experience working

on the synthesis of dibenzacridines and isoxazoline products. She is excited to be a part of OSU and the biochemistry and biophysics community as she further explores protein chemistry and structural research.

**3 Ruben Riordan** is a first-year student rotating through labs at OSU. A graduate of the University of Washington, Riordan has experience in organic synthesis and is interested in studying mitochondria and their relation to age-related diseases.

**4 Amber Vogel's** undergraduate research was focused on synthesizing iodonium salts in David Stuart's lab at Portland State University. She hopes to

use her chemistry background and her health-focused research at OSU to help develop drug treatment methods and ultimately a cure for type 1 diabetes. In her free time, Vogel enjoys cooking, working out, singing and hiking.

**5 Phillip Zhu** studied the regulation of yorkie, a gene transcription co-activator, in *Drosophila* as an undergraduate at the University of Washington. Drawn to OSU for both its breadth of research and rich collaboration among faculty, Zhu is interested in non-canonical amino acid science, particularly the expression of polyphosphorylated proteins. In his spare time, he likes to climb and hang out with his three-year-old son.



Top and middle: the 3rd annual Computational Biology Camp. Bottom: Biochemistry summer camp.



# OUTREACH



the door to understanding how cells respond to starvation or infection as well as mapping the role of autophagy in cancer and neurological disease.

Last spring, Perez also starred in a new video that welcomed Hispanic students and their families to campus for Mi Familia Weekend. In this motivating video, completely in Spanish, Perez shared her experiences as a member of both the faculty and OSU's diverse community at large.

**Michael Freitag, Kristina Smith** and **Kari van Zee** hosted seven high school and pre-service teachers at the OSU Cascades campus for a two-day natural products workshop supported by a National Science Foundation grant. Participating teachers learned through lab sessions and discussions how OSU researchers in biochemistry and biophysics, chemistry, and pharmacy isolate and characterize novel antibiotics from Oregon soil microbes and engineer fungal strains to express new therapeutic compounds. Freitag, Smith and van Zee plan to offer this successful outreach workshop again this summer.

**David Hendrix**, along with graduate students **Lillian Padgitt-Cobb, Rosalyn Fey, Anh Ha, Jack Koch,** and **Michelle Wiley**, and undergraduate

**Ben Sebastian**, led the 3rd annual Computational Biology Camp last August. Middle school students from around Oregon learned basic Python programming, used tools for the computational analysis of protein and RNA sequence and structure, and played games reinforcing programming and computational biology concepts.

## Paying it forward to the next generation of scientists

For the fourth consecutive year, our biophysics and biochemistry graduate students hosted a weeklong biochemistry summer camp for 14 middle school students! With the support of OSU's STEM Academy, students **Kelsey Kean, Robby Blizzard, Shauna Otto, Riley Bednar, James Miyasaki, Elise van Fossen, Dan Breyse, Ally Erlendson** and **Nathan Waugh** led students through exciting, glowing, and sometimes explosive hands-on activities. Campers grew protein crystals, isolated nematodes from local dirt samples, purified green fluorescent protein, tested different tissues for catalase activity, observed phenotypic differences in zebrafish knockdowns, and isolated DNA from strawberries. Our department will offer the camp again this summer. Spots are likely to fill up fast!

## Advocating for science

**Viviana Perez** delivered a public lecture entitled "The Importance of Keeping our Cells Clean" at the Corvallis Public Library to help popularize the research of Yoshinori Ohsumi, winner of the 2016 Nobel Prize in Physiology or Medicine. In the early 1990's, Ohsumi discovered and elucidated the mechanisms underlying autophagy, a fundamental process for degrading and recycling cellular components. His research opened

# 50 YEARS

1967

The Department of Biochemistry and Biophysics held its 50<sup>th</sup> anniversary gala during Homecoming weekend in October 2017. The celebration offered an opportunity to reflect on how far we have come, reaffirm the value and strength of our community and imagine a vital future. Professors, students and alumni participated in a full weekend of festivities, including a research symposium on Friday followed by a dinner, a picnic on Saturday morning at Avery Park and a hike to wrap things up on Sunday.

Founded on July 1, 1967, the department has grown over the last 50 years and currently includes about 20 faculty, 275 undergraduates, 30 graduate students and 850 alumni. Beginning exclusively as a graduate program, the department soon added an undergraduate program, producing its first B.S. graduate in 1972, and just last fall launched a new biochemistry and molecular biology major.

At the 50<sup>th</sup> anniversary celebration, two of our founding faculty members attended the historic occasion, **Dr. Derek Baisted** and **Dr. Bob Newburgh**, who was also the first-ever department chair. Five alumni who were Ph.D. students during the first year of the program attended as well, many of whom had not seen each other since graduation so many years ago.

“It was wonderful to bring together in one place people spanning the entire history of the department, from its very beginnings until today,” remarked Professor **Kevin Ahern**. “We were happy to connect with old friends and to learn of the many successes of our graduates.”

Friday’s research symposium, organized by Professor **Adrian Gombart**, featured lectures by seven biochemistry and biophysics professors. **David Hendrix’s** “Healthy Aging and the Circadian Clock,” **Colin Johnson’s** “Sounds Fishy: Using Zebrafish to Understand Hearing and Deafness,” and **Joe Beckman’s** “Did free radicals kill Lou



Susan Johnson, W. Curtis Johnson, Jr.,  
Adrian Gombart



Thomas Tiffany ('69), Bob Newburgh (faculty),  
Arnold Epstein ('71), Derek Baisted (faculty),  
Anne Kiessling ('71), Thomas Hinds ('72),  
Gerald Adams ('71)



The Jazz First Trio (Affiliate faculty Alan  
Bakalinsky on drums)

# of biochemistry and biophysics

by Nadjalisse Reynolds, biochemistry & biophysics senior

2017

Gehrig? Progress towards treating ALS” provided a fascinating overview of the excellent research and accomplishments that have spurred momentum in the department. The symposium also highlighted student contributions and celebrated the department’s enduring dedication to innovative teaching.

After the symposium, faculty and alumni headed downtown to Vue for an engaging evening of dinner, speeches, socializing and music by the Jazz First Trio led by Professor **Alan Bakalinsky**. Department Head **Andy Karplus** served as the evening’s emcee, welcoming several students, alumni, and current and past faculty members to the podium to share their experience and perspectives. Many spoke warmly of how their training in biochemistry and biophysics prepared them for their careers and shaped them as individuals, emphasizing how much they enjoyed being a part of the family-like community fostered within the department.

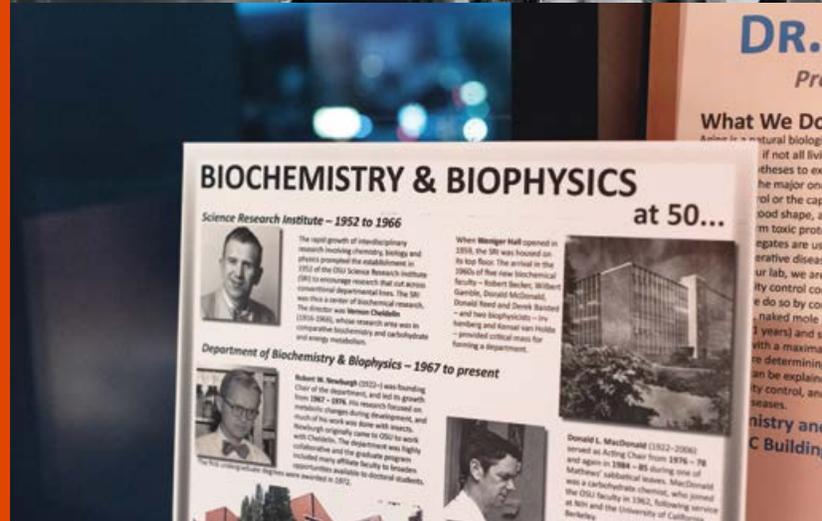
“To see that the department has had such a positive effect on some of the alumni was special and makes you want to work harder and accomplish more,” noted Professor **Victor Hsu**.

On Saturday, the festivities continued with a picnic and tailgate party organized by professor **Gary Merrill** at Avery Park, after which participants made their way to Reser Stadium to watch the homecoming football game. The weekend concluded Sunday morning with a hike, led by graduate student **Nathan Waugh**, of Fitton Green Natural Area, where lucky adventurers enjoyed clear skies and scenic views of Bald Hill and Mary’s Peak.

We appreciate the efforts of the 50<sup>th</sup> anniversary organizing committee members **Victor Hsu** (chair), **Adrian Gombart**, **Kevin Ahern**, **Gary Merrill**, **Chris Matthews**, **David Hendrix**, **Nathan Waugh**, and **Dani Stevens**. We are especially grateful to **Kate Andrews** for volunteering her expertise in event planning.



Fred Stormshak, Barbara Taylor, Kari van Zee



Former Chairs Bob Newburgh, Chris Matthews and Gary Merrill with current head Andy Karplus



Alumna Karen Nickel ('61)



# FROM THE LABS

Ryan Mehl with graduate  
student Elise Van Fossen

## Mehl Lab / New technology for attaching proteins

Since the mid-1990s, biochemistry professor **Ryan Mehl** has been working to find the perfect chemical reaction for attaching proteins to just about anything, one that would work so quickly and efficiently, it could change the way proteins are used in medical, material and environmental applications.

Such persistence is now paying off. Mehl, who is also chief technology officer of xBiologix Inc., has developed a reaction called ideal bioorthogonal ligation that accomplishes a goal sought by many other scientists: controlling protein deposition and orientation on surfaces.

xBiologix's technology uses genetic code expansion to add new amino acids that allow a protein to react and attach to surfaces in an orientation-specific way. Proteins naturally use 20 amino acids, but this method allows scientists to swap natural amino acids

What Mehl calls the “special sauce” for the ideal bioorthogonal ligation is how the proteins can attach to anything incredibly quickly, but also cleanly. His team is using this knowledge to develop medical and environmental devices — known as sensors — that last longer and are more sensitive than currently existing sensors.

Mehl's protein-attaching technology offers a host of potential applications, from the design of long-lasting sequestering materials for coal-fired power plants to remove a percentage of carbon dioxide from their emissions, to sensors that could improve antibody drugs intended to kill only cancer cells, or sensors that detect glucose and lactate to monitor a person's response to exercise or surgery. The possibilities are almost endless.

“For every sensor that's on the market, 100 have failed,” Mehl says. “If we could take 10 out of that 100 and make them feasible because of our technology, we'll be in a great place.”

rapamycin, long known for its immunosuppressive and anti-aging properties, one that researchers say might help prevent neurologic damage and related diseases. Rapamycin helps prevent “cellular senescence,” says Perez, “a stage cells reach where they get old, stop proliferating and begin to secrete damaging substances that lead to inflammation.”

This secretion of damaging compounds creates a toxic environment called senescence-associated secretory phenotype, or SASP. Scientists believe this disrupts the cellular microenvironment and alters the ability of adjacent cells to function properly, compromising their tissue structure and function.

“The increase in cellular senescence associated with aging, and the inflammation associated with that, can help set the stage for a wide variety of degenerative disease, including cancer, heart disease, diabetes and neurologic disease, such as dementia or Alzheimer's,” Perez said. “In laboratory animals when we clear out senescent cells, they live longer and have fewer diseases. And rapamycin can have similar effects.”

Prior to this, there was only one known mechanism of action for rapamycin in this process. Scientists believed it helped to increase the action of Nrf2, a master regulator that can “turn on” up to 200 genes responsible for cell repair, detoxification of carcinogens, protein and lipid metabolism, antioxidant protection and other factors. In the process, it helped reduce levels of SASP.

The Perez Lab has discovered that rapamycin can also affect levels of SASP directly, separately from the Nrf2 pathway and in a way that would affect neurons as well as other types of cells.

with specifically reactive amino acids that do not exist in nature. The added amino acids serve as anchor sites, causing all proteins to align in the same direction.

## Perez Lab / Slower aging with rapamycin

**Viviana Perez** has identified a second mechanism of action for



Viviana Perez with student Luz Jovita DÍmas

## Gombart Lab / Infection-fighting sutures

Anti-infective sutures used today typically contain triclosan, an antibacterial and antifungal agent found in a variety of consumer products. Triclosan, however, poses a wide variety of health risks, from endocrine disruption to liver damage and cancer. In addition, its overuse contributes to antibiotic resistance.

In what could be a game-changing development in the prevention of surgical site infections, a multibillion-dollar cost each year in the United States alone, **Adrian Gombart** and his collaborators at the University of Nebraska Medical Center in Omaha, West Virginia and China, have invented a new nanofiber suture loaded with vitamin D and a peptide. Together, these materials trigger the body's own cells to both convert the vitamin D into its bioactive form and increase vitamin D target gene expression at a cellular level. Why is that important? One of the vitamin D target genes produces the peptide LL-37, which kills microbes by disrupting their membranes. In other words, the sutures both supply the raw materials and trigger the body's own cells to use them in the production of infection-fighting peptides.

But that's not all – Gombart and colleagues believe that the vitamin D delivered by the sutures could also affect additional genes involved in the immune response. Moreover, the nanofiber sutures are highly configurable and thus capable of delivering a variety of other bioactive compounds, an exciting innovation as “none of the currently available sutures has this level of function.”

## A hub for research without borders

By hosting international and national workshops and symposia, the biophysics and biochemistry department continues to strengthen its connections across research and industry, raising its regional, national and global visibility. We strive to foster collaboration and networking in the pursuit of fundamental knowledge and world-changing applications.

### INAUGURAL BIO-NMR SYMPOSIUM

The Department of Biochemistry and Biophysics co-hosted the **Inaugural Biological Nuclear Magnetic Resonance (BioNMR) Symposium** with the NMR facility and the College of Science last August. Approximately 100 attendees learned how NMR illuminates biology at this one-day event featuring internationally recognized experts, including Richard Kriwacki (St. Jude Children' Research Hospital), Valerie Copie (Montana State University), Rachel Klevit (University of Washington), Michael Chapman (Oregon Health & Sciences University), Dorothee Kern (Brandeis University), Clemens Anklin (Bruker Corporation) and David Wemmer (University of California Berkeley). The event also featured a poster session, research talks by students and postdocs and a special session on careers in BioNMR with a broad spectrum of panelists from national labs, academia and industry.

The expert-led workshops and talks covered a variety of topics, including structural biology, intrinsically disordered proteins, drug discovery and metabolomics, all demonstrating how NMR can be used to study complex biological processes. One of many interesting highlights was when



## Honing professional skills

For both undergraduate and graduate students, professional conferences hosted on campus are a wonderful opportunity to practice professional skills such as networking, public speaking and presenting their research.

At the BioNMR symposium, for example, students participated in the conference fully alongside professionals and played important roles. Four students — **Donovon Adressa, David Gallegos, Nathan Jespersen** and **Sarah Clark** — were selected to give short talks during the symposium, talks which were deemed a highlight of the symposium by many attendees.

In addition, graduate students **Kasie Baker, Dani Long, Isabelle Logan, Shauna Otto, Elise Van Fossen, Andrew Popchock, Daniel Breyse** and **Heather Forsythe** moderated sessions or introduced speakers. Several students participated in the poster session as well, presenting their NMR-based research and networking with attendees. Students also greatly benefited from the career panel session of scientists from a range of backgrounds and asked good questions of the panelists.

Dorothee Kern discussed her research that reveals how enzymes evolved to cope with slower catalytic speed as the earth cooled. Cool!

At the end of the day, participants enjoyed networking and debriefing over a complimentary dinner at Tye Wine Cellars in Corvallis, a wonderful and memorable end to the symposium. We are grateful to ISOTEC, the world's largest producer of enriched stable isotopes, for funding the dinner and to all of the other corporate sponsors of the symposium, including Bruker Corporation, Norell, New Era, and Cambridge Isotopes.

We appreciate the efforts of professor **Elisar Barbar**, along with NMR Facility director **Patrick Reardon**'s, in organizing the event and leading the university's efforts to secure funding for our 800 MHz spectrometer, the highest field NMR in Oregon and one of only 50 nationwide. The OSU NMR Facility, a campus-wide core facility dedicated to providing state-of-the-art NMR spectroscopy resources to the research and education community at OSU and throughout the Pacific Northwest, houses the new instrument.

### THIRD ANNUAL GENETIC CODE EXPANSION WORKSHOP

**Ryan Mehl**, **Rick Cooley** and **Kari van Zee** hosted the department's third annual Genetic Code Expansion (GCE) Workshop at OSU's Unnatural Protein Facility July 31–August 5, 2017. The weeklong intensive laboratory and lecture workshop attracted 17 participants from across the country and the world, including graduate students, postdoctoral fellows and research scientists in industry and academia. Six of the participants were women.

For those unfamiliar, GCE is a novel fusion of synthetic and chemical

biology that enables researchers to modify the genetic code of an organism to allow it to efficiently produce a protein with new chemical functionality *in vivo* or *in vitro*, with the goal of engineering living systems for useful purposes. Topics this year included bioorganic chemistry within cellular and molecular processes; drug discovery efforts; material science; and development of interdisciplinary research tools and probes.

Workshop participants arrived on campus with their experiments in hand, ready to collaborate, solve problems and resolve challenges that may have stumped them back in their home labs. Acquiring new knowledge and making progress on their experiments is a primary reason both young and experienced scientists flock to the GCE Workshop.

We are deeply grateful to everyone who supported this event. This



Above and overlay: Students working with Biochemistry and Biophysics mentors at the Genetic Code Expansion Workshop



year National Science Foundation funds were combined with support from the department (\$2,000) and the College of Science (\$2,000) to fund five full scholarships and five half scholarships. These funds were critical to attracting the most diverse group yet for GCE training. Corporate sponsors VWR International, SiChem, Bio-Rad Laboratories, Inc. and Thermo Fisher Scientific provided support for reagents, supplies and GCE collaboration-building dinners that build community and offer networking opportunities. Without this support, we would have been unable to attract students from around the world!

Participants represented a diverse range of institutions and companies, including Hankuk University of Foreign Studies (Korea), The Cleveland Clinic, University of Washington, University of Colorado, Harvard University, Colorado State University, Cornell University, University of Warwick (UK), Colorado State University, Washington University in St. Louis, OSU College of Engineering, University of Pennsylvania, University of Minnesota, Genentech, Merck and AbbVie.

Plans are already underway for summer 2018, which will include a GCE Conference from August 9-11, 2018, in addition to this pre-conference workshop.

A photograph of a man and a woman standing on a rocky mountain trail. The man is on the left, wearing a light-colored button-down shirt and dark shorts. The woman is on the right, wearing a red patterned shirt and dark shorts, with her arm raised towards the mountains. The background features large, rugged mountains with patches of snow under a clear blue sky. The text 'MAKING US PROUD' is overlaid on the right side of the image in a large, blue, textured font.

# MAKING US PROUD

Alumni + Friends

Sonja Berge Chandler ('82) and  
her husband Peter

## Berge Chandler Scholarship

**Sonja Berge Chandler** ('82) and her husband **Peter** remain grateful for the scholarships they received as students, and it gives them great satisfaction to pay it forward by endowing the Berge Chandler Scholarship. The awards are based on merit and financial need and given to rising juniors majoring in biochemistry and biophysics. Sonja recently sat down to reminisce about her time as a student and how it influenced her.

"I look back on my time at OSU fondly, especially being a part of the undergraduate community in biochemistry and biophysics. Transferring into the major as a sophomore, I was inspired by what biochemistry and biophysics had to offer in understanding the processes of living things. My cohort was small in number, and, as our class schedules included big blocks of time spent in labs, we really got to know each other. The list of emeritus professors on the current departmental website basically sums up the teachers and researchers whom I interacted with during my time in the department, including Robert Becker and Irv Isenberg. I learned a lot from them all.

"I finished my undergraduate degree in June of 1982 and was a Peace Corps volunteer teacher in Kenya for two years. While in training, one of my fellow volunteers and I were talking, and the topic of rat liver cell isolation and perfusion came up (as it does!), and we shared a laugh over how we had both done the procedure. I thank Donald Reed for the opportunity of being in his lab as an undergraduate research assistant.

"On returning to the U.S. in 1985, I again enrolled at OSU, this time in the genetics Ph.D. program. I was interested

in how plants developed at the molecular level. Through my graduate years, my links to biochemistry and biophysics continued through my classes and having George Pearson sit on my doctoral committee. During the third year of my program, I worked in Australia at the labs of CSIRO Plant Industry. During this time, I met and married my Australian plant researcher husband, Peter. After finishing my Ph.D., I spent about 10 years teaching undergraduate biology and biochemistry at the University of Canberra. Then I moved to the Australian Academy of Science where I worked in their publications section. Now, I'm a freelance science writer/editor. Peter and I live in New South Wales near Canberra and have two children, Kate and Ross.

"Throughout our student careers, both Peter and I were fortunate to receive scholarships from different sources. Each scholarship represented someone believing in us, seeing that we had potential that should be nurtured. The financial and moral support that accompanies scholarships is important and we want to pass that on to the students of today."

## Lifetime Achievement Alumni Award

**Christopher Mathews**, distinguished emeritus professor of biochemistry and biophysics, received the 2017 Lifetime Achievement Alumni Award in Science last fall. A pioneering biochemist, Mathews has been one of the most distinguished scientists at Oregon State since his arrival here in 1977 as chair of our department. From advancing the study of DNA synthesis and replication to groundbreaking research in nucleotide and coenzyme metabolism and nucleic acid enzymology, Mathews has played a leading role in establishing Oregon State's reputation as an important center for molecular genetics. He was instrumental in the

founding of the Center for Genomic Research and Biocomputing, which today facilitates genome-enabled and data-driven research in the life and environmental sciences. Always in the thick of scientific exploration and collaboration, Mathews and his 35 Ph.D. students, postdocs, research assistants and 150 undergraduate students have explored looming questions in the field of regulation of DNA precursors and enzymology.

In 2015, Mathews and his wife Kate made a legacy gift to inspire future generations of biochemists at Oregon State, the Christopher and Catherine Mathews Graduate Fellowship. We are grateful for their support!

## Joel Peterson travel awards

Six undergraduates were the first to receive the new Joel Peterson Travel Awards, established by microbiology alumnus Joel Peterson ('69), who founded Ravenswood Winery after working as a research immunologist at the Harold Brunn Institute for Cardiovascular Research in San Francisco and as a clinical lab scientist at Sonoma Valley Hospital. **Brian Josephson** (Freitag Lab) presented his work last March at the 29th Fungal Genetics Conference in Asilomar, California. **Dani Stevens** traveled to Plön, Germany for a summer research internship with Dr. Eva Stukenbrock. **Trisha Chau, Richelle Castro, Garth Kong, and Ryan Chung** were all given travel awards to attend undergraduate-focused research conferences in April 2017.

## Rising Young Alumni Stars

### UNDERGRADUATE ALUMNI

Congrats to **Joely Hannan** ('17), who was honored last spring at the annual Oregon State Athletics Academic

Achievement Dinner for maintaining a 3.0 average while competing on the OSU Women's Rowing Team.

Two recent alums, **Lynda Bradley** ('15) and **Arianna Kahler-Quesada** ('17) received prestigious Fulbright Awards for the 2017-18 academic year. Sponsored by the U.S. State Department, Fulbright is the largest U.S. international exchange program, offering opportunity for students, scholars and professionals.

Bradley, who is keenly interested in both local and international infectious disease research, used her Fulbright award to travel to South Africa. There she is collaborating with Dr. Alexander Pym at the KwaZulu-Natal Research Institute for Tuberculosis and HIV on a project to characterize mutations of antibiotic-resistant strains of tuberculosis and work towards finding a combination of antibiotics to inhibit the strains' growth.

Kahler-Quesada, who aspires to study medicine upon her return to the United States, is working with Dr. Christian Toso at the University of Geneva, Switzerland, to investigate the role of obesity in the growth of liver cancer. Supplementing her Fulbright scholarship, Kahler-Quesada was also awarded a prestigious Institute of International Education (IIE) Seydel grant for study in Switzerland.

#### GRADUATE STUDENT ALUMNI

**Sara Codding** (Ph.D., '17) worked in Colin Johnson's lab on characterizing the role of the protein dysferlin in muscle repair and muscular dystrophy. Codding's work implicated dysferlin in the resealing of holes in muscle cell membranes, suggesting it may serve as a catalyst for plasma membrane patching. She received her bachelor's degree from Humboldt State University

and is currently a postdoctoral researcher in the Department of Physiology at the University of Maryland School of Medicine.

**Steve Friedman** (Ph.D., '17) worked in the Freitag Lab on centromere DNA sequences and chromatin structure in fungi, using high-throughput sequencing technologies to map rare gene conversion events. He and his wife Annie moved to Salt Lake City, where Friedman works at ARUP Laboratories, a national reference laboratory owned by the University of Utah that develops unique tests for complex biomedical applications. Currently, he is analyzing genomics data from patients for clinical oncology diagnostics.

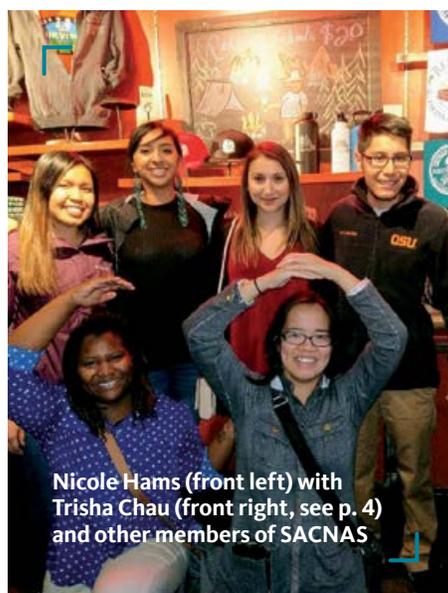
**Nicholas Thomas** (Ph.D., '17) completed his dissertation in Tory Hagen's lab in June. His project, entitled "Age-related Decrease in Resilience Against Acute Redox Cycling Agents: Critical Role of Declining GSH-dependent Detoxification Capacity," elucidated a mechanism by which redox cycling compounds are increasingly toxic with aging and identified a method for bolstering cellular detoxification capacity to reduce this age-related vulnerability. Upon graduation, Thomas received a fellowship on the NIH T32 Grant, "Complementary and Alternative Medicine Research Training in Neurosciences and Stress." He is currently in the first year of this fellowship working at OSU and Oregon Health & Sciences University to explore the utilization of nicotinamide riboside to prevent or delay mitochondrial dysfunction related to neurological decline in both normative aging and Alzheimer's disease.

**Rachel Henson** (M.S., '17), who worked in Ryan Mehl's lab, completed her master's thesis on genetically incorporating halogenated tyrosine into proteins with genetic code expansion



### Join us this summer!

We invite BB alumni to join us for our annual summer hike with BB faculty and students. Last year's excursion to Sweet Creek Falls and Beaver Creek Falls was highly popular, drawing a healthy crowd of 25 people. Watch for the date and location of our summer 2018 excursion on our website sometime in June. We hope you can join us on this fun outing!

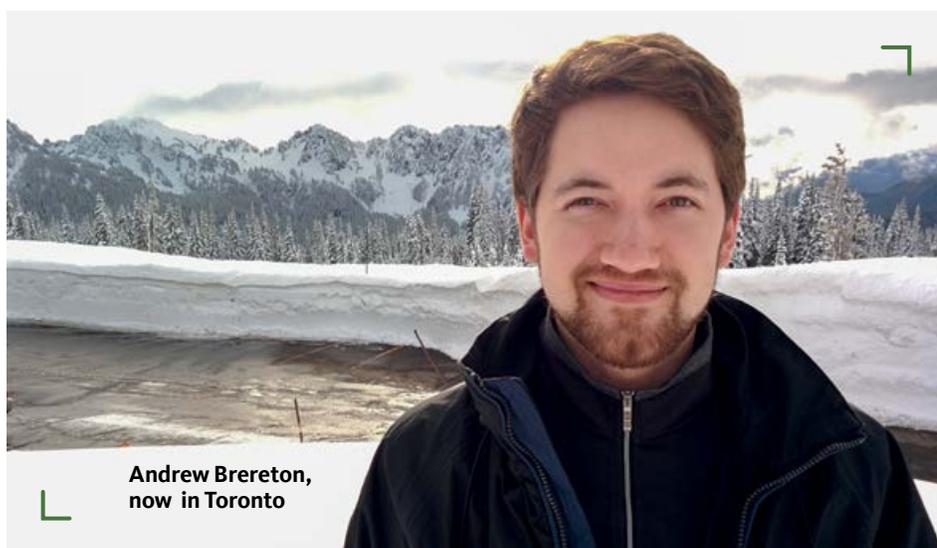


Nicole Hams (front left) with Trisha Chau (front right, see p. 4) and other members of SACNAS

to explore the role of halogenated tyrosine in oxidative stress. This work supports an NIH-funded award on oxidative stress. Henson returned to Missouri where she works at Washington University School of Medicine in the Knight Alzheimer's Disease Research Center as part of its Dominantly Inherited Alzheimer Network Biomarker Core.

**Andrew Brereton** (Ph.D., '17) did computational work in the Karplus Lab to glean information from thousands of known protein structures. Studies

included the unprecedented mapping of a highly distorted conformational transition state and developing a powerful new software package – the Ensemblator v3 – for protein structure comparisons. Thanks partly to his thorough understanding of protein structure and expert Python and R coding skills, Brereton was hired as a bioinformatics developer with Cyclica, a Toronto biotech startup that focuses on problem solving related to systems biology and drug design. He says work there is fast-paced and he has already been involved in two patent disclosures.

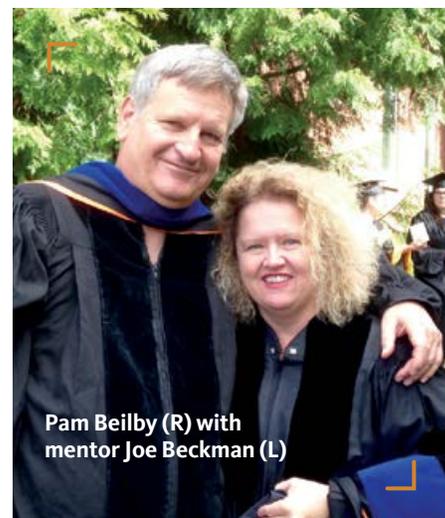


**Andrew Brereton,**  
now in Toronto

**Nicole Hams** (Ph.D., '17) has distinguished herself as both an exceptional young researcher and an impassioned advocate for underrepresented minority students in science. Last year, her peers selected Nicole as the 2017-2018 Western Regional Representative to the National Black Graduate Student Association (NBGSA), the nation's largest interdisciplinary graduate organization for students of African descent in all fields of study. During her two-year term, Hams plans to host a national conference for graduate and undergraduate students at OSU in the summer of 2019.

Hams' NBGSA ambassadorship adds to what is already an impressive roster of service. She is the vice president of SACNAS (Society for Advancement of Chicanos/Hispanics and Native Americans in Science), the co-founder and coordinator of the Graduate Student Ambassador Program, and the Education Chairperson of NAACP (National Association for the Advancement of Colored People) in Corvallis.

Hams is also a rising scientist. She recently published in the highly prestigious journal *Proceedings of the National Academies of Sciences* along with her advisor Colin Johnson,



**Pam Beilby (R) with**  
mentor **Joe Beckman (L)**

**Pamela Beilby** (Ph.D., '17), who worked in Joe Beckman's lab, defended her thesis on the role of cellular senescence and glutathione in amyotrophic lateral sclerosis last May. She continues to work in Beckman's lab, optimizing the synthesis of mitochondrial-targeted glutathione derivatives. This work is part of a grant recently awarded to Beckman and Tory Hagen from OSU's Office for Commercialization and Corporate Development (OCCD) to develop the glutathione derivatives for treating age-related diseases including neurodegeneration and heart failure.

biophysicist Weihong Qiu and former biochemistry doctoral student Murugesh Padmanarayana, research on new experimental methods to study otoferlin—a protein associated with human deafness. Last October, Hams presented her research at the national SACNAS conference in Salt Lake City.

Nicole came to OSU from the University of Missouri, where she received her bachelor's degree. After earning her Ph.D. last fall, she accepted a postdoctoral research position in the OSU College of Agricultural Sciences.

Department of  
Biochemistry and  
Biophysics

Oregon State University  
2011 Agricultural and Life  
Sciences Building  
Corvallis, OR 97331

[biochem.science.oregonstate.edu](http://biochem.science.oregonstate.edu)



Oregon State University  
College of Science



**Real Estate = Real Opportunity**

*Your gift of property can open doors at OSU*

Learn how you can boost your retirement plans through a life-income gift, eliminate capital gains taxes, and create life-changing opportunities for students. All with real estate! Contact us today.

**Julie Irmer**, Office of Gift Planning  
800-336-8217 • [Gift.Planning@osufoundation.org](mailto:Gift.Planning@osufoundation.org)  
[osufoundation.org/giftplanning](http://osufoundation.org/giftplanning)



Oregon State University  
Foundation

