

The *Catalyst*

Department of Biochemistry

2018



Need some good advice? Ask them.

PURDUE
UNIVERSITY

College of Agriculture



Welcome

Dear alumni, students, staff, faculty and friends of the Department of Biochemistry:

More faculty members — and more awards.
Record undergraduate enrollment. Again.
A significant increase in graduate students.

Those examples show why these are exciting times in the Department of Biochemistry. I welcome the opportunity to share the good news in this issue of *The Catalyst*.

Let's start with the faculty. Thanks to the Basic Plant Science hiring initiative, two new faculty members joined the department this year: Dr. Jennifer Wisecaver in August 2017, and Dr. Xing Liu in January 2018. They are off to a great start. They recruited their first graduate students, who joined their labs in April.

In 2017 our faculty received three College of Agriculture awards: Professor Clint Chapple, Outstanding Graduate Mentor; Professor Joe Ogas, David C. Pfendler Outstanding Undergraduate Counselor; and Professor Orla Hart, Outstanding Service to Students. They are all highlighted in this edition of *The Catalyst* and are featured on the cover.

We are also very proud of Professor Andy Tao, who was awarded the 2017 Purdue Outstanding Commercialization Award. This prestigious award is given annually to a Purdue faculty member in recognition of outstanding contributions to, and success with, commercializing Purdue research discoveries. Among his many discoveries, Professor Tao recently discovered a method to detect and monitor breast cancer using a simple blood test, and bladder cancer using a urine test. (See Page 18).

A number of faculty received new grants or were renewed for additional years of grant funding. Our sponsored program expenditures in 2017-2018 are once again the largest ever at \$5.89 million, which is up from \$4.67 million (2016-2017), which was also a historical high (see Page 24). One of the most notable accomplishments in this year's research funding portfolio was for Humaira Gowher, Assistant Professor, who received three grants — from the National Institutes of Health, National Science Foundation, and American Heart Association. Our research productivity in grant funding was matched by another historical high — 68 peer-reviewed research publications in such high-impact journals as *Science*, *PNAS*, *Plant Cell*, the *JBC*, *JMB*, *Molecular Cancer Therapeutics*, *PLoS Genetics*, *PLoS Biology*, etc.

For the third year in a row, our undergraduate Biochemistry program has experienced record enrollment. With the addition of 38 new freshmen in 2017, we now have 173 students enrolled. That shattered our enrollment goal of 150 students by the 150th anniversary of Purdue University, which occurs in 2019 (see Page 24). It appears that our record-breaking enrollment “train” is not going to stop: Our incoming undergraduate class for the fall of 2018 is more than 50! The word is getting out that the Department of Biochemistry's undergraduate program in Biochemistry is the best of the three at Purdue and, in our opinion, the best in Indiana. It is the only American Society of Biochemistry and Molecular Biology (ASBMB) accredited program in Indiana; there are only four such accredited programs in the Big Ten Conference.

The number of new students entering our graduate program is also beginning to increase significantly. In 2017 we had nine new graduate students enter our program. For the upcoming fall 2018 semester, a record-setting 13 new students will enter our program. This increase is key for supporting the research programs of our new and existing faculty as well as for supporting the training and education of our growing population of undergraduate students. There is a lot of excitement among the faculty and around the department for onboarding 13 outstanding new graduate students this August.

The trajectory of our teaching, research and outreach missions is on a rapid rise. It is an honor to lead such a vibrant group of faculty and students and to be able to share their accomplishments with you through *The Catalyst* and now through our monthly electronic newsletter, *Molecular Matters*. I hope you enjoy reading our stories, as we have so many to share. We also want to hear about *your* stories, so please share them with us so that we can share them with all of our alumni and friends.

Andy Mesecar - Department Head

On the cover



“Biochemistry is for everybody. It’s not as hard as people think!”

Orla Hart believes that, and she will make a believer out of you, too. (Resistance is futile.)

Of course, the academic path isn’t always smooth. Purdue Biochemistry students can

count on support from throughout the department. In this issue of *The Catalyst*, we salute three professors who received College of Agriculture Faculty and Staff Awards because — this list is not exhaustive — they excel at saying the right thing, being a good listener, knowing how hard to push, and helping make the big picture come into focus.

- Distinguished Professor Clint Chapple is the Outstanding Graduate Mentor/Teacher.
- Associate Professor Joe Ogas is the David C. Pfendler Outstanding Counselor.
- Clinical Assistant Professor Orla Hart won the Outstanding Service to Students award.

“It’s nice to be recognized,” Ogas, the head advisor for undergraduates, says. He reads a lot about education. “Always trying to pick up new ideas, things that work. We’re all different. You try something and you try it again. Nothing is 100% guaranteed to work.”

Before coming to Purdue, Hart was “exposed to more structured teaching methods.” She fondly recalls frequent

conversations with Chapple about teaching and learning, and Ogas is her “go-to person to bounce ideas off.”

“One of the really nice things,” she says, “about both Clint and Joe: Holding the students to a standard higher than they think they can obtain themselves. Making them do things they’re a little bit uncomfortable doing. Because you know they can do it, but when they start off, they don’t know they can do it.”

“That’s where you do your best learning — when you’re uncomfortable. It should be the same for me, right? I should be pushing myself in the classroom to see how I’m able to do this more effectively.”

In an otherwise inspirational recent New York Times essay, a University of North Carolina student called graduate school at U.S. research institutions not only stressful but “a notoriously isolating experience.” At Purdue, scores of Biochemistry graduate students have felt less isolated because Clint Chapple pays attention.

“Our most significant product as faculty is not our research but our students,” the former department head says. When students get off track, choosing a strategy is challenging. “All of these people are individuals. They all have their own needs for motivation, guidance, and supervision. Some need a lot, others little.”

From Canada, California and Ireland — three professors worth knowing. Their stories start on Page 2 of this year’s *The Catalyst*. Thanks for reading.

— Chuck Wineland/Communications Specialist,
Department of Agricultural Communication

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He did more than listen

*Grad students weren't happy. Want to talk about it?
In 2008, Clint Chapple learned a lot over lunch.*

Clint Chapple

Distinguished Professor, 2007-present

Head, Department of Biochemistry, 2008-2015

Professor, 2000-2007

Associate Professor, 1997-2000

Assistant Professor, 1993-1997

Ph.D. (Department of Chemistry and Biochemistry),
1989, University of Guelph, Ontario, Canada, 1989

Master's (Botany), University of Guelph, 1984

Personal reflections on involvement in graduate training

By Clint Chapple

I have been committed to graduate training since arriving at Purdue University in 1993.

My initial administrative efforts were relatively modest, as would be expected for an assistant professor. I served on the admissions committee for the Plant Biology Program (PBP) and the Purdue Genetics Program (PGP) and assembled a recruiting brochure as part of an effort to reinvigorate the graduate program of the Department

of Biochemistry, which had become solely dependent on the Biochemistry and Molecular Biology (BMB) program that had been established in the mid-1960s.

Eventually, Randy Woodson, Director of PBP at the time, suggested that I take over his role, an offer that I accepted once I was promoted to Associate Professor. Not long after that, then-Provost Sally Frost Mason issued a challenge to the directors of PBP, BMB, PGP and the Purdue Neurosciences Program (PUN) to develop an overarching graduate program that would subsume these individual programs with the promise of centralized administrative graduate student assistantship support.

This very challenging task took almost three years to complete. The committee, including Stan Gelvin, Richard Kuhn, Steve Broyles, Chris Sahley and me, worked to obtain faculty buy-in. I presented the vision for what would become PULSe to faculty groups in four two-hour sessions. Participation was extensive and often quite animated. I continued to serve as PBP director for the students still enrolled in that program, and also served as Executive Director of PULSe for its first two years. PULSe recently celebrated its 10-year anniversary.

In May 2008 I interviewed for the position of Head of the Department of Biochemistry. I knew going into the interview that there was significant discontentment among our cadre of departmental grad students. During my two-day interview, I had a lunch meeting scheduled with graduate students. Once everyone had their sandwiches, I went over to the door of the room, closed it, sat down and said, "OK, let me have it." They did. I worked diligently during the next few years to address their issues, and as a result of that lunch meeting, met with them annually over lunch to listen to their concerns. At the fourth yearly meeting, their attitude was entirely different because of the improvements that the department had been able to make. It was truly gratifying to be able to help effect such a change.

Within my own lab, I have found graduate student training to be a vital and rewarding component of my role as a professor. Vital because for the most part, graduate students are the research engine that drives scientific progress at universities such as Purdue. My graduate students have been critical to my own success in research, and I am grateful for that. Rewarding because our most significant product as faculty is not our research but our students. It is through them and their efforts that we will have the biggest impact on the world.

I have had many students from all around the world who have gone on to fantastic careers. Several of my students are now faculty at institutions including the University of Manitoba, Towson University, Chulalongkorn University in Thailand, and MIT. Another is a research scientist at the University of Texas, while another is an entrepreneur and runs a bioinformatics company. Another joined BASF and is in the patent and legal division. Yet another runs the Oklahoma Broader Impacts Infrastructure Project at the University of Oklahoma.

The diverse goals and careers of these former students highlight a key principle of my approach (not that it is unique to me) to graduate training: all of these people are individuals. They all have their own needs for motivation, guidance, and supervision. Some need a lot, others little. Some of my students worked 80 hours per week because they just loved science. Others put in 40 hours per week because work-life balance was important to them — but they were very productive because they were extremely focused and organized during those 40 hours.

I always respect the approaches taken by my graduate students so long as they are on the right track. Figuring out how to handle students who are not is always a challenge, but the key issue is to remember that graduate training is about their success, not the success of the faculty. Of course, that's easy for me to say as a tenured, senior faculty member, but I have tried to have that focus my entire career, and I think it has served me and my students well.



‘It’s all about creating opportunity’

To keep undergrads on the best path forward, he drops hints, plants suggestions, unwraps unwritten rules. It’s working.

Joe Ogas

Associate Professor, 2004–present

Assistant Professor, 1998–2004

Research Associate, Carnegie Institution

of Washington, Department of Plant Biology,

Stanford, California, 1994–1998, and

Michigan State University, Department of

Energy Plant Research Laboratory, 1992–1993

Ph.D. (Department of Biochemistry and Biophysics),

University of California at San Francisco, 1992

Bachelor’s degree (Chemistry), Stanford University,

1986.

From a Dec. 19, 2017, interview. Content lightly edited for clarity.

I have been the head advisor since 2007. But I’ve been advising students — it’s something you do fairly soon — since about 2000, 2001.

As an undergraduate, were you given good advice? Funny you’d ask that: No. There wasn’t much of an advising system in place. It was kind of all self-directed. I don’t recall getting much advice at all.

There are a lot of unwritten rules. If you know them, they’ll help you be successful. It’s not the students’ fault that they don’t know them. I am very fortunate in that I get to be with the students for eight lectures while they’re freshmen. I use that as kind of an extended

advising session, where I give them hints, suggestions and strategies to be successful. A lot of them come in thinking, “As long as I get good grades, that’s enough.” You want to let them know that, no, that’s not enough.

Companies and institutions are looking for experience. What sort of experience do you have? What sort of experiences are available to you? For a lot of the competitive positions that they’re striving for, they’ll need a letter of recommendation. You need to develop a relationship with faculty, because otherwise that letter of recommendation is not going to be very meaningful. They don’t know that, so it’s about promoting that discussion.

We want them all to be as successful as possible. For those who aren’t being successful, sometimes what I have them do is write a letter to themselves. Explain the consequences of their current actions and how those actions are affecting their desired path toward success. It can be a useful way to get them to think, “Is this my best path forward?” So we don’t tell them. We let them tell themselves.

You give the information as best you can. They’re adults. It’s up to them to decide. You do not know all the things going on in their life. You’ve given them the information, and it’s their decision. You promote self-reflection if you think they don’t realize the cost of their actions — or inaction, sometimes.

My goal is always to set the bar high. When I have a really strong student, what I love doing is saying, “Have you considered doing this as well? Have you considered trying this as a different activity?” For example, “Have you considered a study abroad experience? That might help you look at things differently, so when you become a physician, you’ll interact differently with your patients.”

I feel very lucky. Biochem students are awesome. They work hard. I was a postdoc at Stanford. When I interacted with undergrads there, pretty much uniformly they knew they were going to cure cancer. The Purdue students want to help cure cancer but don’t think they’re going to do it alone. There’s a difference: “I want to help contribute,” instead of “I’m going to be the one.” I think it’s also different being in the College of Agriculture. I find the College of Agriculture to be people-focused. That’s good. That’s how we get things done. We work together as a whole.

We have a lot of first-generation students who are incredibly gifted. You promote opportunities they may not think of otherwise. We started a graduate

certificate program so students could come in and get a B.S. and a graduate certificate in four years. We look at that as a way for them to experience graduate courses while they’re still an undergrad. They might come in and think, “OK, I want to come here. I want to get a job. I could never do graduate school. My family has never even gone to college.” Why would they go to graduate school? But now, in their fourth year, you set it up so they’re taking graduate coursework, and they go, “Well, I can do this.” Then you’ve got them doing research, and so they sit there and think, “Maybe I might want to go on to be a Ph.D. as well.” It’s all about creating opportunity.

The other thing we’ve done is a collaborative effort with the Summer Science Program. We’ve created a new program in Biochemistry for rising high school seniors. This is an opportunity for students to come do authentic research — as a high school student — have a really intense authentic research experience and see if that’s something that hopefully increases their interest in STEM and going to a school like Purdue.

Our numbers are up. Whatever we’re doing seems to be working well. When I started we had less than 100; now we’re getting close to 200 in the program. We do a lot of outreach to elementary school kids. Purdue’s a STEM school, right? Enrollment just keeps going up.

I’m up front with acknowledging how much students pay to come here. I say, “How do you make the most out of this?” It’s one thing to say, “I just want to get through as quick as possible.” But you want to point out, “If you do this, this is the benefit that you’ll accrue.”

I have 10 undergrads in my lab right now. They’re doing a huge amount of research. If someone had told me how much I would enjoy teaching and advising when I started this position, I don’t think I would have quite believed them. Because you come here to do research, right? I’m primarily a research scientist.

You don’t do it for a plaque. It’s much more meaningful when the students come by to thank me.

You’re focused on them being successful. I’ve learned it’s dangerous to have preconceptions because then you’ll hold the student back. No matter what: You give them the opportunity to succeed. And you wait and see what happens.



‘Teamwork is so, so big’

Not from around here. Took a different path. Can tell a story. Knows how long a GPA matters. She’ll get your name right, too.

Orla Hart

Clinical Assistant Professor, 2015-present
Coordinator of Teaching Labs, 2013-2015
Biotechnology Program Director, Medtech College,
Indianapolis, 2010-2013
Postdoctoral Scientist, Eli Lilly and Company, Indianapolis, 2008-2009
Research Scientist, Teagasc, Ireland, 2006-2008
Ph.D. (Department of Biochemistry and Immunology),
Trinity College, Dublin, Ireland, 2006
Research Assistant, Novartis AG, Basel, Switzerland, 2001-2002
B.Sc. (Biochemistry), University College Cork, Ireland, 1997.

From a Dec. 22, 2017, interview. Content lightly edited for clarity.

I am the first teaching-focused faculty in this department. Biochemistry is, and has been forever and a day, a research department. That’s one of the things that sells to the undergrads — the authentic research experience that they can get here. When I came to Purdue, my position was coordinator of the teaching labs. I said, “I love teaching.” I took over the big lab course, which usually has five or six sections, in the region of 70 to 90 students.

I commute 62 miles each way to work. You can’t do that drive if you don’t love your job.

I enjoy the drive. It bookends the workday. I find it really effective in thinking things through and organizing things. It also gives me a really effective way of telling students that I don't care if it's snowy and cold – if I can get here from Indianapolis, I think you can drag your (self) across campus! I think you can be on time, too.

How did you become so aware of what students need? Part of it is my natural tendency to be reflective. But I did take an unusual route to this position. Most faculty members will do their undergraduate, go to grad school, get a postdoc and then come here. It's academia all the way. After my undergrad, I took a year and worked in Switzerland. It was basically a one-year internship. Ireland wanted to create a system where recent graduates get training in some foreign country in a specialized field and then come back and be awesome.

I wanted to go to Japan. Ended up with Novartis in Switzerland. I got a lot of very good technical training. In fact, I still talk about that when I teach students, in lab, how to pipette. The bottom line is: If you can transfer tiny volumes of liquid from A to B, and nothing else, when you graduate, you can get a job. Granted, robots can do that, but that's on a larger scale. The precision and accuracy that's involved – when you do it technically and manually, you also appreciate the precision and accuracy that's required in the thinking. And how you interpret results. It transfers to other things.

I still look back on that. Most of my memories of Switzerland involve skiing and hill walking and traveling all over central Europe. The nature of how I teach students how to do basic lab techniques, I'm remembering not from grad school or undergraduate but from that year in Switzerland.

Then I went into grad school – Trinity College in Dublin. When I graduated there, I went to Teagasc, the Irish food development authority. Very focused on translational research. Big collaborative projects, European-wide projects. "What is the product at the end? How's this going to be useful?" It wasn't industry but it was almost industry thinking. And then I applied for a postdoc with Eli Lilly, in Cork, Ireland. They said, do you want to go to Indianapolis? I'm not sure where that is but sure, why not?

One of the things I say frequently is that your GPA matters for about 15 minutes after you graduate. It can get you to an interview but it will get you no further. If students don't also develop so-called soft skills – teamwork is so, so big. You will never be working on your own. And here's a news flash: Not everyone on that team is going to be awesome!

Students tell me in their end-of-course reflections that they are horrified when they hear that they have to do remote group work in an online course. And I'm like, yeah, I guess you've got to make friends with your calendar on your phone. I don't know what you normally use it for, but guess what: You've got deadlines, you've got people in different time zones. Communicate with them online. You're not going to sit down with them in person. You need to be able to do this. It's really important.

I teach undergraduates who aren't majoring in Biochemistry. They are students from Food Science, Nutrition Science, Animal Sciences, Biological Engineering, Biomedical Engineering. Chemical engineers are taking the lecture course. Plant Science, Plant Breeding and Genetics, Botany, Entomology. I teach undergrads from other departments.

The single biggest thing that you can do to engage students in class is to call them by their name. Get it right. Pronounce it correctly. Call them what they like to be called.

I think my students appreciate that I'm from somewhere different. Students are interested in hearing stories. Being authentic – they know that I've experienced a lot of different things. I'm genuinely interested in talking about that stuff, so I think it resonates very well with them. And of course, the fact that I like to talk.

If you fail, it's not the end of the world. This is the time to fail. Learn from it now, because when you graduate – if you go to medical school and mess up? The consequences are bigger! You need to be able to fail here and learn from it. The inability to fail and learn from it is something you see a lot in students now. They're so conditioned: They gotta get their A's. They are trained to focus on points. Their entire student history, that's what they're trained to do.

So you get them to think, "How is this relevant?" All they're thinking about is "this grade, this grade." The content is secondary, right? Part of what we're trying to do here is get them prepared. That's more than just having a bank of knowledge. I mean, the internet is there. You don't need just the bank of knowledge. You need to develop the skills to use it.

Planning for the future

Developing a new minor to meet a growing demand; Walther Cancer Foundation plays key role

Cameron Mann, Manager of Development Operations and Donor Stewardship, College of Agriculture

The Department of Biochemistry is preparing its students to be the next generation of scientists, researchers, medical professionals, veterinarians — and data scientists, too.

One of the department's current focuses is building a new program in computational genetics and bioinformatics. This program will collaborate with departments outside of the college, especially the Department of Computer Sciences in the College of Science. Such collaboration would allow the two departments to use computational and statistical analysis to decipher, for example, genome sequences and related data. This cutting-edge area of study and research has the potential to make a large impact on areas such as cancer research.

One specific way the department is placing an emphasis on computational genetics is by developing an undergraduate minor in bioinformatics and computational genomics. The job market continues to see increasing demand for students with skills and knowledge in this area. The minor will allow students to learn about and gain experience handling large data sets with genomics.

The Department of Biochemistry's ability to successfully build and expand on these efforts has recently received a \$1.5 million boost from the Walther Cancer Foundation through the Purdue Center for Cancer Research. Half of that amount was used to hire Majid Kazemian (Page 9). The other half will be used to hire another faculty member in the area of cancer genomics.

The Walther Cancer Foundation, an Indianapolis-based private grant-making foundation that supports cancer research, has created a \$10 million match to build endowment dollars that benefit the Purdue Center for

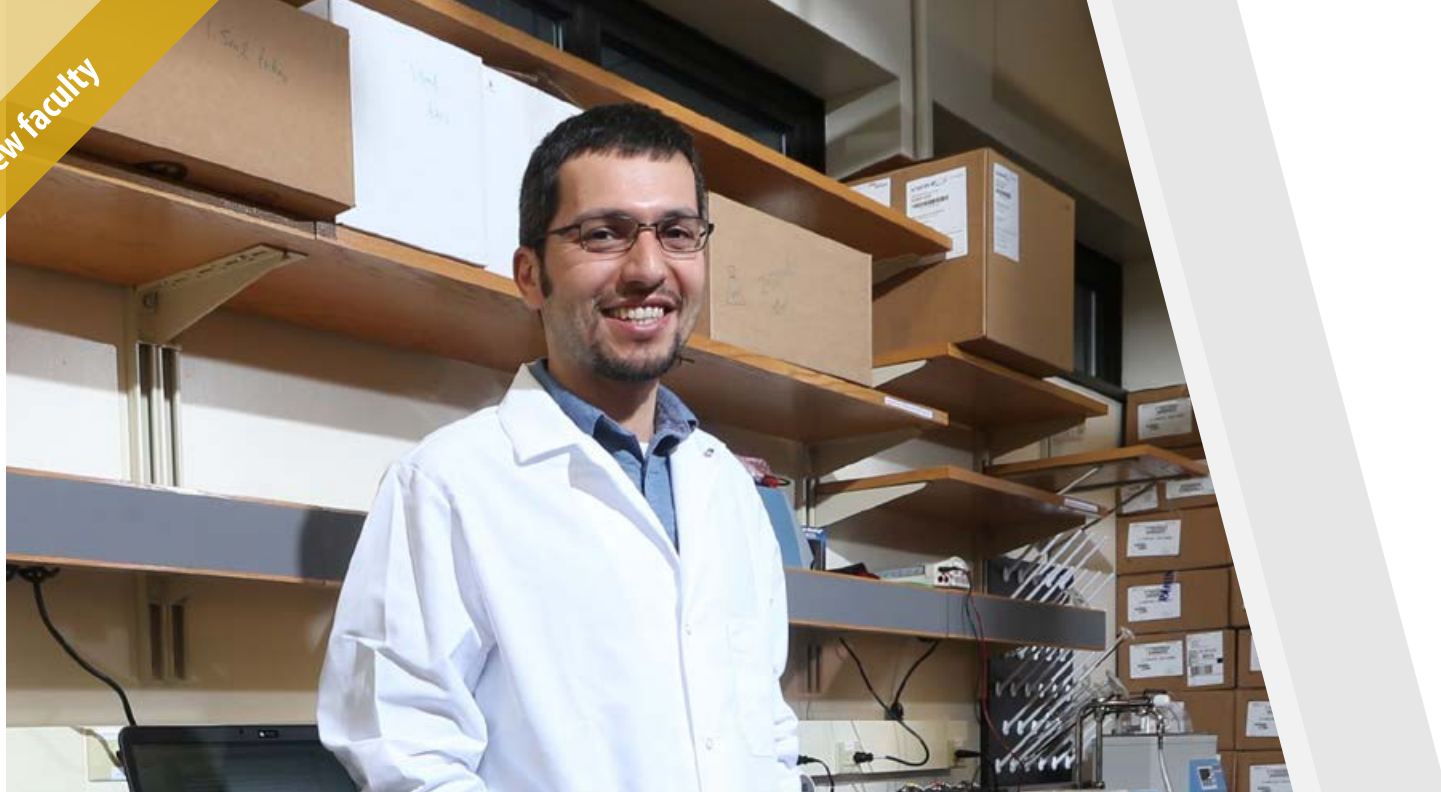
Cancer Research and oncological research happening at Purdue. This match pairs well with the research performed within the Department of Biochemistry. In fact, more than half of Biochemistry's faculty are members of the Purdue Center for Cancer Research.

Those interested in supporting the department's focus on computational genetics and cancer research can take advantage of this match to further the impact of their gift. Gifts made using this match can assist with a variety of departmental needs, including obtaining necessary equipment, and recruiting and retaining faculty.

It's an exciting time to be a supporter of the Purdue Department of Biochemistry. Thanks to the generosity of the Walther Cancer Foundation for providing this matching opportunity, gifts given to the Department of Biochemistry can have an even greater impact on the students and faculty who are continuing to prove that agriculture is definitely more than cows, plows and sows!

For more information on how you can support the Department of Biochemistry or further details on how to utilize the Walther Cancer Foundation match when making a gift, please contact Joel Hartman with the College of Agriculture Development Team.

Joel Hartman
Senior Director of Development
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Wet into dry or dry into wet

By Assistant Professor Majid Kazemian

Computer science was my first passion, but I was always interested in bio-oriented research. I received my Bachelor of Science in Computer Hardware Engineering. I performed a research project in the area of image processing and pattern recognition inspired by how the human eye recognizes shapes to identify handwritten digits. I did my master's degree in Artificial Intelligence and Robotics.

At that point, my interests veered toward bio-computing. I found that the solutions emerging from life science could inspire development of new computational paradigms, such as neural network computing and genetic algorithms. Soon, I found ways to use biological data as an application for testing the power of computational algorithms — and thus discovered my interest in computational biology.

I pursued my Ph.D. in Computer Science, focusing on biology-oriented problems. I studied regulatory sequences, part of the non-coding genome that controls gene expression, and developed several computational programs to locate enhancers and model their function.

Upon completing my Ph.D., I joined one of the well-known Molecular Immunology laboratories at the National Institutes of Health (NIH) to expand my knowledge of the human cancer genome and immunology. I not only developed computational

pipelines to analyze next-generation sequencing data from cancer patients and immune cells, but I also acquired biological skills and benchwork expertise required for designing and implementing novel high-throughput sequencing techniques to study regulatory sequences in the human genome.

After four years at NIH, I began applying for faculty positions at universities where there were opportunities to have both traditional (wet) and computational (dry) labs. Purdue was one of only a few schools that could provide both.

In early 2017, I joined the university, splitting my time between computer science and life science (biochemistry). I am also a member of the Purdue Center for Cancer Research. My lab is now active with a diverse group of students with computational and/or life science backgrounds. Together, we are developing new technologies and computational paradigms to study genome regulation in cancer and immune disorders.

Majid Kazemian

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Sunlight – a vital ingredient

By Assistant Professor Sujith Puthiyaveetil

Life is bottled sunshine — William Winwood Reade,
The Martyrdom of Man

Jan Ingenhousz (1730-1799), a Dutch physiologist, is the discoverer of photosynthesis, the process by which plants, algae and certain bacteria convert light energy into usable chemical energy. In experiments leading up to the discovery of photosynthesis, Ingenhousz placed plants under water and noticed that bubbles formed on the underside of leaves when plants were illuminated with sunlight. Bubbles ceased to form when plants were moved to shade. The bubbles Ingenhousz observed were oxygen, a byproduct of the light-driven water-splitting reaction of photosynthesis.

In the type of photosynthesis found in plants, algae and cyanobacteria, two distinct pigment-protein complexes, photosystems, work in tandem to undertake the light-driven electron transport reactions of photosynthesis. Water is the electron donor and carbon dioxide is the ultimate electron acceptor in photosynthetic reactions that convert carbon dioxide to carbohydrates. Complex life on earth is the exploit of this remarkable chemical reaction. In plants and algae, photosynthesis takes place in cellular compartments known as chloroplasts.

Seemingly abundant for photosynthesis, sunlight, however, varies profoundly in quality and quantity on a timescale of seconds to seasons. Low light conditions, which often enrich particular colors of light, can erode photosynthetic efficiency by unequally exciting the two photosystems, and high light conditions, as on a sunny day, could tear down the tiny fabric of photosynthetic machinery. How photosynthetic organisms, under some conditions, utilize every photon that is available for photosynthesis, while in others protect the photosynthetic machinery from excess light is a fascinating tale of life at the molecular level.

How I came to study photosynthesis

Having been born and brought up in the lush green countryside of the southwestern state of Kerala, India, and having grandparents who were paddy farmers, plants have always fascinated me. Growing up in a secular household, my dad instilled in me a strong sense of enquiry that is based on science and reason. I solidified my interest in science and plants further by bachelor's and master's degrees in botany at Sir Syed College, Kannur University, Kerala. Professor K. Ravindran at the botany department was an early influence. With his passionate advocacy of the theory of evolution, he encouraged me to think beyond the narrow confines of academic syllabus and to take up a career in scientific research.

After briefly teaching at a local higher secondary school and a college, I went to Jawaharlal Nehru University (JNU), New Delhi, India, to undertake research with Professor Baishnab Charan Tripathy for three years. Supported by a Junior Research Fellowship of the University Grants Commission of India, my research concerned how wheat plants adjust their photosynthetic machinery in response to changing light conditions.

During this time I came across a *Nature* paper from Professor John F. Allen's research group at Lund University, Sweden, which reported an intriguing observation — that the photosynthetic electron transport reactions switch on and off chloroplast-encoded photosystem genes in response to changes in light quality. This autoregulatory loop adjusts the composition of the photosynthetic machinery to maximize photosynthesis in the prevailing light quality condition. John's paper sparked my interest in the genetic control of photosynthesis. After a brief email correspondence, John kindly offered me a Ph.D. position. I moved to Lund University in 2003 and to Queen Mary University of London, where John relocated his laboratory in 2005.

My research project dealt with the question of how the photosynthetic electron transport chain communicates with chloroplast genes. It turns out that chloroplasts use an ancient two-component signal transduction system that they retained from their cyanobacterial ancestor to link electron transport with gene expression. I consider working with John as instrumental in shaping my attitude toward science and research. He was an exceptional scientist and mentor with a contagious passion for science and discovery.

Upon the completion of my Ph.D., I was awarded a Leverhulme Trust early career fellowship to undertake independent postdoctoral research at Queen Mary. This allowed me to build on my discovery of the chloroplast two-component system and further identify the precise gene regulatory switch that operates in chloroplasts.

Healing the sunburn

In 2012, I moved to Washington State University in the research laboratory of Professor Helmut Kirchhoff. There my work focused on a unique aspect of plant life – how plants heal photodamage, the botanical equivalent of sunburn. Intense sunlight damages a key protein in the photosystem; plants have evolved a repair mechanism that heals this photodamage. The repair pathway operates at a remarkable pace. My research showed that the repair reactions and enzymes are organized as if an assembly line, ensuring the high efficiency of the repair process. Working with Helmut at WSU was an invaluable opportunity for me as I learned many quantitative

aspects of photosynthesis. In 2016, I joined the Department of Biochemistry at Purdue, where I continue to work on the genetic and molecular tricks plants and algae use for optimizing photosynthetic light harvesting.

We take photosynthesis for granted. At every hour on a sunny day, Earth receives enough light energy to power the world for a year. Unfortunately we don't know how to use that energy, but photosynthetic organisms have learned to tap into it, albeit with a lower efficiency. Plants and algae make up for the lower efficiency by their vast numbers – number of plants, algae, leaves, photosynthetic proteins and genes. Photosynthetic proteins are some of the most abundant proteins on earth. We are grateful to plants and algae for this marvelous feat of light energy conversion.

Significant progress over the last few decades has revealed a great deal about photosynthetic machinery and carbon fixation reactions, but we know relatively little about the molecular and genetic control mechanisms that maximize light energy usage. If we understand these processes in great detail, will we be able to re-engineer photosynthesis for increased efficiency? This question comes at a time when global agriculture is facing serious challenges in the form of climate change, loss of arable land and population growth.

I am happy being at Purdue. Purdue has a distinguished history of photosynthesis research with pioneers that include Fred Crane, Richard Dilley, David Krogmann, Louis Sherman, and Bill Cramer. It is a privilege to study the fundamental reaction that powers the planet, a conviction shared by two of my lab colleagues, Iskander Ibrahim, a postdoctoral research associate, and Gilbert Kayanja, a graduate student.

Sujith Puthiyaveetil

Assistant Professor, Biochemistry

spveetil@purdue.edu

BCHM 305A

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They've earned it

Achievements, promotions, awards

Academic Year July 1, 2016 – June 30, 2017

On June 21, Biochemistry participated in 4-H Career Exploration Day as part of 4-H Roundup, a three-day event that gives Indiana youth an opportunity to experience life at Purdue and get hands-on experience in different disciplines. This year, **Orla Hart** led a class investigating the properties and discussing the effects of consuming commonly used artificial food dyes. The 31 students and three teachers learned spectrophotometry, electrophoresis and chromatography techniques.

Graduate **Kyle Schulz** (B.S. 2016) received a Woodrow Wilson National Fellowship and was selected to participate in “STEM Goes Rural”, a program that works to staff rural schools with teachers who are trained in education and the principles of STEM (science, technology, engineering and math).

John Morgan was selected a 2016 University Faculty Scholar. The program, sponsored by the Office of the Provost, recognizes outstanding faculty members across the university who are on an accelerated path for academic distinction. Faculty Scholars are appointed for a nonrenewable five-year term and receive an annual \$10,000 discretionary allocation.

Jian-Kang Zhu received the 2016 Herbert Newby McCoy Award, presented annually to a Purdue student or faculty member for outstanding contributions to the natural sciences.

The Purdue Agribusiness Science Academy (PASA) initiative is an effort developed to encourage Indiana students to get involved in agricultural and science programs offered by the College of Agriculture. The Office of Multicultural Programs hosted its annual Tier III event for high school students from July 10-23. Ten students spent time in the Department of Biochemistry with **Orla Hart**, with help from Kevin Solomon (ABE), for a CSI forensics and population genetics project. Students successfully identified the perpetrator of a “crime” by completing STR allele analysis by PCR, compared methods of forensic DNA analysis, and explored the federal CODIS database to determine powers of discrimination for allele analysis.

Spending two weeks on their own lab project is an effective way to foster enthusiasm for biochemistry and open minds to where a degree in biochemistry can lead. The quality and engagement of the participating students this year was exceptional.

Orla Hart hosted a class of students during Experience Purdue, a university-wide event for rising high-ability high school seniors, for a lab session titled “Getting the fuel out of Biofuels: Mushrooms are not just a pizza topping!” Students created hypotheses, prepared extracts from different types of common mushrooms, and compared their β -glucosidase activity. As part of the lab, students had the opportunity to perform common biochemical techniques – enzyme kinetic assays and spectrophotometry, in addition to liquid handling and data manipulations. Experience Purdue students elect to participate in two workshops while visiting, and we hope to see some of these students back in a year as BCHM freshmen.

Undergraduate **Peyton Sprecker** attended the National Undergraduate Research Symposium (NURS) organized by the St. Jude Children’s Research Hospital Graduate Program in Memphis, Tennessee. Participants presented a 10-minute oral presentation and a poster. Peyton’s poster was titled “Determining the binding interaction between Spt-Ada-Gcn5-acetyltransferase (SAGA) and SF3B proteins of the U2 snRNP.” Attendees were from around the country and selected through an application and referral process.



Hana Hall, Associate Research Scientist (Weake lab), accesses stocks of *Drosophila melanogaster*.

Xiaoqi Liu was chosen as a 2016 Showalter Faculty Scholar. Showalter Faculty Scholars must be Purdue University Faculty Scholars, and they hold this title for the duration of their faculty scholar appointment. The title reflects support for the Purdue University Faculty Scholars program from the Ralph W. and Grace M. Showalter Trust and represents an official recognition of their expertise and excellence specifically in life sciences. Xiaoqi's faculty scholar appointment runs through 2021.

Graduate student **Siwen Wang** (Tran lab) was accepted into the very selective Epigenomics course at Van Andel Research Institute in Grand Rapids, Michigan, that took place in July 2016.

Sujith Puthiyaveetil joined the department on August 15, 2016, as Assistant Professor. Originally from Kerala, India, he received a B.Sc. from Calicut University (Kerala, India), a M.Sc. from Kannur University (Kerala, India), and his Ph.D. from the University of London. He most recently was a post-doc at Washington State University, Pullman, where he uncovered the molecular basis of the high efficiency of protein repair in chloroplasts, which heals photodamage – the botanical equivalent of sunburn.

Barbara Golden was reappointed a Dean's Fellow for the 2016-2017 academic year. She continued to work with Dean (now Provost) Jay Akridge and Senior Associate Dean for Research and Faculty Affairs (now Dean) Karen Plaut on a project focused on the success of associate professors.

The **Beach Lecture Series** was held on September 20-21, 2016. Dr. Jef Boeke, Director, Institute for Systems Genetics, and Professor, Department of Biochemistry and Molecular Pharmacology at New York University, Langone Medical Center, was the speaker. He presented two seminars: "Genome Writing" and "Genome scrambling and synthesis of neochromosomes."

Natalia Dudareva took a sabbatical in fall 2016 at the Institute of Plant Biochemistry, Heinrich Heine University, Dusseldorf, Germany, in the laboratory of Professor Andreas P.M. Weber. She worked on a project titled "Metabolite trafficking within and release out of the cell."

The **Purdue Biochemistry Club** was awarded a \$749 grant from the 2016-2017 Purdue Agricultural Council for its proposal to attend the Celebrate Science Indiana festival at the Indiana State Fairgrounds.

Associate researcher **Sara Cloutier** (Tran lab) presented a talk titled "Regulated Formation of lncRNA-DNA Hybrids Enables Faster Transcriptional Induction and Environmental Adaptation" at the Chromatin and Epigenetics Symposium in October 2016 at Purdue University. Graduate students **Chris Petell** (Gowher lab) and **Nina Serratore** (Briggs lab) won best talk prizes at the Chromatin and Epigenetics Symposium on October 11.

Barbara Golden was elected as a fellow of the American Association for the Advancement of Science (AAAS). She was chosen for numerous key and substantial contributions to the field of RNA structural biology and biochemistry.

Graduate student **Xiangying (Candy) Mao** (Chapple lab) was awarded an honorable mention at the Global Climate & Energy Project (GCEP) Research Symposium poster session held at Stanford University in November 2016. The title of her poster was "MED5 and CDK8 play a role in lignin-modification-induced dwarfing in Arabidopsis."

Majid Kazemian joined the department in January 2017 as an Assistant Professor. He earned a Ph.D. in computer science at the University of Illinois at Urbana-Champaign, with major focus on computational biology. He did postdoctoral research in the Laboratory of Molecular Immunology at the National Heart, Lung and Blood Institute. His primary appointment is in the Department of Biochemistry with a secondary appointment in the Department of Computer Science. Majid's research focuses on acquiring and utilizing high-throughput genome sequencing data to create new computational models and biological assays to study genome regulation. His lab will initially work on the discovery and modeling of the regulatory circuitry of the non-coding genome, which is essential for maintaining normal cellular physiology.

Andy Tao and Professor Emeritus **Victor Rodwell** were recognized during the 12th annual Inventors Recognition Reception in February 2017 for their invention(s) that were patented in the 2015-2016 fiscal year. They were two of more than 100 Purdue innovators recognized at the reception sponsored by the Purdue Research Foundation Office of Technology Commercialization.

Andy Tao was elected to serve a three-year term on the Board of Directors for the U.S. Human Proteome Organization (USHUPO). USHUPO engages in scientific and educational activities to encourage the use of proteomics technologies and to disseminate knowledge pertaining to the human proteome and that of model organisms.

Biochemistry alumnus **Robert (Bob) Deschenes**, Ph.D. (1984, Dixon) was honored as a 2017 College of Agriculture Distinguished Ag Alumni. While on campus, Dr. Deschenes met with faculty, staff and students, and presented a seminar titled “The journey from catfish (Purdue University) to human neurons (University of South Florida), and steps in between.”

Jim Forney was awarded the Exemplar of Professionalism Award, a new award given by the Indiana University School of Medicine (IUSM). Jim was nominated by a medical student because of his commitment to upholding the IUSM Honor Code, which emphasizes professionalism, honesty and respect for the dignity of others.

Joe Lynch, post-doctoral scholar (Dudareva lab), was a winner of the 2017 Graduate Student and Post-Doctoral Sigma Xi Poster Competition held in April 2017.

Several Biochemistry students received awards at the annual College of Agriculture Awards banquet: Outstanding Sophomore: **Stephanie Price**; Outstanding Junior: **Abdias Rodriguez**; Outstanding Teaching Assistant: **Nina Serratore**. Also recognized were graduating seniors in the following programs: MANRRS: **Charles Hawthorne** and **Adetoro Koleosho**, and Ag Ambassador: **Kaelan Brennan**.

As part of the College of Agriculture A/P Advancement program, **Sara Cloutier** (Tran lab) was promoted to Administrative Professional staff rank 5.

Dr. Bruce Yankner, Co-Director, Paul F. Glenn Center for the Biology of Aging, Professor of Genetics and Neurology, Harvard Medical School, gave the **Bernard Axelrod Lectures** in April 2017. His lecture titles: “REST and Stress Resistance in Aging and Alzheimer’s Disease,” and “Transcriptional Regulation of Lifespan.”

At the 2017 MANNRRS (Minorities in Agriculture, Natural Resources and Related Sciences) National Career Fair and Training Conference, several biochemistry students were recognized as being tops in the country in their respective contests: **Brandon Hunter** and **Kierra Jammer** were part of the 2nd place team in the Bunge Agribusiness Case Student contest, and **Charles Hawthorne** was a member of the 2nd place Quiz Bowl team.

Four Biochemistry students were among Purdue students recently inducted into Phi Beta Kappa, the oldest honor society for the liberal arts and sciences: senior **Jacob Crosser** and juniors **Julia Weeder**, **Kate Harris**, and **Abdias Rodriguez**.

Graduate student **Tiffany Young** (Kirchmaier lab) was named the Outstanding TA in Biochemistry (formerly the Hickory Stick Award). Established in 1970, the award is given annually to commend an outstanding teaching assistant in the Department of Biochemistry. Tiffany was also recognized at the Annual Celebration of Graduate Teaching Excellence.

Erin Sorlien, graduate student in the Ogas lab, was named the recipient of a one-year Purdue Research Foundation (PRF) Grant. This grant is provided by the College of Agriculture in conjunction with the Office of the Vice President for Research.

The spring winners of a Beach Family Travel Grant were **Zheng (Cindy) Xing** (Tran lab) and **Ruixin (Ricky) Wang** (Liu lab). **Funmilayo Adebisin** (Dudareva lab) received the award in the fall. This award was first given in 2006 through the Beach Family Lectureship in Biochemistry endowment. The \$1,000 award is given twice per year to help defray the costs of a graduate student to attend a scientific meeting.

Rachel Stegeman (Weake lab) received the fall Henry Weiner Biochemistry Travel Award, and **Chuan-Chih Hsu** (Tao lab) received the spring award. The award provides \$1,000 to help defray the costs to attend a scientific meeting.

Allison Norvil (Gowher lab) received the Henry A. Moses Award. Established in 2008 by Dr. Bradley Sheares and Adrienne Simmons, it honors fellow alumnus Dr. Henry Moses for his contributions to research, education and service. This award is given annually to a graduate student in the Department of Biochemistry based on a scientific paper that the applicant has authored that demonstrates his/her productivity and excellence in scientific research.



Graduate student Spencer Escobedo (Weake lab) evaluates a vial of *Drosophila* used to study aging of the eye.

Chen Shao (Liu lab), was the recipient of the Arnold K. Balls Award for outstanding graduate student. This award is given annually to one of our graduate students who has demonstrated outstanding research potential, scholarliness and intellectual curiosity.

Chris Petell (Gowher lab) and **Nina Serratore** (Briggs lab) received Bilsland Dissertation Fellowships. The College of Agriculture, in conjunction with the Graduate School, makes these fellowships available to provide a semester of salary support to graduate students who are within the final year of completing their Ph.D. degree.

Jie Li (Liu lab) received the Don Carlson Award. Established in 2011, this award is given annually to a postdoctoral fellow, research associate or staff scientist to recognize their contributions as full-time research personnel to the scientific goals of the Department of Biochemistry.

Staff member **Sherry Honn** (Business Office) was awarded the Linda Siersema Staff Excellence Award. This award was established in 2013 and is given annually to a staff member who has demonstrated outstanding performance and service to the department.

The department hosted 24 high school students from across the country as part of the Summer Science Program in Biochemistry. This program consisted of six weeks on campus conducting research projects and learning about biochemistry and the drug discovery process.

Scott Briggs received a 2017 Research Refresh (R²) Award from Purdue. The R² program is a competitive, campus-wide program sponsored by the Office of the Provost. R² is designed to provide protected time for tenured Associate Professors and Full Professors who would benefit from intense focus to advance their scholarship and reinvigorate their careers.

Barbara Golden was chosen as a Big Ten Academic Alliance Academic Leadership Program Fellow for 2017-18. The program is designed to develop leadership and managerial skills of faculty who have demonstrated exceptional ability and administrative promise. It is specifically oriented to prepare faculty members to meet the challenges of academic administration at major research universities in the 21st century. The Big Ten Academic Alliance is an academic consortium of Big Ten universities and the University of Chicago.

Graduate student **Samantha Lee** (Golden lab) was the organizing committee chairperson for The Hitchhiker's Guide to the Biomolecular Galaxy Symposium held May 2017. Also on the committee were graduate student **Emma Lendy** and postdoc **Kristina Kesely**, both in the Mesecar lab. **Lee Stunkard** (Lohman lab) presented a talk titled "Investigating the Catalytic Molecular Details of Malonyl-thioester Decarboxylating Enzymes" and **Allison Norvil** (Gowher lab) presented a poster titled "Dnmt3b Methylates DNA by a Noncooperative Mechanism, and its Activity is Unaffected by Manipulations at the Predicted Dimer Interface." **Austin Dixon** (undergraduate researcher, Lohman lab, Class of 2017) won the award for Best Undergraduate Presentation for his poster titled "Structural Analysis of LigB from Plants to Determine the Mechanism of Substrate Specificity." **Andy Mesecar** gave a talk on "StructureBio Facilities at Purdue" and **Jeremy Lohman** served as an oral presentation judge.

Gabrielle Buck (undergraduate) received the Martin Agricultural Research Fund Scholarship from Agricultural Research at Purdue to continue her research during the 2017-2018 academic year.

Undergrad **Stephanie Price** was awarded first place from the Townsend Writing Excellence Competition for her submittal, "The Seagull and the Sandwich: How Birds Adapt to Cities." The award included a cash prize of \$2,500 to be used toward tuition.

Dr. **Harry Charbonneau** retired March 31st and was named Professor Emeritus after 26 years at Purdue.

Academic Year July 1, 2017 – June 30, 2018

Barbara Golden has been asked to serve in a part-time role as Interim Assistant Dean for Faculty Development. She has served as a Dean's Fellow for the past two years, focusing on associate professor career development and mentoring. She will expand her role to include faculty development all levels and will also work on graduate education and diversity initiatives.

Jennifer (Jen) Wisecaver joined the department as Assistant Professor. She comes to us from Vanderbilt University, where she was a postdoctoral researcher. She earned her B.S. in Biological Science from Humboldt State University (Arcata, California) and her Ph.D. in Ecology & Evolutionary Biology from the University of Arizona (Tucson, Arizona). Her research involves studying the birth, evolution, and death of ecologically specialized metabolic pathways in plants, fungi, and microbial eukaryotes using comparative genomics, coexpression networks, and phylogenetics.

Howard Zalkin (Professor Emeritus) was recognized as a 50-year member of the American Society of Biochemistry and Molecular Biology (ASBMB).

In November 2017, the department held the inaugural biennial **Biochemical Horizons Symposium**, where some of the nation's top scientists shared their latest research insights. The daylong event provided more than 100 students, faculty and staff an opportunity to hear about new developments that are challenging paradigms in the areas of systems biology, genomics and genetic engineering. J. Michael Cherry, a Purdue Biochemistry alumnus and professor at Stanford University, was the keynote Beach lecturer. Other speakers included: Brenda J. Andrews, University of Toronto; Margaret (Peggy) Goodell, Baylor College of Medicine; and Gregory Stephanopoulos, Massachusetts Institute of Technology.

Barbara Golden was elected Councilor for the Biological Chemistry Division of the American Chemical Society.

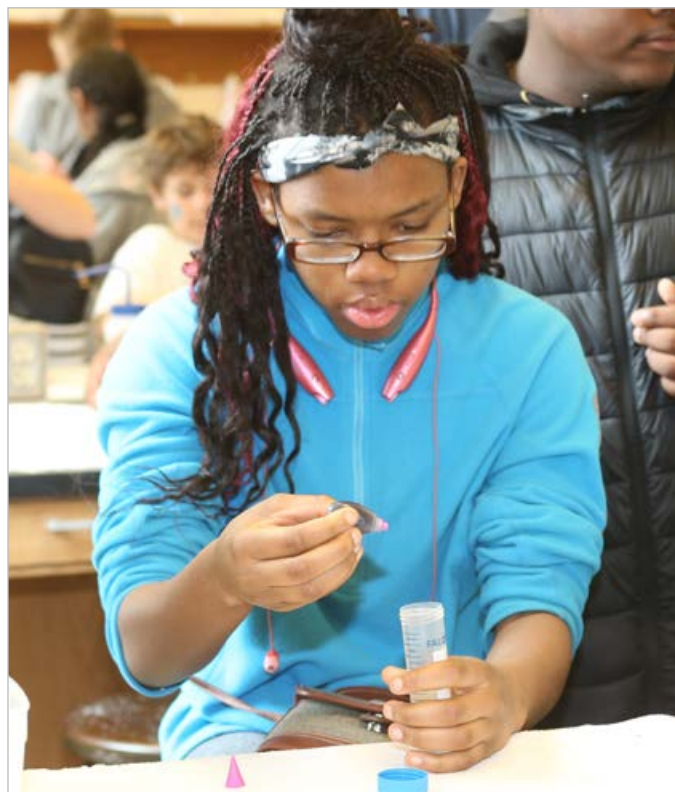
Undergrad **Mark Gee** took part in a two-week mission to the Mars Desert Research Station in Utah. The seven-member team from Purdue took part in a mission simulation.

Xing Liu joined the department as Assistant Professor. Dr. Xing Liu earned her B.S. in Bioscience and Biotechnology from Beijing Normal University (Beijing, China) and her Ph.D. in Plant Biological Sciences from the University of Minnesota (St. Paul, Minnesota). She previously served as a postdoctoral researcher and a fellow of the Jane Coffin Childs Memorial Fund for Medical Research at California Institute of Technology. Her research involves studying mechanisms in regulating protein ubiquitination and degradation.

Elizabeth Tran was chosen as a Purdue University Faculty Scholar. The program recognizes outstanding faculty members at the West Lafayette campus who are on an accelerated path for academic distinction.

Shiv Grewal, NIH Distinguished Investigator, presented this year's **Bernard Axelrod Lectures**. Dr. Grewal is recognized for his groundbreaking research in the field of epigenetics.

Natalia Dudareva received the 2018 Herbert Newby McCoy Award, the University's most prestigious research award, for outstanding work in the natural sciences.



The Department of Biochemistry is committed to introducing the natural sciences to students ranging from 6 to 18 through a variety of outreach events.

Ruixin (Ricky) Wang (Xiaoqi Liu lab) was named the 2018 recipient of a one-year Purdue Research Foundation (PRF) Research Grant. This grant is provided by the College of Agriculture in conjunction with the Office of the Vice President for Research. This award is given to a student who has demonstrated commitment to the department.

The Beach Travel award is given twice a year, fall and spring, to help defray the costs of a graduate student attending a scientific meeting. **Erin Sorlien** (Ogas lab) received the fall Beach Travel Award. She used the award to attend the Keystone Symposium on Cancer Epigenetics in Denver, Colorado. **Elia Farah** (Xiaoqi Liu lab) received the spring Beach Travel Award. Elia plans to use his award to attend the AACR annual meeting in Atlanta, Georgia, in 2019.

The Henry Weiner Travel Grant is given to help defray the costs of a graduate student or postdoc to attend a scientific meeting. The award was established in 2012 in memory of Dr. Henry A. Weiner, professor of biochemistry from 1966 to 2010. **Funmilayo Adebesein** (Dudareva lab) received the fall award as a grad student and later served as a postdoc in the Dudareva lab. She used the award to attend the Gordon Research Conference in Ventura, California.

Fengyi Mao (Xiaoqi Liu lab) received the Henry A. Moses Award, which recognizes a graduate student for an early publication. This award was established in 2008 by Dr. Bradley Sheares and Adrienne Simmons, to honor his mentor and fellow alumnus, Dr. Henry Moses, for his contributions to research, education and service. Dr. Moses played an influential role in Sheares' decision to pursue his doctorate at Purdue. Fengyi is being recognized for her first author publication, "Plk1 inhibition enhances the efficacy of BET epigenetic reader blockade in castration resistant prostate cancer," which is in press in *Molecular Cancer Therapeutics*.

Erin Sorlein (Ogas lab) received the Bilsland Dissertation Fellowship. The College of Agriculture, in conjunction with the Graduate School, makes this fellowship available to provide a semester of salary support to graduate students who are within the final year of completing their Ph.D.



Each year Biochemistry undergraduate students participate in events that reach in excess of 1,000 elementary school children.

Joseph Lynch (Dudareva lab) received the Don Carlson Award. This award recognizes a postdoctoral fellow, research associate or staff scientist for outstanding research accomplishments in the lab. Dr. Don Carlson was a professor in the Department of Biochemistry from 1975 to 1985. He served as head from 1975 to 1981.

Sherry Pogranichniy, Undergraduate Program Administrator, received the Linda Siersema Staff Excellence Award. This award was established in 2013 in recognition of Linda Siersema, who worked in the department her entire 41-year career, retiring in 2014. The award is given annually to a staff member who has demonstrated outstanding performance and service to the department.

Each year, the department selects one student as the outstanding student from each class on the basis of excellence in academics, research and service. These students are then nominated for the college-level awards. The outstanding students for 2017-2018 are: Freshman – **Ana Pascual-Garrigos**; Sophomore – **Nicole Adkins**; Junior – **Stephanie Price**; and Senior – **Abdias Rodriguez**. This year, two of Biochemistry's nominees were selected as Outstanding Student in the College: Stephanie Price as Outstanding Junior and Abdias Rodriguez as Outstanding Senior.

A step closer to easy detection of cancer

Brian Wallheimer, Department of Agricultural Communication

Andy Tao tempered his expectations when his lab started an experiment to see whether they could identify phosphorylated proteins in blood.

Phosphorylation — the addition of a phosphate group to a protein — is often a precursor to cancer cell formation. However, detecting the process would be only half the battle. They needed to correctly identify the phosphorylated proteins in the blood of patients known to have cancer.

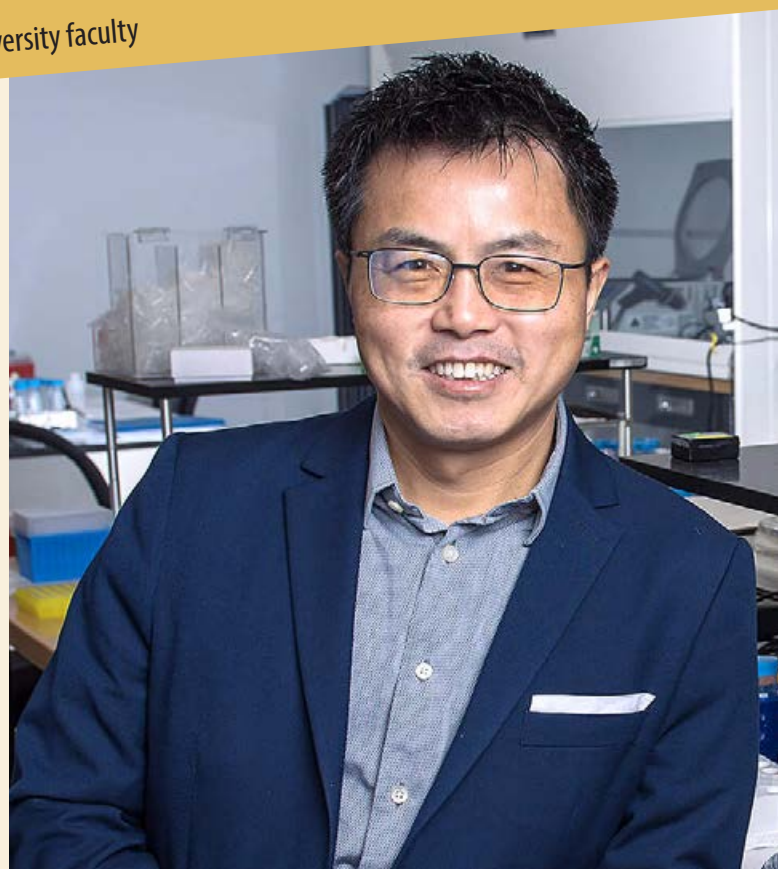
“My student, Blair Chen, got the data and immediately came to my office,” Tao said. “She detected over a thousand phosphorylated proteins from 1 milliliter of plasma in a single experiment. She was shocked, and I was totally overwhelmed.”

Doctors can test for a lot of things from a blood draw — diabetes, anemia, and kidney and liver function, along with levels of cholesterol, calcium and other substances. Such testing provides a good look into a person’s health.

One day, cancer might be on that list.

Tao, a professor of biochemistry and member of the Purdue University Center for Cancer Research, received Purdue’s 2017 Outstanding Commercialization Award for development of tests that can detect breast cancer in blood and bladder cancer in urine.

Tao and colleagues identified phosphoproteins in blood plasma that are significantly elevated in cancer patients. The liver releases phosphatase, which removes the phosphate group from phosphoproteins, making them difficult to find in blood. Tao used high-speed centrifuges



to separate microvesicles and exosomes, which encapsulate and protect the phosphoprotein structure. It’s believed that microvesicles and exosomes, which cells release into the bloodstream, are involved in intracellular communication and metastasis of cancer.

“Our work is the first to demonstrate that many important disease-related molecules can be detected from blood. This can open a new direction for how we achieve early detection of devastating diseases such as cancer,” Tao said. “The technology can also potentially benefit patients who are undergoing treatment by evaluating therapeutic effectiveness of treatment without waiting for long periods of time to monitor whether cancer might come back.”

Tao’s test employed breast cancer cells and bladder cancer cells, but he believes it would transfer well to most types of cancer. His company, Tymora Analytical, is working to develop technology to make the test faster and feasible in standard laboratories.

Tao joined the Purdue faculty in 2005, was named a Purdue University Faculty Scholar 2011-16; an Entrepreneurial Leadership Academy Scholar 2012-13; and a Bindley Bioscience Center Fellow in 2012-13. He earned his doctorate from Purdue in 2001; R. Graham Cooks was his adviser. Cooks, the Henry B. Hass Distinguished Professor of Chemistry, was the second commercialization award winner in 2005.

What have you been doing?

1950s

Ken Kirby (M.S. 1956 and Ph.D. 1958, Whistler) remains busy by playing in two bands, playing tennis and volunteering. He also finds time to write essays and stay up on the developments in Alzheimer's disease research.

Donald Burns (Ph.D. 1959, Parker) continues to enjoy retirement. He and his wife, Linda, continue to travel, visiting their children and grandchildren.

1960s

R. Larry DeVault (M.S. 1961) continues to keep busy by researching autism through studying brain memory biochemistry.

1970s

Daniel Walker (Ph.D. 1979, Axelrod) retired after the sale of Premacure AB, a Swedish pharmaceutical company that he co-founded in 2006.

1980s

David Chafin (B.S. 1987) is a Principal Scientist at Ventana Medical Systems in Tucson, Arizona.

2000s

Mark Fretz (B.S. 2001) is a Product Manager for the Metalworking Fluids division of Chemetall, a BASF company, and recently relocated to the Philadelphia, Pennsylvania, area. He and his wife, Deborah, welcomed their second son, Jeremiah, on December 30, 2016.

Erika Morris (B.S. 2001, M.S. 2003) was promoted to Assistant Professor with Ivy Tech Community College in Bloomington, Indiana, in August 2017.

Autumn Sutherlin (Ph.D. 2003, Rodwell) became Assistant Dean in the College of Arts and Sciences at Abilene Christian University in fall 2017.

2010s

Christie Eissler (Ph.D. 2013, Hall) accepted a Scientist position in the Proteomic Platform group at Vividion Therapeutics in San Diego, California, in September 2017.

Misha Remy-Keown (B.S. 2014) earned a Master of Science in Biochemistry from Texas A&M in May 2018. She is currently working as a contractor for Pace Analytical on assignment at Elanco. In June 2018, she married Chandler Keown (ABE 2014).

Ryan Gandy (B.S. 2015) received a Master of Science in Medical Physiology from Loyola University Chicago in May 2017. He was accepted to Indiana University School of Medicine for fall 2018.

Nina Serratore-Deno (Ph.D. 2017, Briggs) is a Clinical Scientist at Cook Research Inc. in West Lafayette, Indiana.

Chris Petell (Ph.D. 2017, Gowher) accepted a position as a postdoctoral fellow under Dr. Brian Strahl at the University of North Carolina-Chapel Hill School of Medicine.

Rachel Stegeman Graham (Ph.D. 2017, Weake) is a postdoctoral fellow at the Center for Immunology at the University of Minnesota.

Alex Kosiak (B.S. 2014) graduated from Indiana University School of Medicine in May 2018. He will be completing a transition-year residency at Ball Memorial Hospital in Muncie, Indiana, and will then head to Emory University in Atlanta, Georgia, to complete a residency in Anesthesiology.

We want to hear news and updates from our alumni. Send information to Rachel Weaver, rrweaver@purdue.edu. Thanks.

Prepared to move ahead

2016-2017 Ph.D. Graduates

Benjamin Carter

Next Stop: Postdoctoral Research Fellow at the National Heart, Lung and Blood Institute

Whitney Dolan

Next Stop: seeking employment

Jingqun Ma

Next Stop: Research specialist, Janelia Farm Research Campus

Aamir Mir

Next Stop: Postdoctoral research, University of Massachusetts Medical School

Brendan Powers

Next Stop: Senior Scientist, PPD Laboratories GMP Lab

Anwasha Sanyal

Next Stop: Postdoctoral research, Purdue University

Chen Shao

Next Stop: Seeking employment

Siwen Wang

Next Stop: Pursuing degree in biomedical visualization

Yueping Zhang

Next Stop: seeking postdoc position in U.S. or China

2016-2017 M.S. Graduates

Hunter Balduf

Next Stop: seeking employment

Bethany Manning

Next Stop: Master of Arts in Teaching Secondary Education, Columbus State University

2016-2017 B.S. Graduates

Kaelan Brennan

Next Stop: Ph.D. in Molecular and Cellular Biology, University of California, Berkeley

Kelsey Bullens

Next Stop: Scribe, Scribe America

Rochelle Camden

Next Stop: Doctor of Veterinary Medicine, Purdue University

Shelby Cummings

Next Stop: Indiana University School of Dentistry

Andrew Delks

Next Stop: Seeking employment, Denver, Colorado

Austin Dixon

Next Stop: Ph.D. in Biochemistry, Indiana University

Andjela Djokovic

Next Stop: Applying to medical school, University of Queensland

Rebecca Donnelly

Next Stop: Clinical Trial Development Program, AbbVie Inc.

Sarah Gutman

Next Stop: Doctor of Veterinary Medicine, Ohio State University

Arryn Harris

Next Stop: Ph.D. in Interdisciplinary Life Sciences, Purdue University

Charles Hawthorne

Next Stop: Capacity building coordinator, Harm Reduction Coalition

Kristen Hendricks

Next Stop: Environmental Engineer, South Dakota Department of Environmental and Natural Resources

Adetoro Koleosho

Next Stop: Quality Control Chemist, Hallstar

Sarah Kriger

Next Stop: Bioanalytical Chemist, Covance

Christopher Long

Next Stop: Quantitative Biology, Advanced Testing Laboratory

Lauren Macadlo

Next Stop: Lab technician, Purdue University

Stephen McCune

Next Stop: Lab technician, Roche Diagnostics

Lisa Miller

Next Stop: Master's in Biology, Indiana University-Purdue University Indianapolis

Joseph Nigh

Next Stop: Seeking job lab tech or QA job

Logan Richards

Next Stop: Ph.D. in Biomedical Sciences, Vanderbilt University

Andzelika Rzucidlo

Next Stop: Master of Public Health, Indiana University-Purdue University, Indianapolis

Peyton Spreacker

Next Stop: Ph.D. in Biochemistry, University of Wisconsin

Kirsten Westerhouse

Next Stop: Ph.D. in Biochemistry, Purdue University

John Whitney

Next Stop: Scribe, Scribe America

Cole Wunderlich

Next Stop: Ph.D. in Bioinformatics, Cold Spring Harbor Laboratory

Elizaveta Yurovich

Next Stop: Winemaking intern, The Wine Group

2017-2018 Ph.D. Graduates

Funmilayo Adebesein

Next Stop: Scientist, Bayer Corporation

I-Hsuan (Blair) Chen

Next Stop: Research Specialist, Weill Cornell Medicine

Laura Henry

Next Stop: Analytical Chemist, Heritage Group

Chris Petell

Next Stop: Postdoctoral Researcher, University of North Carolina

Nina Serratore

Next Stop: Clinical Scientist, Cook Research Inc.

Rachel Stegeman

Next Stop: Postdoctoral Fellow, University of Minnesota Medical School

Zheng (Cindy) Xing

Next Stop: Postdoctoral Researcher, Purdue University

Tiffany Young

Next Stop: Seeking employment

2017-2018 M.S. Graduate

Zachary Beck

Next Stop: Seeking employment

2017-2018 B.S. Graduates

Evan Adams

Next Stop: Technical Problem Solver, Epic Software

Elizabeth Amundson

Next Stop: Marian University College of Osteopathic Medicine

Wyatt Baysinger

Next Stop: Chemist, Midwest Compliance Laboratories

Evan Billings

Next Stop: Ph.D. in Biological Sciences, Purdue University

James Bower

Next Stop: Ph.D. in Biochemistry, Indiana University

Logan Colwell

Next Stop: Customer Service Representative, Envigo

Amy Cox

Next Stop: Wayne State University School of Medicine

Jacob Crosser

Next Stop: Ph.D. in Math and Statistics (Computational Biology), SUNY Stony Brook

Luke Garner

Next Stop: Chemist, Gordon Ag Group

Daniel Goldfarb

Next Stop: Research Specialist, Ceres Nanosciences

Kate Harris

Next Stop: Indiana University School of Medicine

Ryan Hockemeyer

Next Stop: Ph.D. in Botany and Plant Pathology, Purdue University

Adam Hoehn

Next Stop: Marian University College of Osteopathic Medicine

Katelyn Huff

Next Stop: Lab technician, OnTarget Labs

Benjamin Kick

Next Stop: Pilot/2nd Lieutenant, United States Air Force

Kevin Lin

Next Stop: Indiana University School of Medicine

Hailey Lloyd

Next Stop: Doctor of Veterinary Medicine, Purdue University

Mengran Ma

Next Stop: Ph.D. in Biostatistics, Columbia University Medical Center

Ramya Modi

Next Stop: Ph.D. in Interdisciplinary Life Science, Purdue University

Sara Monhollen

Next Stop: Master of Physician Assistant Studies, Butler University

Matthew Nordland

Next Stop: Indiana University School of Medicine

Jordan Page

Next Stop: seeking employment

John Petroskey

Next Stop: Indiana University School of Medicine

Jacqueline Phipps

Next Stop: Research Associate I, Discovery Biology, Surrozen

Mihir Prasad

Next Stop: Analytical Chemist, Eurofins Scientific

Blake Reid

Next Stop: Medical Scribe, Scribe America

Abdias Rodriguez

Next Stop: Harvard Medical School

Julia Weeder

Next Stop: Doctor of Veterinary Medicine, University of Pennsylvania

Kyle Wettschurack

Next Stop: Ph.D. in Chemical Engineering, Purdue University

Mary Witucki

Next Stop: Ph.D. in Biomolecular Sciences, Boise State University

Shihan Xu

Next Stop: seeking employment

Kylie Zehner

Next Stop: Doctor of Veterinary Medicine, Purdue University

Aaron Zych

Next Stop: Master of Public Health (Epidemiology), Indiana University

Recognizing their potential

2017-2018

Departmental Scholarships

Bernard Axelrod Biochemistry Scholarship

Jasmin Gonzalez, Reid Herran

Dr. Stephen P. and Charlotte A. Coburn Scholarship in Biochemistry

Nicole Adkins, Quin Waterbury

Ray Fuller Scholarship in Biochemistry

Benjamin Anderson

Edwin T. Mertz Memorial Scholarship

Amy Cox, Kate Harris, Adam Hoehn, Matthew Nordland, Stephanie Price, Abdias Rodriguez, Julia Weeder

David & Mary Scheible Scholarship

Abigail Gress, Christopher Roberts

Kwok Yip Tso Scholarship

Kevin Lin

Donald and Rita Weeks Scholarship

Jordan Page

Zhao-Hermann Scholarship in Biochemistry

Emily Overway

Zygmunt Family Scholarship in Biochemistry

Elizabeth Amundson, Gabrielle Buck, Will Collier, Justin Couetil, Jacob Crosser, Katelyn Huff, Sara Monhollen, Jacqueline Phipps, Madison Smith, Kyle Wettschurack, Mary Witucki

College Scholarships

Agriculture Scholarship Award of Excellence

Jacob Boyer

Agriculture Study Abroad Scholarship

Dominik Bozek, Gabrielle Buck, Cameron Bumbleberg

John Benham Alumni Scholarship

Stephanie Price

Alva R. Bryant Ag Alumni Scholarship

Jacob Crosser, William Delacruz, Matthew Nordland, Ashique Zami, Zachary Zelten

Leonard B. Clore Scholarship

William Collier, Jordan Page

Joseph Dawson-Klauss Herrmann Scholarship

Abigail Gress

Diverse Leaders in Agricultural Sciences Scholarship

Brandon Hunter

Floyd E. and Nellie P. Elliot Agriculture Scholarship

Paige Lippens, Jordan Page

MSP Franklin Scholarship

Brandon Hunter

Fred M. Fraser Memorial Agriculture Scholarship

Sara Monhollen, Jacqueline Phipps

Goecker Scholarship

Luke Garner

Gruel Memorial Scholarship

Jacob Crosser, Katelyn Huff, Matthew Nordland, Julia Weeder, Kyle Wettschurack

Rex Hall Memorial Scholarship

Nicole Adkins, Benjamin Anderson, Alexander Angel, Ethan Brown, Gabrielle Buck, Reid Herran, Adam Hoehn, Kendal Paul, Ashwin Sunderraj, Quin Waterbury, Daniel Wesenberg

David and Mary Howell Scholarship in Agriculture

Kaylen Meeks

Huff Family Agriculture Scholarship

Brandon Hunter, Jake McClain, Abigail Murphy

Ice Miller LLP Scholarship in Agriculture

Benjamin Anderson

William and Barbara Jennings Scholarship

Amy Bowman, Mekenzie Gear, Jasmin Gonzalez, Ryan Hockemeyer, Paige Lippens, Dylan Riddle, Carleena Rocuskie, Elizabeth Schwartz, Claire Stamper, Ashique Zami

Marquardt Alumni Scholarship

Alexander Angel, Jacob Boyer, Ethan Brown, Reid Herran, Ryan Hockemeyer, Abigail Murphy, Kendal Paul, Jacqueline Phipps

Martin Agricultural Research Scholarship

Alexander Angel, Gabrielle Buck, Matthew Nordland, Stephanie Price, Dylan Riddle, Madison Smith

J.R. Mitchell Memorial Scholarship

Alexander Angel

Kelly and Margaret O’Neal Scholarship

Amy Bowman, William Collier, James Ford, Mark Gutay, Ryan Hockemeyer, Macey Lee, Dylan Riddle, Carleena Rocuskie, Elizabeth Schwartz, Zachary Zelten

Herbert and Dortha Parker Scholarship

Kate Harris

Richard A. Pickett Memorial Award

Mekenzie Gear

Runkle Scholarship

Mekenzie Gear, Kate Harris, Claire Stamper

Lloyd and Gene Sellers Scholarship

Logan Colwell

Pearl W. Smith Scholarship

Dominique Bennett

Olive K. Smith Scholarship

Evan Baker

Henry Andrew and Ida Sophia Sailer Wedeking Memorial Scholarship

Thomas Ault

Richard D. and Emma F. Schweikhardt Memorial Scholarship

Sarah Innis

Merrill Turley Family Agriculture Scholarship

Madison Smith

Ernest and Eva Voliva Scholarship

Elizabeth Amundson

Rich and Helen Willsey Scholarship in Agriculture

Jasmin Gonzalez, Ashique Zami

Brenta H. Wykoff Memorial Scholarship

Kate Harris, Paige Lippens

Undergraduate Research and Creative Endeavors Award

Mark Gee, Kate Harris, Gabrielle Williams

University Scholarships**Harold E. Alley 1926 Memorial Scholarship**

Hannah Bredikhin

Alumni/Purdue General Scholarship

Amy Bowman, Ellen Denning, James Ford, Luke Garner, Abigail Murphy, Matthew Nordland, Elizabeth Schwartz, Claire Stamper, Haley Staniszewski, Gabrielle Williams, Zachary Zelten

Steven C. Beering Scholarship

Mark Gee

Big Moves Study Abroad Scholarship

Alexander Angel, Thomas Audley, Amy Bowman, Cameron Bumbleberg, Brandon Hunter, Sarah Innis, Stephanie Price, Madison Smith, Claire Stamper, Ashwin Sunderraj

Mitchell and Cheri Daniels Scholarship

Stephanie Price

Emerging Leaders Scholarship

Kierra Jammer

Marquis Scholarship

Wyatt Baysinger, Matthew Dawson, William Delacruz, Khristina Erickson, Mekenzie Gear, Rachel Goedde, Jake McClain, Allison Megl, Claire Stamper, Gabrielle Williams, Zachary Zelten

Office of Undergraduate Research Scholarship

Benjamin Anderson, Abigail Gress, Kate Harris, Zian Liu, Jordan Page

Presidential Scholarship

Benjamin Anderson, Alexander Angel, Amy Bowman, Ethan Brown, Gabrielle Buck, William Collier, Livia Georgescu, Rachel Goedde, Daniel Goldfarb, Abigail Gress, Reid Herran, Katelyn Huff, Emily Overway, Ana Pascual-Garrigos, Kendal Paul, John Petroskey, Christopher Roberts, Elizabeth Schwartz, Haley Staniszewski, Ashwin Sunderraj, Julia Weeder, Gabrielle Williams, Kathryn Wolfert, Aaron Zych

Purdue Summer Scholarship

Oluwakemi Adejumo, Deborah Aremu, Jarrod Aronson, Hannah Bredikhin, Patrick Bustamante, William Delacruz, Jasmin Gonzalez, Seba Kaakeh, Jay Qiu, Ashique Zami

Science Bound Scholarship

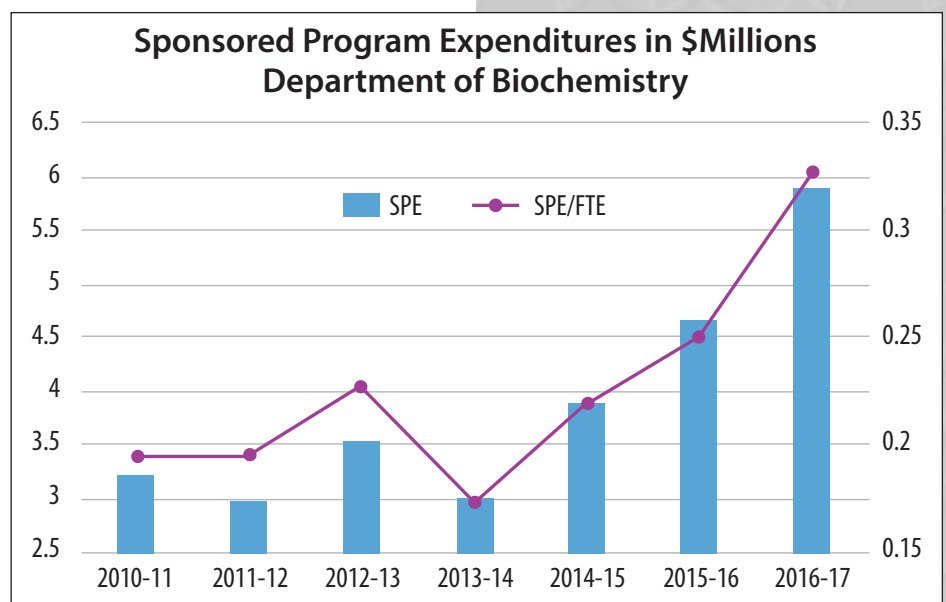
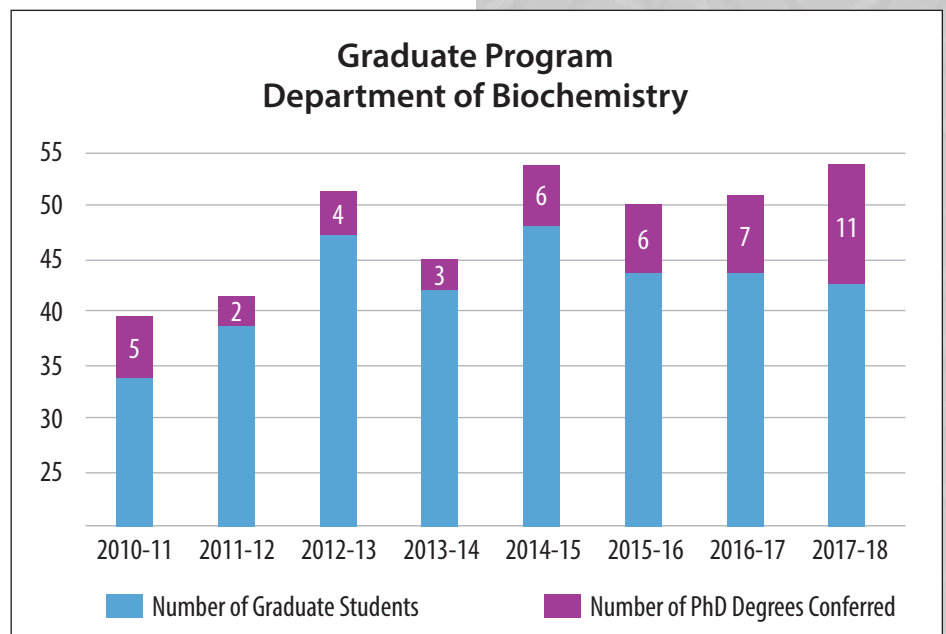
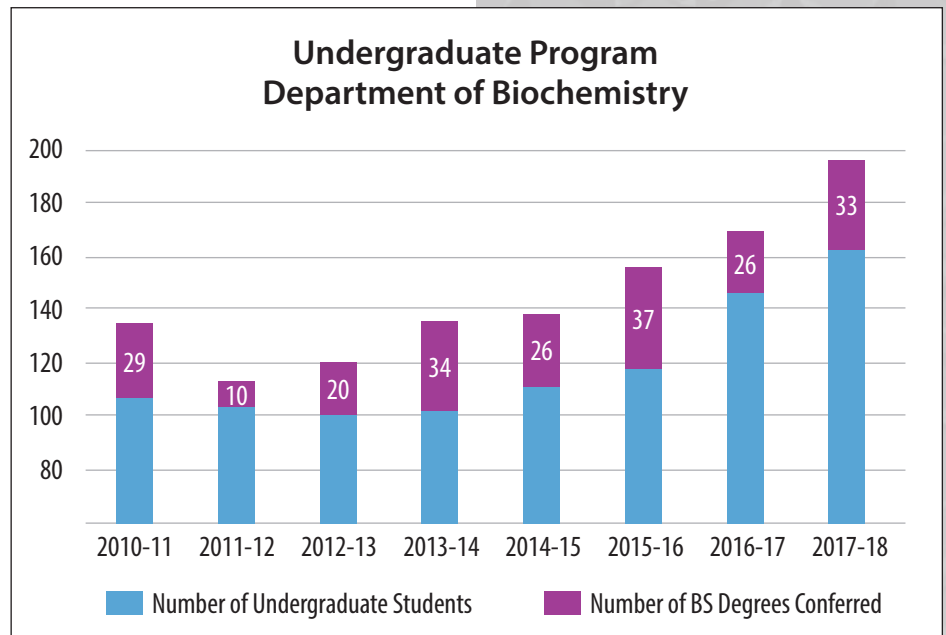
Dominique Bennett

Trustees Scholarship

Ellen Denning, Kate Harris, Adam Hoehn

Year in review

There are a number of important metrics, such as faculty research grant expenditures and undergraduate and graduate student enrollment, that Purdue University uses to assess departmental progress. Such metrics are used in part for determining our departmental budget and the number of faculty positions. These charts give a snapshot of the past few years and show that we are well-positioned for continued growth.



Let's keep in touch.

It's easier than ever to keep up with what's new in the Department of Biochemistry. In addition to *The Catalyst*, you can follow the department's happenings through our monthly newsletter, *Molecular Matters*, or via social media. We invite you to join us as we explore and find new ways to keep our alumni, prospective students, colleagues, and "friends of biochemistry" up-to-date.

You can connect with us on LinkedIn (Purdue Biochemistry) or follow us on Twitter (@PurdueBiochem). In today's fast-paced technological world, time and information go hand-in-hand. Using social media services allows us to more easily and quickly provide you with news in a variety of outlets. Aren't a fan of social media? Don't worry. We will continue to communicate with you through *The Catalyst* and our website, www.ag.purdue.edu/biochem.

Communication is a two-way street. Let us know how we're doing and what you're up to! Send any and all updates to Rachel Weaver at rweaver@purdue.edu. We would love to hear from you! If you aren't receiving our monthly newsletters and would like to, send in your email address.

While every effort has been made to ensure that information in *The Catalyst* is accurate and up-to-date, the Department of Biochemistry cannot guarantee accuracy and is not responsible for any errors or omissions. If you believe something is in error, please contact *The Catalyst*, Department of Biochemistry, 175 S. University St., West Lafayette, IN 47907.

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