July/August 2017 • Volume 44, Number 4

p. 6
Phenome 2018 Tucson, AZ February 14–17

p. 8
Plant Scientists Elected to the U.S. National Academy of Sciences

p. 9
ANU Scientist Graham Farquhar Wins Kyoto Prize

ASPB News

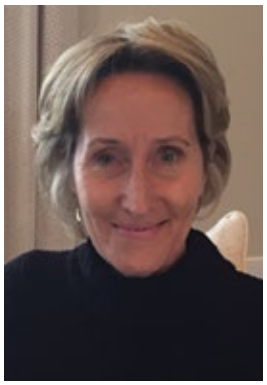
THE NEWSLETTER OF THE AMERICAN SOCIETY OF PLANT BIOLOGISTS

President's Letter

The System Can Still Work, But Not Without Your Help

BY SALLY MACKENZIE
Pennsylvania State University

It is not easy to recall a time when there was so much uncertainty about federal support for science. Part of this ambiguity is, of course, a consequence of President Trump's proposed budget for fiscal year 2018, which portends sizable reductions in funding for scientific research. Such research already hovers below 2% of the total federal budget, and most recent federal funding rates have seemed alarmingly low for years. Yet, funding rates for NSF (2017) plant-relevant research programs averaged 22% in 2016; for USDA's Agriculture and Food Research Initiative (2017), 17% in 2015; and for NIH's National Institute of General Medical Sciences, nearly 30% in 2016 (Miklos and Lorsch, 2017).



Sally Mackenzie

These rates, although not what we would like them to be, nevertheless offer the opportunity for outstanding science to be funded. But during times of funding uncertainty, it is especially important that everyone consider how they might help a very lean system run effectively and fairly. In particular, we should look for ways to address the topic of the most common hallway conversation among scientists who rely on grant support for their research: the highly biased and seemingly arbitrary tone of grant reviews.

It is not clear whether this problem is more pervasive now than it has been in the past. However, a number of valuable commentaries have been published over the past few years addressing the importance of the peer review process and the increasingly uncivil tone that characterizes reviewer

continued on page 3

2017 ASPB Election Results

Hearty congratulations to our new officers! They will begin their service to ASPB on October 1, 2017. Look for more information about our new leaders in the next issue of the *ASPB News*.

Incoming President-elect
Rob Last, Michigan State University

Incoming Elected Member
Christine Foyer, University of Leeds

Contents

The *ASPB News* is distributed to all ASPB members and is also available online. It is published six times annually in odd-numbered months. Its purposes are to keep membership informed of ASPB activities and to reinforce the value of membership. The *ASPB News* is edited and produced by ASPB staff from material provided by members and other interested parties.

Copy deadline is the 5th day of the preceding even-numbered month (for example, April 5 for May/June publication).

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PRESIDENT'S LETTER
continued from page 1

comments. Nichols and Ioannidis (2012) made a compelling, data-supported argument that the most innovative research generally goes unrewarded in the grant review system.

This state of affairs exists largely because there is nothing built into the grant review process to address its inherent and irrefutable bias. Anyone who has ever served as a review panel member recognizes the intrinsic subjectivity of the process, with reviewer commentary often focused on the relative "importance" of the work, appropriateness of the technical approaches, and style of the proposal writing. These are clearly matters of individual taste, influenced by whether any particular reviewer serves as a champion of his or her own field, possesses a competitive streak that leads to critical dissection of each and every technical detail, appreciates risk and innovation in a proposal, or prefers conformity. Unless the proposal is fundamentally flawed in its logic or design, these factors, which reflect the reviewer's personal preference, tend to take precedence over the proposal's scientific soundness.

What is to be done? Clearly, the peer review system could be significantly improved to reflect an understanding of this inherent bias. Agencies might treat reviewers as the highly biased experts they are and formally treat reviewer input as advisory rather than decisive to the process.

But each of us has a role to play, too. What we tend to forget with the many demands placed on our time is that declining to review a manuscript or grant proposal for which we are an expert leaves the task to others who are not. Anecdotal inquiry of NSF panel managers provides a reminder that not all reviews are weighed equally in their impact. It is the thoughtful, carefully worded, detailed review that most often sways panel opinion. More importantly, it is the reviewer who spends as much time describing precisely why the work is important, high priority, potentially transformational, and relevant to the broader field who helps steer the discussion.

Until federal agencies are able to incorporate into their review process a more sophisticated approach to inherent reviewer bias, and until our government and the private sector resolve to treat research funding as a critical investment in the U.S. economic future, we will have to do what we can to make sure the current system works to its very best. And that means saying yes when asked to review a proposal that aligns with our expertise and interests and taking the time to provide cogent, expert, and carefully worded reviewer advice. ■

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Plant Biology 2017: Five Days in Blue Hawaii

Great science, new colleagues, creative ideas, and professional insights!

22 elevator pitch videos

Learning how to tell the world what we do and why it's so important
http://bit.ly/2fnqzk8

20 blog posts

Documenting the meeting experience through the written word

http://bit.ly/2fnIXcy

130 new Plantae users

15 video interviews

91% of attendees used the conference app

35 symposia

2017 ASPB award winners. *Back row, left to right: Rick DeRose, Ganesh Kishore, Stephen Padgette, David Stalker, Julia Bailey-Serres, Widmar Tanner (2016 award winner), Blake Meyers, Edgar B. Cahoon, Julia Santiago Cuellar, Prateek Tripathi, ASPB President Sally Mackenzie, Georges Freyssinet, Kevin Folta, Jiří Friml (2016 award winner), and Richard Vierstra.*
Front row, left to right: Marguerite Varagona, Daniel Szymanski, David Smyth, Eran Pichersky, Joe Kieber, Maureen Hanson, Anja Geitmann, Sarah Wyatt, Ralph Bock, and Gloria Coruzzi (2016 award winner), and Luca Comai.

PHENOME 2018

TUCSON, AZ • FEBRUARY 14–17

HILTON EL CONQUISTADOR RESORT

Embracing and Harnessing the Complexity of Biological Systems

The newly established Phenome conferences are designed to bridge the gap between the lab and the field—and between academia and industry—by fostering connections and collaborations among plant scientists, engineers, data scientists, and problem solvers from a range of other fields.

Established by the National Plant Science Council and the North American Plant Phenotyping Network (http://nappn.plant-phenotyping.org/) and powered by ASPB Meeting & Event Solutions (http://meetings.aspb.org/), the annual Phenome meetings promote research and technology related to genotype–environment interactions, adaptations to the changing environment, plant communication, plant phenotyping, and other key aspects of the bioeconomy. These emphases address the Decadal Vision (https://tinyurl.com/yaf9swr6) call to "increase the ability of plant scientists to understand, predict, and alter plant behavior."

Phenome 2017, the inaugural conference, brought together more than 200 key research drivers from academia, industry, and government. These diverse participants enjoyed a broad range of networking opportunities and symposia on emerging technologies, plasticity in plant traits, computational modeling, metabolomics, environmental/stress biology, quantitative traits, and metadata analysis. Attendees new to phenomics found that the conference provided an excellent perspective on the state of the technology, research trends, and knowledge gaps.

The Phenome 2018 organizers are building on this momentum. According to committee chair Chris Topp, Phenome 2018 will emphasize the "collaboration of biologists, engineers, computer scientists, and allies, including industry" and include an "emphasis on how we collect and organize data, how we process it, and how we use it to develop statistical and conceptual frameworks to understand biological complexity, from molecular to ecological scales."

Phenome 2018 will also provide many opportunities for discussion, learning, and collaboration at workshops, poster sessions, and short-format talks. Organizing committee member Alina Zare stated, "We plan to have sessions focused on 'Sensors and Systems' topics in which researchers can share their experience and recent advances in putting together agricultural robotics systems. I am particularly looking forward to learning about both the development of new sensing modalities and creative adaptations of existing sensor systems for agriculture research questions."

Registration OPENS September 2017

Phenome2018.org

Praise from Phenome 2017 Attendees

Great talks from some of the best scientists in the world.

Phenome 2017 had workshops before and after the meeting and specific concurrent sessions to bring together a diverse set of researchers to introduce the group to big data sets, computing infrastructure, and other mechanisms to help us connect across disciplines.

Hearing the leaders speak about their programs gave me guidance for running my own.

High quality…talks from both plant biologists (focused on interesting biology by using phenomics instead of just talking about the tools) and engineers [and] computer scientists (who did focus on tools, but did a good job of both explaining the concepts behind the tools and demonstrating relevant applications in their talks).

[Beneficial aspects were] meeting colleagues, making new connections, and getting up to speed with the latest in this field.

Phenome brought together many of the leading experts in plant biology applications to phenomics.

Join the Plant Phenomics network on Plantae.org.

PHENOME 2018 ORGANIZING COMMITTEE

CHAIR
Chris Topp
Danforth Center

CO-CHAIR
Nathan Springer
University of Minnesota

Ivan Baxter
Danforth Center

Jennifer Clarke
University of Nebraska

Malia Gehan
Danforth Center

Ad hoc member Malia Gehan (Danforth Center) will be organizing workshops and a hackathon where attendees will work on a phenotyping problem as a group.

Carolyn Lawrence-Dill
Iowa State University

Jan Leach
Colorado State University

Sally Mackenzie
Penn State

Josh Peschel
Iowa State University

Pam Soltis
Florida Museum of Natural History and University of Florida

Alina Zare
University of Florida

Follow @PlantPhenomics and #phenome2018 on Twitter.

Plant Scientists Elected to the U.S. National Academy of Sciences

Five plant scientists have been elected as members of the U.S. National Academy of Sciences (NAS) in recognition of their distinguished and continuing achievements in original research. These plant biologists are among the 84 new members and 21 foreign associates just elected. There are now 2,290 active NAS members and 475 foreign associates.

The following were elected to this year's NAS class:

Dominique Bergmann

Donald R. Ort

Craig S. Pikaard

Douglas W. Schemske

Douglas E. Soltis

Dominique Bergmann

Dominique is a Gordon and Betty Moore–Howard Hughes Medical Institute investigator and professor in the Department of Biology at Stanford University. Her lab works on the development of stomata to better understand cell specialization, stem cell renewal, and cell polarity. Dominique is a recipient of the 2010 Charles Albert Shull Award.

Donald R. Ort

Don is the research leader of the USDA/ARS Global Change and Photosynthesis Research Unit and the Robert Emerson Professor of Plant Biology in the departments of plant biology and crop sciences at the University of Illinois, Urbana–Champaign. His current research emphasis is on photosynthetic energy transduction centers and their impact on the regulation of the photosynthetic ATP synthase enzyme complex. Don has been highly active in the ASPB community over the years. In addition to serving as the Society's president (1996–1997) and as editor-in-chief of *Plant Physiology* (2005–2012), Don has served on the Executive, Program, Education, and Science Policy Committees and the Board of Trustees. He is a recipient of the 2006 Charles F. Kettering Award and in 2007 was named a Fellow of ASPB.

Craig S. Pikaard

Craig is a Gordon and Betty Moore–Howard Hughes Medical Institute investigator and distinguished professor of biology and molecular and cellular biochemistry in the Department of Biology at Indiana University Bloomington. The Pikaard lab is currently working on projects examining the roles of chromatin modifying enzymes and noncoding RNAs in gene silencing and epigenetic phenomena. Craig is a recipient of the 2015 Martin Gibbs Medal.

Douglas W. Schemske

Douglas is the John Hannah Distinguished Professor of Plant Biology in the Department of Plant Biology at Michigan State University. A central theme of his work is probing the link between temporal and spatial variation in ecological conditions and the adaptive differentiation of populations and species using ecological and genetic approaches to better understand the origins and maintenance of biological diversity.

Douglas E. Soltis

Douglas is a distinguished professor in the Florida Museum of Natural History and Department of Biology at the University of Florida. His research interests are in plant systematics, genome evolution (polyploidy), floral evolution, angiosperm diversification, and phylogeography.

ASPB extends its sincerest congratulations to these outstanding plant scientists. ■

This article was first published on June 16, 2017, by the Australian National University (https://tinyurl.com/ycevdhcs). It has been edited for the ASPB News.

ANU Scientist Graham Farquhar Wins Kyoto Prize

Graham Farquhar has become the first Australian to win a Kyoto Prize—the most prestigious international award for fields not traditionally honored with a Nobel Prize.

Graham won the 2017 Kyoto Prize in Basic Sciences for his life's work in plant biophysics and photosynthesis, which has involved research on water-efficient crops and the impacts of climate change. He has helped develop new water-efficient varieties of wheat, improved global food security, and found evaporation and wind speeds are slowing as the climate changes.

"It's wonderful to get this kind of international recognition, but it also brings on a case of imposter syndrome," said Graham, who works at the Australian National University (ANU) Research School of Biology. "I can think of so many people among my peers who have done more than I have. The work that this prize recognizes has really been a team effort, so I'd like to acknowledge my colleagues, students, and the ANU, where I have worked for my whole career. It's a wonderful honor for all of us."

Graham Farquhar

The prize is the latest in a string of accolades, including the Prime Minister's Prize for Science in 2015 and Britain's prestigious Rank Prize, which Graham shared in 2014 with CSIRO colleague Richard Richards.

ANU Vice Chancellor Professor Brian Schmidt congratulated Graham on the latest honor. "This award acknowledges Graham's crucial work and global leadership to help feed the world in a changing climate," Professor Schmidt said. "I'm proud that we have a person of Graham's caliber working at ANU, tackling some of the most profound challenges facing humanity and the environment."

As part of the award, Graham will receive 50 million yen (U.S. $475,000). Kyoto Prizes have been awarded annually since 1985 in three categories—Advanced Technology, Basic Sciences, and Arts and Philosophy—to people "who have contributed significantly to the scientific, cultural, and spiritual betterment of mankind."

Graham was appointed an Officer in the Order of Australia (AO) in 2013 and won the 2016 Australian Academy of Science Macfarlane Burnett Medal and Lecture. He was elected a Foreign Associate of the U.S. National Academy of Sciences in 2013 and was a member of the United Nations Intergovernmental Panel on Climate Change, which won a Nobel Prize in 2007. He is an associate editor for *Plant Physiology.*

Graham first came to ANU as an undergraduate, completing his bachelor of science in 1968. He returned to the university to complete his PhD in environmental biology in 1973. He was appointed a distinguished professor at the ANU Research School of Biology in 2004, and he is a chief investigator at the Australian Research Council Centre of Excellence for Translational Photosynthesis, which is based at ANU. He also leads a collaboration between ANU, University of Western Sydney, and CSIRO on Forests for the Future: Making the Most of a High CO_2 World, funded by the Science and Industry Endowment Fund.

For more information on the Kyoto Prize, visit www.kyotoprize.org/en/. ■

Welcome to the *ASPB News* "Luminaries" column. Student and postdoc members are invited to submit their ideas for a 500- to 750-word interview they might like to conduct with a prominent scientist. Contact Membership Committee Chair Jill Deikman at jill.deikman@monsanto.com, who will help you develop some questions to frame your story. If we publish your interview, you will receive a $50 Amazon gift card.

Rajeev Varshney

Program Director, Research Program–Genetic Gains, and Founding Director, Center of Excellence in Genomics, International Crops Research Institute for the Semi-Arid Tropics

BY RISHI R. MASALIA
ASPB Student Ambassador and Research Student, Department of Plant Biology, University of Georgia

Rajeev Varshney grew up in the small town of Bahjoi, Uttar Pradesh, India. Rajeev always wanted to be a scientist, but fueled by a love of comics, his interests tended to be space based. However, Rajeev eventually became grounded, opting to pursue his new interest: the cosmos of the cell.

He received his bachelor's (BSc Honours) and master's degrees in botany from the Aligarh Muslim University in Aligarh, India, and his PhD in agricultural botany with P K Gupta at Chaudhary Charan Singh University in Meerut, India. After receiving his PhD, Rajeev ventured to Gatersleben, Germany, where he studied the structural and functional genomics of barley and comparative genomics of cereal grasses at the Leibniz Institute of Plant Genetics and Crop Plant Research.

After five years in Germany, Rajeev accepted a position as senior scientist for applied genomics at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in

Rajeev Varshney

Patancheru, India, in late 2005 and was promoted to principal scientist three years later. During this time, he took up and maintained dual appointment status with the Generation Challenge Programme hosted at the Consultative Group for International Agricultural Research's (CGIAR) International Maize and Wheat Improvement Center in El Batán, Mexico. Over the next few years, in addition to his work with nonprofit organizations, Rajeev was also appointed adjunct or visiting professor at the University of Western Australia, the Guangdong Academy of Agricultural Sciences, and the Beijing Genomics Institute in Hong Kong. In 2013, Rajeev was made program research director of legume gains for ICRISAT, and in 2016, he became program research director of the Research Program–Genetic Gains (RP–GG).

Rajeev's research revolves around sequencing and identifying markers associated with drought tolerance in regionally important crops, which is itself a facet of ICRISAT's mission to identify long-term solutions to overcome poverty and hunger for millions of small farmers. Beyond his research, Rajeev has given a lot of his time to the scientific and global communities. He has been on the editorial boards of many scientific journals and has served on or chaired the steering committees for international conferences including the Food and Agricultural Organization's Agricultural Biotechnologies in Developing Countries Conference, the fourth International Congress on Legume Genetics and Genomics, and the InterDrought-V conference.

For his research contributions and willingness to serve the community, Rajeev has been awarded numerous prizes, including the Shanti Swarup Bhatnagar Prize for Science and Technology in 2015. He was elected to the Indian National Science Academy in 2013 and the National Academy of Sciences, India, in 2015. He's also an extremely nice, all-around friendly guy.

For those not familiar with ICRISAT, can you describe the organization, the mission, and your role?

ICRISAT is a nonprofit, nonpolitical organization that belongs to the consortium of centers supported by CGIAR. We conduct agricultural research for development in Asia and sub-Saharan Africa and are based in Hyderabad, Telangana, India, with two regional hubs and six country offices in sub-Saharan Africa. ICRISAT conducts research on five highly nutritious,

drought-tolerant crops—chickpea, pigeon pea, millet, sorghum, and groundnut—and works with a mission to reduce poverty, hunger, malnutrition, and environmental degradation in the dryland tropics.

I lead the Research Program–Genetic Gains and Center of Excellence in Genomics (CEG) at ICRISAT. As a director of RP–GG, I provide strategic direction and supervision for research activities aimed at enhancing genetic gains of breeding programs. We accomplish this by harnessing the full potential of ICRISAT's gene bank and germplasm, as well as modern breeding approaches and a faster varietal replacement in farmers' fields. As a director of the CEG, I look after service- and capacity-building activities related to genomics research and molecular breeding activities.

ICRISAT's main goals revolve around smallholder farmers. Can you explain your role in helping ICRISAT achieve these goals?

We create long-term solutions to overcome poverty and hunger, and we help millions of smallholder farmers with improved varieties that allow them not only to do subsistence farming but also to grow their own food and make farming profitable.

Because my work focuses on legume crops, which are rich in protein, oil, and micronutrients such as iron and zinc, we significantly contribute to malnutrition reduction. While working on these key aspects, we make sure to engage highly talented and motivated staff with gender balance and apply new technologies at the CEG for high-quality breeding and research.

What are some of the projects you've been working on?

For the past 10 years, I've been working on legume crops, which provide proteins and nutrition to the large populations in developing countries and form the livelihood of several million smallholder farmers. With an objective to enhance crop productivity and benefit human health, we, together with several partners around the world, have been engaged in decoding the genomes of several crops. Comprehensive analysis of those genomes helped us understand the genes responsible for different traits required for farmers and for human health. For instance, peanut genome analysis conducted recently has provided clues on peanut allergen genes, and I believe that once these are altered, allergen-free peanut products could be produced.

What scientific discoveries of the past few years have influenced your research directions?

For me, the primary influence over the past few years has been advances in rapid whole-genome sequencing. With these technological breakthroughs, gene sequences can now be more easily linked with phenotypic characteristics to enable study and understanding of different traits for the development of improved crop varieties. This effort can address some of the critical issues of our time, such as climate change, nutrition, and environmental degradation.

What's the next big thing in plant biology?

Until recently, biological questions have been addressed mainly by studying gene functions and gene products. Approaches such as genomics and transcriptomics have allowed linking of genes to biological functions responsible for, for instance, various agronomically important traits. At the CEG, by using these approaches, we have assembled reference genomes and resequenced several thousand lines, and we have delivered several molecular breeding lines for our six mandate crops (chickpea, pigeon pea, groundnut, pearl millet, sorghum, and finger millet).

However, genes are regulated at the transcriptional level as well as the posttranscriptional level, with the majority of gene products functioning together with other gene products, leading to a complex network of interconnected components for a specific biological process. Systems biology is an emerging holistic approach that allows understanding of biological systems by combining various *-omics* approaches such as genomics, transcriptomics, epigenomics, proteomics, and metabolomics, together with modeling, synthetic biology, and high-performance computational analysis. In brief, systems biology is the study of an organism or trait, viewed as an integrated and interacting network of genes, proteins, and biochemical reactions. In my opinion, systems biology can help us understand better the entirety of processes and traits that happen in a biological system for the greater benefit of humankind.

What advice would you give to a student interested in plant biology today?

Today, almost a billion people worldwide live in hunger. Moreover, there will be a steep elevation in this figure by 2050. Simultaneously, climate change is resulting in huge yield loss every year, making the situation worse. In my opinion, different fields of plant biology are of equal importance, as all plant biology disciplines help us understand biological mechanisms and facilitate plant improvement. For developing countries, where agriculture remains the primary method of earning livelihoods for the majority of the population, there is not anything more fundamental than agriculture.

Students and young researchers, in my opinion, need to focus more on finding solutions for grand challenges such as how to feed 9 billion people by 2050. Such questions provide a vast ocean of opportunities to help others and will themselves be rewarding to pursue in the coming years.

Additionally, students need to be committed and work hard to achieve the goal they've set. There will always be obstacles in life, and things will not go as planned, but instead of changing your goal, you should change the approach to pursuing your goal.

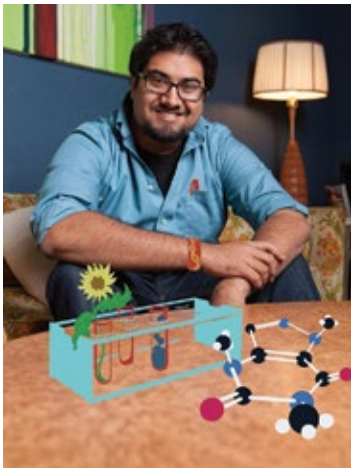
What inspires you to continue your science?

I always have been inspired by the idea of achieving the impossible. When your job can impact the lives of millions of smallholder farmers, achieving the impossible becomes more important. The current "impossible" that I am pursuing is developing high-yielding legume varieties with enhanced drought tolerance and disease resistance through molecular breeding.

continued on page 12

LUMINARIES
continued from page 11

In addition, the other three key things that inspire me are (1) good-quality science with which to improve the livelihoods of smallholder farmers, (2) good-quality research papers to share our knowledge and benefit the global scientific community, and finally (3) training of the next generation of highly motivated scientists to continue achieving the impossible. ■



Rishi R. Masalia is a graduate student at the University of Georgia. He is a biologist, bioinformatician, artist, avid science communicator, and all-around nerd. You can read about his research and science communication endeavors at www.rishimasalia.com or follow him on Twitter: @RishiMasalia.

Policy Update

BY LAUREN BROCCOLI
Lewis-Burke Associates, LLC

House Science, Space, and Technology Subcommittees Hold Hearing on NSF Reimbursement of Facilities and Administrative Costs

On May 24 the House Science, Space, and Technology (HSST) Subcommittee on Research and Technology and Subcommittee on Oversight held a joint hearing on "Examining the Overhead Cost of Research." The hearing focused on examining the payment of facilities and administrative (F&A) costs by NSF and ensuring that these costs are as efficient and transparent as possible. The impetus for the hearing was the fiscal year (FY) 2018 budget request proposal that would cap F&A costs on NIH grants at 10% of total research costs.

All committee members acknowledged the importance of F&A costs and their support for the critical partnership between the government and universities to conduct research. However, HSST chairman Lamar Smith (R-TX) expressed concern with what he described as improper uses of F&A, such as "fancy buildings," and stated that F&A costs have continued to expand, taking up now a quarter of NSF budgets (these facts were later disputed by other members). He said that the committee is looking at potential caps and other limitations on F&A costs.

Research and Technology Subcommittee chair Barbara Comstock (R-VA) and Oversight Subcommittee chair Darin LaHood (R-IL) took softer tones, indicating they were looking to streamline indirect costs and ensure federal funds are spent in the most efficient and effective way possible. All committee member Democrats argued against any caps and noted that reimbursement rates are already below the total costs of research. Many members on both sides also noted the importance of streamlining the regulatory burden for grantees.

One witness, James Luther, associate vice president of finance at Duke University and chairman of the board for the Council on Governmental Relations, defended the importance of F&A costs and university practices. Richard Vedder, professor of economics emeritus at Ohio University and director of the Center for College Affordability and Productivity, recommended vast changes to a system he described as distorting research incentives and driving up costs. Vedder also recommended two potential alternative systems to reimburse universities for F&A costs: one would set a uniform rate across universities, eliminating the need to negotiate or justify costs, and the other would establish a points system that would enable consideration of a university's F&A rate as part of proposal review, thus incentivizing universities to lower their rates.

Source and Additional Information

- A full webcast and witness testimonies are available at https://tinyurl.com/y8eoaulk.

USDA Secretary Sonny Perdue Appears Before House Agriculture Committee

On May 17, Secretary of Agriculture Sonny Perdue appeared before the House Agriculture Committee to testify at a hearing on the "State of the Rural Economy." Topics discussed included the potential budget cuts proposed in the FY2018 budget request. Secretary Perdue also answered questions about the USDA reorganization that would create a new position of Under Secretary for Trade, streamline a new mission area focused on domestic agriculture, and eliminate the job of Under Secretary for Rural Development.

Although some of these changes were mandated in the 2014 Farm Bill, others are part of government-wide efforts to reduce costs and the federal workforce. Secretary Perdue emphasized that these structural changes will help elevate issues of concern to rural communities, which remain a priority of the Trump administration. The rest of the hearing focused on trade and farm incomes; agricultural research was not specifically discussed.

Source and Additional Information

- The archived webcast and witness statements are available at https://tinyurl.com/y7fc7vz5.

USDA Announces Agency Reorganization, New Positions

On May 11, Secretary of Agriculture Sonny Perdue announced a restructuring of USDA that will create two new positions—Under Secretary for Trade and Foreign Agricultural Affairs and Under Secretary for Farm Production and Conservation—and streamline mission areas to support trade and domestic affairs priorities. This new structuring will also shift oversight of the Rural Development programs directly to the Office of the Secretary.

The new Under Secretary for Farm Production and Conservation will oversee the Farm Service Agency, the Risk Management Agency, and the Natural Resources Conservation Service. This new role and consolidation of existing programs is consistent with the Trump administration's interest in bolstering domestic-focused mission areas and streamlining USDA services, focusing on U.S. agricultural producers. Although these changes will eliminate the Under Secretary for Rural Development and shift oversight directly to the Secretary, the Under Secretary for Natural Resources and Environment will retain oversight of the U.S. Forest Service.

USDA released a full report in conjunction with the announcement that highlights the signifi-

continued on page 14

POLICY UPDATE
continued from page 13

cant economic contributions made by the agricultural industry and the potential for increased growth through administrative reorganization. The White House accepted public comment on the restructuring through June 12.

Sources and Additional Information

- The press release announcing the administrative changes is available at https://tinyurl.com/k3whxsr.
- Secretary Perdue's op-ed in the *Wall Street Journal* is available at https://tinyurl.com/kkkye8c.
- The full USDA report to Congress is available at https://tinyurl.com/y9p2vfjq.
- More information about the public comment period is available at https://tinyurl.com/n6z98a5.

FY2017 Omnibus Appropriations Bill

In May, the House and Senate Appropriations Committees concluded negotiations on an omnibus appropriations bill (H.R. 244) to fund federal research agencies for the remaining five months of FY2017. In contrast to the increases provided through the recent FY2017 omnibus, the FY2018 Trump administration budget blueprint released in March proposed cutting nondefense programs by $54 billion to pay for $54 billion in defense increases, cuts that were reaffirmed in the president's full FY2018 request outlined below.

The delayed conclusion of the FY2017 appropriations process seven months into FY2017 was brought about by the Trump administration's insistence on putting its stamp on federal spending. In the end, however, the administration relented on its top priorities, such as money for a border wall and increased defense spending, and signed the omnibus into law to avoid a government shutdown.

The following are topline numbers for agencies of interest to ASPB:

- DOE's Office of Science is funded at $5.39 billion, an increase of $42 million, or 0.7%, above the FY2016 enacted level. Despite the administration's proposed elimination, the Advanced Research Projects Agency–Energy received $306 million, an increase of $15 million, or 5.1%, above the FY2016 enacted level. The Biological and Environmental Research program received $612 million, a $3 million, or 0.5%, increase.
- NSF is funded at $7.472 billion, an increase of $9 million, or 0.1%, above the FY2016 enacted level.
- USDA's National Institute of Food and Agriculture (NIFA) received $1.36 billion, an increase of approximately 2.72% above the FY2016 level. Within NIFA, the Agriculture and Food Research Initiative is funded at $375 million, an increase of $25 million above the current enacted level.

Source and Additional Information

- Full details for the omnibus can be found at https://tinyurl.com/l6ymw67.

President Trump Releases FY2018 Budget Request

On May 23, the Trump administration released the full FY2018 budget request, which generally proposes dramatic cuts and eliminations for federal research funding at NSF, DOE, and USDA. These proposals are inconsistent with the recently enacted FY2017 omnibus, which demonstrates bipartisan congressional priorities for these same programs, as detailed above. Looking ahead, Congress will begin the FY2018 appropriations process with significant disregard for the administration's dead-on-arrival budget. Congressional appropriators have already voiced criticism of the budget request, including chairman of the Senate Agriculture Appropriations Subcommittee John Hoeven (R-ND). The following are proposed topline numbers of interest to ASPB:

- NSF would receive $6.653 billion, a decrease of $819 million, or 11%, below the FY2017 enacted level. Research directorates would see relatively similar top-level cuts of approximately 10%. Core research and infrastructure programs would be relatively protected, whereas most cross-cutting initiatives and strategic investments from the previous administration would be deeply cut.
- DOE's Office of Science would receive $4.5 billion, a proposed decrease of 17%. Basic Energy Sciences would receive $1.6 billion, a decrease of 16.9%, while the Biological and Environmental Research account would decrease by 42.9%, or $263 million. Advanced Research Projects Agency–Energy would be eliminated. Overall, most of the cuts at DOE are targeted at university grants and research and development projects, with funding prioritized for national laboratories.
- USDA's National Institute of Food and Agriculture (NIFA) would receive $1.26 billion, a decrease of 7.8% below the FY2017 enacted level. Within NIFA, the Agriculture and Food Research Initiative would be funded at $349 million, a $26 million decrease below the recently enacted FY2017 omnibus level.

Many of the projects proposed for steep cuts or elimination by the administration have broad congressional support, and funding is likely to be maintained by Congress through the FY2018 appropriations process. For example, NSF has champions in Congress who will likely protect it from major cuts, although NSF would likely be squeezed if overall domestic discretionary spending was to be reduced dramatically. Similarly, agricultural research within USDA has received strong bipartisan support in Congress and saw a funding increase in the FY2017 omnibus, so it seems unlikely that there will be support for the proposed cuts in FY2018.

Source and Additional Information

- The president's FY2018 budget request is available at https://tinyurl.com/k3d6u4j; more detailed information is available at individual agency websites.

DOE's Biological and Environmental Research Advisory Committee Meeting

DOE's Biological and Environmental Research (BER) Advisory Committee met on April 20 and 21. Steve Binkley, acting Office of Science director, and Sharlene Weatherwax, BER associate director, presented news from the DOE Office of Science. Despite Secretary of Energy Rick Perry's recent confirmation, he has started defining DOE priorities that do not align with BER mission areas, such as exascale computing, U.S. leadership in high-performance computing, and cybersecurity of energy systems. All six of the Office of Science associate directors have briefed the new DOE political appointees on program accomplishments and priorities. With respect to BER, these priorities include energy and infrastructure security and the effect of climate variability.

Gary Geernaert, director of the Climate and Environmental Sciences Division (CESD), presented updates on the CESD including a new five-year strategic plan being developed. He noted impacts on the DOE missions including predicting future blackouts, improving pipeline security, enhancing infrastructure risk calculations, and deploying more resilient energy infrastructure. Grand challenges of the strategic plan include system forcers of the "coupled Earth–energy–human system," high-latitude feedbacks and interdependencies, biogeochemistry, integrated water cycle, and data-model integration.

Source and Additional Information

- The agenda and several presentations from the BER Advisory Committee are available at https://tinyurl.com/y9fn55kz.

NSF BIO Advisory Committee Meeting

On April 25 and 26, the NSF Advisory Committee for the Biological Sciences (BIO) held its spring 2017 meeting. The committee discussed NSF's 10 Big Ideas, such as the rules of life and convergence research. BIO is currently in the process of shaping priorities related to the rules of life and identifying examples and narratives to inform this effort. Other topics included the upcoming turnover for the Advisory Committee and the ongoing nomination process for new members.

Finally, the Advisory Committee hosted a series of guest speakers to discuss interagency collaborations between NSF and mission-driven research agencies. Speakers included USDA National Institute of Food and Agriculture (NIFA) deputy director Dr. Parag Chitnis and Dr. Mary Voytek, senior scientist for astrobiology at NASA. These guest panelists discussed past collaborations with NSF BIO, including the NASA Ideas Lab and the NSF–NIFA Plant Biotic Interactions program, as examples of ways to leverage federal funding to address grand challenges. Due to the upcoming NSF move, the next BIO Advisory Committee meeting will occur in April 2018.

Source and Additional Information

- Archived details on the BIO Advisory Committee meeting are available at https://tinyurl.com/y8886jqk.

NSF Funding Opportunity: Joint Solicitation for the Plant Biotic Interactions Program

On April 14, NSF and USDA's National Institute of Food and Agriculture (NIFA) released a joint solicitation for the Plant Biotic Interactions (PBI) program, which supports basic research on the interactions among plants, microbes, and invertebrates and applied research to develop methods for sustainably increasing crop yields. A primary focus of this program is to investigate symbiotic relationships among agricultural plants and viruses, bacteria, fungus, pathogens, pests, and other plants—more specifically, the genetic, genomic, and cellular signaling responses and their effect on "nutritional, metabolic, and developmental processes."

Applicants should consider genetic, genomic, biochemical, metabolic, and image-based approaches in the investigation of fundamental principles and ways discoveries may be applied to the agricultural industry, including potential economic benefits if applicable. Although a broad objective of the PBI program is to fill existing information gaps regarding recognition and signaling between these symbionts, successful proposals must consider this in a more targeted context, investigating the biological mechanisms and systems necessary to overcome key agricultural problems.

Eligible entities under this solicitation include but are not limited to institutions of higher education, professional and scientific societies, observatories, and research labs. NSF and USDA NIFA anticipate distributing a total of $14.5 million for 20 awards. No preliminary proposals are required; the submission deadline for full proposals is September 1, 2017.

Source and Additional Information

- The full solicitation is available at https://tinyurl.com/y882xbld. ■

Fascination of Plants Day 2017

BY NATALIE HENKHAUS
Executive Coordinator, Plant Science Research Network

Thank you to everyone who participated in Fascination of Plants Day 2017 on May 18! It was a great success, and we are looking forward to the next event in 2019.

Fascination of Plants Day is an international event organized by the European Plant Science Organization (learn more at epsoweb.org/fopd17). Now in its fourth year, the event raises awareness of plants and the importance of plant science research. As the national coordinator for the United States, ASPB registered nine events around the country and awarded prizes through a photo contest. Take a look at the photos submitted by searching the tag #PlantDayUSA on social media. Event recaps and participant experiences can be found on the ASPB blog (blog.aspb.org).

Photo Contest Winners

Congratulations to the winners of the ASPB Social Media Photo Contest!

FIRST PRIZES
Jennifer Robison (Twitter) and **Marwa Zafarullah** (Facebook)

SECOND PRIZES
Lynn Sosnoskie (Twitter) and **Sandra Raimundo** (Facebook)

HONORABLE MENTIONS
Ravi Palanivelu, Monica Lewandowski, Ian Street, Zoe Dubrow, Tim Taylor, Joanna Jelenska, Sen Subramanian, and **Pratibha Choudhary**

View all winning photos on the ASPB blog (blog.aspb.org/2017/06/01/fascination-of-plants-2017-success-stories/).

First Prize (Facebook)
Wild type Arabidopsis thaliana *(above) and plant with stem fasciation (right), a rare condition of abnormal growth in vascular plants in which the cells around the growing tip become elongated. According to the photographer, "It is rare to find this kind of plant showing fasciation so beautifully in the stem."* PHOTO BY MARWA ZAFARULLAH

First Prize (Twitter)
"Happy Mother's Day was inspired by my mother. Her favorite flowers are daisies, and they were in full bloom at her house Mother's Day weekend. I wanted to capture the brightness of the spring." PHOTO BY JENNIFER ROBISON (@OSHNGIRL ON TWITTER)

Plant Day 2017 U.S. Participants

We acknowledge the following U.S. participants:

Argelia Lorence and Rodney Shea Harris
Plant Imaging Consortium, Arkansas State University

Bjorn Hamberger and Anne-Sophie Bohrer-Cognon
Michigan State University

Courtney Price
Ohio State University and Arabidopsis Biological Resource Center

Hua Lu
University of Maryland, Baltimore County

Jason Wallace
University of Georgia

Marcella Tello-Ruiz
Cold Spring Harbor Laboratory and Gramene

Marcia Harrison-Pitaniello
Marshall University

Peggy Lemaux
University of California, Berkeley, and Communication, Literacy & Education for Agricultural Research

Rajnish Khanna
i-Cultiver and Carnegie Institution for Science

Rebecca Roston
University of Nebraska–Lincoln

Botany Live

Many ASPB members participated in Fascination of Plants Day by taking part in the first Botany Live event (learn more by visiting botany.live and on social media by searching #BotanyLive). Thanks to Anne Ostreider, Ian Street, and Mary Williams for organizing this event!

Contact plantday@aspb.org for more information.

Announcing the 2017 Summer Undergraduate Research Fellows (SURF)

The ASPB Summer Undergraduate Research Fellows (SURF) program funds promising undergraduate students so they can conduct research in plant biology during the early part of their college careers over the course of 10 consecutive weeks. This year's SURF recipients will present their research at Plant Biology 2018.

SURF recipients possess high academic achievement, strong motivation and skills for conducting research, and career objectives showing interest in or close relevance to plant biology. Reviewers also consider the contribution of the project to the mentor's research program, institutional commitment to the proposed research, and the mentor's commitment to undergraduate research.

Proposals are evaluated in two groups based on whether the research will be conducted at a primarily undergraduate or doctoral granting institution. Awards reflect the ratio of applicants in each group.

Congratulations to these 15 SURF fellows and their mentors!

SURFers from Doctoral Granting Institutions

Samantha Connolly

Samantha Connolly, University of Vermont
Mentor: Jeanne M. Harris, Associate Professor
Project: *Determining the function of NPF1A in* Lotus japonicus

The SURF award gives me the opportunity to explore an exciting question involving legumes, genetics, and evolution. I am happy to be able to spend my summer fully immersed in a plant biology lab, and I believe this experience will help prepare me for a career in research. In addition, I am excited to join the ASPB community and to be a part of the 2018 ASPB meeting.

Cameron Criswell

Cameron Criswell, Texas A&M University
Mentor: Ping He, Associate Professor
Project: *Understanding plant cell death with "bak to life" screens*

It is an honor to receive the ASPB SURF award and to have the chance to take on my first undergraduate research project. The ASPB SURF program will enhance my career objectives. This opportunity will greatly expand my undergraduate experience by allowing me to work closely with my mentor. I will gain invaluable experience in the lab, further enhancing my skills as a young researcher.

David "Max" Hagelthorn

David "Max" Hagelthorn, University of California, Davis
Mentor: Philipp Zerbe, Assistant Professor
Project: *Functional characterization of stress-inducible diterpene synthases in switchgrass*

The ASPB fellowship process has been extremely educational in grant writing. Receiving the award is an honor and will provide me with invaluable experience in scientific research.

Christopher Imler

Christopher Imler, University of Florida
Mentor: Gerardo Nunez, Lecturer and Undergraduate Adviser
Project: *Genetic and biochemical evidence for direct rhizosphere acidification in* Vaccinium corymbosum

I owe my selection for this award to my mentor, without whom I wouldn't have been able to engage in such meaningful and rigorous research. I look forward to working on what is the beginning of a lifelong commitment not just to academia but to a continued love and appreciation of plant life.

continued on page 18

SURFERS FROM DOCTORAL GRANTING INSTITUTIONS
continued from page 17

Victoria Morris

Victoria Morris, University of California, Riverside
Mentor: Carolyn Rasmussen, Assistant Professor
Project: *Microtubule dynamics in cell division using maize tangled-1*

I am grateful for the opportunity to continue my research as a recipient of the ASPB Summer Undergraduate Research Fellowship. Participating in this research experience and presenting at Plant Biology 2018 will allow me to delve further into the world of plant research as I prepare for graduate school.

McKenzie Pickle

McKenzie Pickle, University of California, Riverside
Mentor: Carolyn Rasmussen, Assistant Professor
Project: *Role of microtubule dynamics in cell division using maize tangled-1 mutant*

I am extremely grateful to ASPB for selecting me to receive this fellowship and supporting my research. Since I began my undergraduate career at UC Riverside, I have been working and participating in a research lab. The SURF award allows me to continue my research while also giving me the opportunity to share my work at an international conference with other plant scientists.

Angus Rae

Angus Rae, University of Newcastle, Australia
Mentor: David Collings, Associate Professor
Project: *Measuring cell wall anisotropy in Arabidopsis roots using polarized fluorescence*

G'day from Down Under! I am thrilled by the opportunity the SURF grant has given me to conduct research—over the winter here in Australia—in exciting new techniques of measuring cell wall anisotropy and by the chance to travel halfway around the world to attend and participate in Plant Biology 2018. I know this experience will prove invaluable as I pursue a career in the plant sciences.

Alex Riley

Alex Riley, University of Illinois at Urbana–Champaign
Mentor: Amy Marshall-Colon, Assistant Professor
Project: *System genetics of rhizobium mutualists of varying partner quality*

Being awarded this fellowship is such an amazing honor! The SURF award will allow me to continue my work this summer studying mutualism in the legume–rhizobium system. This award, along with the opportunity to present my research next year, will allow me to become a better scientist and will help me throughout my future in plant biology.

SURFers from Primarily Undergraduate Institutions

Elizabeth Winnicki

Elizabeth Winnicki, University of Hawaii at Manoa
Mentor: Michael Kantar, Assistant Professor
Project: *Analyzing the genetic diversity of the varieties of sweet potato found in Hawaii and North America*

The SURF award allows me to develop my understanding in genetics and genomics with an emphasis on genetic diversity, plant genetic resources, crop diversity and improvement, and food security. It provides an opportunity to develop my career goals because I am able to delve into the field of plant biology through practical experience and study of the relevant literature to prepare myself for graduate school and beyond.

Robert Yvon

Robert Yvon, University of Massachusetts
Mentor: Alice Cheung, Professor
Project: *Discovering the connections of the FERONIA receptor kinase and its functional partners in Arabidopsis*

A cascade of doors have opened for me as a result of the SURF award. I am grateful to ASPB for making this fellowship available and to my mentor, whose hard work and personal investment in my studies have created this opportunity. I am excited to continue my research to impact our global understanding of how plants respond to pathogens, develop, and reproduce. Additionally, I am thrilled to be able to continue mentoring two fellow undergraduate students as well as a high school student during the fellowship. I take great pleasure in introducing the area of plant biology to other fledgling researchers, which has been made possible by SURF.

Patricia Goytortua

Patricia Goytortua, Instituto Politécnico Nacional, Mexico
Mentor: Rubén Rellán-Álvarez
Project: *Effect of having a PT or Pising allele associated with lipid metabolism of maize plants grown in Mexican highland conditions*

I am honored, greatly excited, and grateful to ASPB and my mentor. This fellowship gives me the opportunity to further enhance my skills and be prepared for graduate school by conducting research at the National Laboratory of Genomics for Biodiversity. I will be closer to realizing my goal of strengthening Mexico through the dissemination of knowledge and development of profitable ideas that contribute to solving problems.

Kenneth Kim

Kenneth Kim, University of West Georgia
Mentor: Mautusi Mitra, Associate Professor
Project: *Molecular characterization of two high light sensitive* Chlamydomonas reinhardtii *mutants, defective in a novel functionally uncharacterized gene*

I thank my research mentor for introducing me to the fascinating world of plant biology and mentoring me to apply for the SURF award. The award will allow me to hone my molecular research skills and increase my knowledge about photosynthesis and photoprotection. I am excited to characterize the novel functionally uncharacterized *Lsr1* (light stress related 1) gene and confirm its functional role in photoprotection in the model green microalga *Chlamydomonas reinhardtii*. My undergraduate research will provide me with a strong foundation for a future career in plant biology. I thank ASPB for providing me with this amazing opportunity.

continued on page 20

SURFERS FROM PRIMARILY UNDERGRADUATE INSTITUTIONS
continued from page 19

Tayler Lewis

Lauren Pope

Jennifer Walz

Tayler Lewis, Radford University
Mentor: Tara Phelps-Durr, Associate Professor
Project: *Computational modeling of the* AS1/AS2 *complex*

I am very excited to receive ASPB's SURF award! This summer, I will computationally model the 3-D structure of the Asymmetric Leaves 1 and 2 (*AS1* and *AS2*) proteins in Arabidopsis. I will also clone the *AS1* and *AS2* genes, express them in *Escherichia coli,* and begin the process of verifying the 3-D structure of these proteins. Receiving the SURF award allows me to gain 3-D perception skills and obtain a variety of new scientific knowledge while developing my own scientific identity. Upon completion of my undergraduate biology degree, I plan to attend physical therapy school, with the hope of pursuing a career in pediatric physical therapy.

Lauren Pope, James Madison University
Mentor: Jonathan Monroe, Professor
Project: *Structural and physiological characterization of* Arabidopsis thaliana *β-amylase 2: A unique starch-degrading enzyme*

ASPB's SURF award will allow me to take my interests in plant biology to a new level by funding summer research and giving me the opportunity to learn more about plant biology careers. I plan to earn my PhD in plant biology after graduating from James Madison University, and the SURF award will be an invaluable experience in helping me take that next step in my educational career. I look forward to presenting my work in Montreal in 2018!

Jennifer Walz, University of St. Thomas
Mentor: Amy Verhoeven, Professor and Director
Project: *Determining the role of xanthophyll cycle dynamics and thermal energy dissipation in the desiccation tolerance of common bryophytes in Minnesota*

I am honored to receive the SURF grant in order to research moss drought tolerance. This research will provide valuable experience for my future plans, including graduate school studying horticulture. I am excited to be involved with the plant community and to meet people who have an equally unique obsession with plants. ■

Thomas J. Guilfoyle

1946–2017

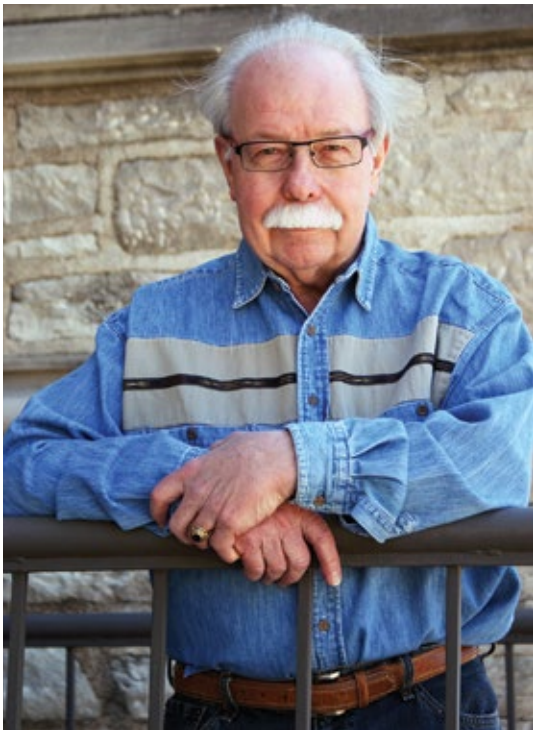
BRUCE McCLURE, University of Missouri

We sadly note the death of our colleague Emeritus Professor Thomas J. Guilfoyle, who died suddenly on April 30 at the age of 71.

Tom was born in Mendota, Illinois, on January 13, 1946, to Lawrence and Marguerite Guilfoyle. He earned his BSc from Illinois State University in 1968. His graduate studies at the University of Illinois were interrupted by two years of service in the U.S. Army, but he took his MSc (1969) before leaving and then returned to finish his PhD with John (Jack) Hanson in 1974. He did postdoctoral work with Joe Key at the University of Georgia, and in 1976 he joined the Departments of Botany and Biochemistry at the University of Minnesota. In 1986, he moved to the University of Missouri, where he joined the Department of Biochemistry and the Interdisciplinary Plant Group.

Tom and his colleagues played a key role in moving auxin research to the molecular level. The notion that auxin affects transcription was, at one time, controversial; auxin responses were thought to be too rapid to be regulated at the transcriptional level and therefore were thought to be indirect. Joe Key, however, had observed a massive ribosome accumulation in soybean hypocotyls after auxin treatment. Tom's graduate work showed that ribosome accumulation is associated with both increased activity and accumulation of RNA polymerase I, which provided a connection between auxin and the key enzyme in rRNA transcription.

Tom and Gretchen Hagen, his wife and research partner (1973).



Tom Guilfoyle

Tom's important contributions include identification of auxin-regulated genes, the proteins that regulate their transcription, and the framework for understanding how auxin-regulated transcription works. In the late 1970s, he and his lab showed that auxin rapidly affects the abundance of specific proteins. Later experiments identified changes in mRNA within 15 minutes, again pointing toward rapid, direct effects on transcription.

Three labs cloned cDNAs for auxin-regulated mRNAs almost simultaneously in the 1980s. Like some of the other genes isolated, the *GH1* clone, identified by Gretchen Hagen in the Guilfoyle laboratory, encoded an AUX/IAA protein. The well-known *GH3* gene turned out to encode an auxin conjugation enzyme. Tom's laboratory used run-on transcription assays to demonstrate that auxin induces transcription of *GH* and other genes within minutes. Other experiments with the SAUR mRNAs showed that gene expression changes occur in response to internal changes in auxin, not just externally applied hormone. Auxin's effects were rapid, direct, and specific, ending any controversy over whether it directly affects gene expression.

Tom and his lab then worked backward from the auxin-regulated genes to identify other components of the auxin signaling pathway. Crucial experiments showed that the *GH3* gene promoter had three auxin response elements (AuxREs) that were sufficient to confer auxin inducibility when joined to constitutively active promoters. This knowledge led to the

continued on page 22

GUILFOYLE
continued from page 21

creation of the widely used DR5 reporter, a standard tool for understanding how auxin dynamics regulate growth. Tom and his colleagues discovered the auxin regulatory factors (ARFs), a family of proteins that bind the AuxRE, and then demonstrated that some ARFs promote transcription while others inhibit it. Further studies of the ARF proteins found that AUX/IAA proteins can interact with and inhibit transcriptional activation by ARFs. Ultimately, Tom's work converged with that in other laboratories showing that auxin binding to its receptor triggers polyubiquitination and subsequent destruction of AUX/IAA proteins.

Tom's research was published in 113 articles and 32 chapters. He published in the leading scientific journals, including *Science, Nature,* and *Proceedings of the National Academy of Sciences*. It is impossible to imagine today's subtle and developed understanding of auxin-regulated gene expression, which is a triumph of plant biology, without Tom's contributions.

Tom was an active, longtime member of ASPB. He generously contributed his time and expertise in many ways, including as coeditor of *The Plant Cell* for over a decade. His editorial work was an expression of how much he cared for the scientific enterprise and its values. Tom's scientific discoveries and service to plant biology were recognized by ASPB with three of its most prestigious awards: the Lawrence Bogorad Award for Excellence in Plant Biology Research in 2014, the Charles Reid Barnes Life Membership Award in 2009 (jointly with Gretchen Hagen), and the Fellow of ASPB Award in 2007.

As a mentor for his 12 graduate students and 24 postdoctoral fellows, Tom set high standards for scientific rigor and hard work while cultivating independence. According to University of Minnesota Professor Neil Olszewski, who completed his doctoral work with Tom in the 1980s, "He loved discussing and debating ideas and encouraged it in others. He treated his graduate students and postdocs as colleagues and encouraged us to be independent and develop our own ideas and research approaches." Tim Ulmasov, a former postdoctoral fellow in Tom's lab, echoed these sentiments: "He expected greatness. He demanded independence, creativity, and critical thinking. Above all, he wanted to see or hear something that was new and exciting."

During his graduate studies at the University of Illinois, Tom met Gretchen Hagen, who would become his wife and research partner. In the lab, they shared their passion, talents, energy, and creativity to advance our understanding of the auxin response. Outside the lab, they enjoyed good wine, cooking, jazz, and the company of their stalwart cat, Junior. Tom and Gretchen retired in October 2016 and looked forward to the prospect of life without faculty meetings and classes. Still, Tom's passion "to see or hear something that was new and exciting" never abated. His love of science brought him to his office almost every day. He is sorely missed. ■

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