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July 14–18
Montreal, Quebec



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Runs for
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Matters**

ASPB *News*



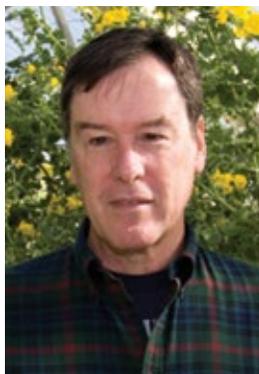
THE NEWSLETTER OF THE AMERICAN SOCIETY OF PLANT BIOLOGISTS

President's Letter

A Case for More Plant Science Research Funding

BY HARRY KLEE
University of Florida

Let me begin with a startling statement published by *Scientific American* (2012) during the run-up to the 2012 presidential election: half of the U.S. economic growth since World War II has come from advances in science and technology. This idea was the foundation for the 1987 Nobel Prize in Economy awarded to Robert Solow. One study found that 73% of the citations in biotechnology patents were the products of U.S. public research institutions (Narin et al., 1997). A deeper analysis highlights the essential and disproportionate contributions of public science to innovation (McMillan et al., 2000). Investment in innovation (i.e., science) is a proven way to grow the economy and produce better-paying jobs. You would think this would be a pretty simple concept to grasp. Invest in basic research, and you discover things that lead to better



Harry Klee

jobs. Think Google, Apple, Amazon.

For the most part, the biggest scientific breakthroughs do not occur in the private sector. They occur in public institutions funded by the investment of our government in scientific infrastructure. Discovery science is not going to be driven by industry. The window for return on investment is too short and competition too

great. Industry is far better at development than academia. A model in which long-term research is performed at universities and licensed to industry is much more appropriate. Let everyone do what they are best at.

Two great examples of innovation illustrate the unexpected beauty of the scientific endeavor: recombinant DNA and genome editing. The former arguably changed the

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Don't Forget to Cast Your Vote Online!

ASPB members are invited to vote for a president-elect and secretary-elect to serve on the ASPB Council, as well as for corresponding members. Please cast your vote by May 25, 2018, at <http://excom.aspb.org>.



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PRESIDENT'S LETTER
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entire nature of biology research, whereas the latter promises to be just as disruptive over the next decade. In both cases, the foundations for these discoveries came out of basic research in microbiology; for example, how do microbes protect themselves from other organisms? Most of us would not have predicted that a DNA restriction–modification system that chews up foreign DNA would revitalize biology, biochemistry, and genetics for decades to come.

Serendipity has also had a role in revolutionizing plant biology and agriculture. For decades, a few researchers around the world studied the curious bacterium that somehow made plants produce tumor-like growths called *crown galls*. My own postdoctoral fellowship, coincidentally in a microbiology department, was from the American Cancer Society to study how normal plant tissue became tumorous. Of course, we know how that turned out: *Agrobacterium tumefaciens* revolutionized modern agriculture in ways that even Norman Borlaug appreciated. More fundamentally, *Agrobacterium* opened up the entire field of plant biology. Think T-DNA knockouts. Think RNAi, another completely unexpected phenomenon first described in plants and leading to yet another Nobel Prize.

So where am I going with this train of thought? I was struck a few weeks ago when I heard that Congress had allocated \$2 billion for research into genome editing to address human diseases. My first reaction to the news was, “Great. This is revolutionary technology that has the potential to cure numerous genetic disor-

ders.” But my second reaction was, “Why don’t they understand that a \$2 billion investment in genome editing for agriculture would change everything we do?” The simple answer is that our representatives get sick and want to make sure that cures are available for what ails them (and us). The more complicated answer is that our society does not understand where its food comes from and the simple principle that a good diet prevents illness, reducing the need for expensive health care. We take our healthy, cheap, abundant food supply for granted. This is both a shame and a lost opportunity.

I come back to the concept of science as a driver of the economy. U.S. agriculture is the most efficient in the world. Only 2% of Americans produce enough food to feed all of us and much of the rest of the world. Our agriculture system is an important part of the economy. In my state of Florida, agriculture is the second largest segment of our economy, trailing only tourism. The phenomenal productivity of our agricultural system is the result of 150 years of investment in land-grant institutions, ARS, and federal grant dollars dispersed most prominently, but not exclusively, through NSF, USDA, and DOE. But federal funding for plant science research has been flat for this century. The best available estimates are that the federal government spent about \$4.1 billion on agricultural research in 2016 (Ferguson, 2018), about the same real dollar amount as in 1990. About \$1.5 billion of that total went to plant sciences.

This flat funding has come at a time when China has hugely ramped up its funding of basic and applied plant science research. In 2013 China invested an estimated \$9 billion in agricultural

research, more than double the U.S. investment. China has a strong policy supporting food security for its people and sees this investment as essential to not only stability but prosperity. Much as occurred in America in the 20th century, a shrinking segment of the Chinese population is dedicated to food production. That investment is starting to pay off in the area of basic plant science. You can open any major plant science journal and see the ever-increasing percentage of papers by Chinese researchers. Science is an international endeavor, and I applaud these advances. I have multiple rewarding and productive collaborations with my Chinese colleagues. But the contrast between what is happening in our two countries is disheartening. One nation is dramatically rising while the other is stagnating from three decades of flat funding.

Coming back to that \$2 billion investment in genome editing: why not make a parallel investment in agriculture? Genome editing holds the promise of immensely speeding up plant breeding programs. In months, I can deploy a desirable allele into all of my germplasm instead of taking years to cross and backcross. Efficient techniques for allele replacement would open up a world of possibilities for crop improvement. *Agrobacterium*-free delivery of the editing machinery would potentially eliminate any question of labeling the products as GMO. Advances in technology would also greatly enhance basic discovery research, just as *Agrobacterium* transformation revolutionized plant science in the 1980s. I am reminded of the joint public–private push to establish the Plant Genome Research Program administered by NSF. That was new money that flowed

into plant science, and the benefits have been remarkable. Isn’t it time for another such partnership to invigorate plant research?

We need to do a more effective job of convincing the public and our elected representatives that they cannot take America’s preeminence in agriculture for granted. People need to appreciate where their food comes from and invest appropriately. Flat or reduced funding will only lead to mediocrity. The next great advances in agriculture will be coming to America from abroad if we don’t invest in the future of plant science. Our labs are small businesses, and our products are innovations and the next generation of innovators. Let us not forget that each of our labs is putting many thousands of dollars into our local economies. As other nations become more efficient and implement the products of their own basic research, they threaten our export markets.

We at ASPB do our best to convey this message to Capitol Hill. But you need to help us get this message across. Representatives listen to their constituents. They need to understand that this is a basic economic issue. ■

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Plant Biology 2018

<https://plantbiology.aspb.org>

July 14–18, 2018, Montreal, Canada

It may seem like you've just finished shaking the sand out of your shoes from Plant Biology 2017 in Hawaii, but it's time to start planning your participation in Plant Biology 2018. To be held in beautiful, historic Montreal, Quebec, July 14–18, 2018, Plant Biology 2018 will be jointly hosted by ASPB, the Canadian Society of Plant Biologists/Société canadienne de biologie végétale (CSPB/SCBV), and the International Society of Photosynthesis Research (ISPR).

Plant Biology 2018 features the following major symposia:

Gibbs Medal Symposium, "Genome Evolution"

Organized by Ralph Bock and featuring talks from Eva Nowack, Jeffrey D. Palmer, and Pamela S. Soltis

ASPB President's Symposium, "Translational Science"

Organized by Harry Klee and featuring talks from Ian Graham, Marty Yanofsky, David Mackill, and Sherri Brown

CSPB President's Symposium, "Integrating Signals in Plant Cell Biology and Development"

Organized by Geoff Wasteneys and featuring talks from Elizabeth Haswell, Mark Estelle, Daphne Goring, and Karin Schumaker

CSPB–ASPB Joint Symposium, "Opening Research Avenues Through New Technologies"

Organized by Anja Geitmann and Phil Taylor

ISPR–ASPB–CSPB Joint Symposium, "Ecophysiology of Photosynthesis from the Leaf to Global Scale"

Organized by Tom Sharkey

Although the science and networking at Plant Biology 2018 are the main event, Montreal has a great deal to offer. In addition to its world-renowned history and architecture, Montreal has a beautiful botanic garden that is known for its Insectarium; its ecosystem-based Biodôme; and its cultural gardens, which include a First Nations Garden. Soak up the natural beauty of La Fontaine Park or go further afield for a hike in the Laurentian Mountains. For lovers of *Vitis vinifera*, the climate of the Montreal region of Quebec has produced a unique wine industry with varieties adapted to cold cultivation and the unusual production style of ice wines—you can explore these by heading out to wine country for a wine tasting. You can also sample local flavors at the year-round Jean Talon Market, one of the oldest public markets in Montreal, or indulge in a cheese crawl through nearby *fromageries*.

For More Information

Botanic Garden: <https://tinyurl.com/m7b2byq>

Insectarium: <https://tinyurl.com/ya3wjkgj>

Biodôme: <https://tinyurl.com/y6uflw78>

First Nations Garden: <https://tinyurl.com/y8zgbmln>

La Fontaine Park: <https://tinyurl.com/y76vh6mm>

Laurentian Mountains: <https://tinyurl.com/hpgfoko>

Quebec cold climate grape varieties: <https://tinyurl.com/ydcztoxf>

Ice wines: <https://tinyurl.com/y9dp9t9h>

Wine tastings: <https://tinyurl.com/y952r58n>

Jean Talon Market: <https://tinyurl.com/y9fm2hom>

Cheese crawl: <https://tinyurl.com/y8ne5n24>

Get ready for Plant Biology 2018

- Arrange visas or other necessary travel documents. U.S. residents can find information at <https://tinyurl.com/ya2vfhxc>, and the Canadian government provides more information at <http://www.cic.gc.ca/english/visit/visas.asp>.
- Join the Plantae Network (<https://tinyurl.com/ydfou83q>) for ASPB conferences, follow #plantbio18 on Twitter, and keep an eye on developments in the Plant Biology 2018 program.
- Looking for a roommate? Hotel and housing information can be found at <https://plantbiology.aspb.org/montreal-information/hotels/>.

Workshops at Plant Biology 2018

Forest for the Trees: Science Communication with Deep Roots
Saturday, July 14, 8:30 a.m.–12:00 p.m.

Plant Science Training in 2035
Saturday, July 14, 8:30 a.m.–12:00 p.m.
Requires preregistration; space is limited

PUI Faculty Development Workshop
Saturday, July 14, 8:30 a.m.–12:00 p.m.
Requires preregistration: \$45 fee, \$25 for students and postdocs

MaizeCODE Workshop
Saturday, July 14, 9:00 a.m.–11:00 a.m.
Workshop has a maximum of 20 attendees.
Pre-registration is required. No fee

Strategies for Developing Leadership Skills
Sunday, July 15, 7:30 a.m.–8:30 a.m.
Requires preregistration: \$10 fee

Bioinformatics Workshop
Sunday, July 15, 11:10 a.m.–12:30 p.m.

Ensuring Plant Scientists Have a Seat at the Table: What You Can Do to More Effectively Communicate with Policy Makers
Sunday, July 15, 11:10 a.m.–12:30 p.m.

Reproducibility for Everyone
Sunday, July 15, 11:10 a.m.–12:30 p.m.
Requires pre-registration; space is limited

Too Creative for Science?
Sunday, July 15, 11:30 a.m.–1:00 p.m.
Requires preregistration: \$35 fee, \$25 for students

Environmental and Ecological Plant Physiology Business Meeting and Lightning Talks
Monday, July 16, 11:10 a.m.–12:30 p.m.

How to Review
Monday, July 16, 11:10 a.m.–12:30 p.m.

Incorporating Research into the Classroom
Monday, July 16, 11:10 a.m.–12:30 p.m.

NSERC information session on the Discover Grants Program
Monday, July 16, 11:10 a.m.–12:10 p.m.

USDA, DOE and NSF Plant Funding Informational Workshop
Monday, July 16, 11:10 a.m.–12:30 p.m.

Leadership Skills in Science
Monday, July 16, 11:30 a.m.–1:00 p.m.
Requires preregistration: \$35 fee, \$25 for students

Demonstration of the PhotosynQ Platform
Wednesday, July 18, 12:15 p.m.–1:15 p.m.
Located at the Westin Hotel. Requires preregistration; space is limited

Bioinformatics Workshop: Data Carpentry/RNA-Seq Analysis/Custom ePlant
Thursday, July 19, 8:00 a.m.–4:00 p.m.
Requires preregistration: \$25 fee

A bientôt à Montréal!

Choose Your 2018 Workshop by Specialty Track

PROFESSIONAL DEVELOPMENT

PUI Faculty Development Workshop
Saturday, July 14, 8:30 a.m.–12:00 p.m.
Requires preregistration: \$45 fee, \$25 for students and postdocs

This workshop is for faculty currently working at primarily undergraduate institutions (PUIs) or younger scientists who would like to get a job at a PUI. PUIs are institutions that offer few PhDs in the sciences. Although teaching is a large part of being a PUI faculty member, maintaining a successful research program is also critical for career advancement and for providing undergraduates with high-caliber research experiences. The workshop will include presentations and discussions on mentoring in the PUI research environment, including ways to improve communication between mentor and mentee to enhance student learning and research success. Attendees will also share their strategies for overcoming common hurdles in mentoring undergraduates in research.

Strategies for Developing Leadership Skills
Sunday, July 15, 7:30 a.m.–8:30 a.m.
Requires preregistration: \$10 fee

Panelists will initiate the discussion and answer questions from participants. Participants will then work in small groups on specific topics. Fee includes breakfast.

How to Review
Monday, July 16, 11:10 a.m.–12:30 p.m.

This workshop offers peer review guidelines for *The Plant Cell*, *Plant Physiology*, and *Plant Direct* that are applicable to most scholarly journals. The workshop will cover the purpose of reviewing and the author–editor contract, who should review (and who should not—the ethics of reviewing), the elements of a good review, the language of reviewing, and what makes a good review (and a bad one). A few short presentations will be followed by an extended question and answer period.

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PLANT BIOLOGY*continued from page 5***Leadership Skills in Science****Monday, July 16, 11:30 a.m.–1:00 p.m.**

Requires preregistration: \$35 fee, \$25 for students

This luncheon will feature keynote speaker Michelle Smith, associate research and development director and lead of the Monocot Traits Development Team in Dow AgroSciences. Michelle has over 20 years of business and R&D experience in pest management, technology transfer, and communications. She is a Dow AgroSciences Science Ambassador for science programs directed to children and has been a leader in the Women's Innovation Network within the company. Fee includes lunch.

Incorporating Research into the Classroom**Monday, July 16, 11:10 a.m.–12:30 p.m.**

Students learn better when they are actively engaged in course material. For the sciences, this translates into involving them in authentic research experiences. Research experiences for undergraduates in our research labs are a valuable opportunity for all concerned, but these spaces are limited. Providing research experiences for all science majors (and possibly nonmajors) should be a goal, but large class sections and limited resources restrict access. This workshop will focus on incorporating authentic research experiences into biology classes, both large and small. Classroom examples and resources will be shared by faculty who have successfully used strategies in classrooms serving freshmen to seniors.

SCIENCE COMMUNICATION**Forest for the Trees: Science Communication with Deep Roots****Saturday, July 14, 8:30 a.m.–12:00 p.m.**

Stories about people in our past connect them to the present and point the way to our future. The purpose of this workshop is to teach human-centered storytelling as an effective approach in science communication to connect with the public, using examples from Canada and the United States. The workshop will feature presentations about science communication, facilitated group discussions, and guidance on how to get started in communication as a complement to a scientific career. Stories with deep roots have a lasting impact, and this workshop will explore how to connect present-day plant science stories to the past to make them more compelling and engaging.

Too Creative for Science?**Sunday, July 15, 11:30 a.m.–1:00 p.m.**

Requires preregistration: \$35 fee, \$25 for students

Have you ever wondered what it is like to grow up in a family of artists and then end up a scientist? What does thinking like an artist offer the scientist? Can the blending of art and science encourage a more diverse population of students to pursue science and improve the public understanding of science? This workshop will provide a glimpse into the presenter's life and how she has interacted with science, education, and the public regarding her two passions: science and art. Fee includes lunch.

Ensuring Plant Scientists Have a Seat at the Table: What You Can Do to More Effectively Communicate with Policy Makers**Sunday, July 15, 11:10 a.m.–12:30 p.m.**

With national research funding stagnating or declining across U.S. and Canadian science agencies, the individual voices of plant scientists are desperately needed in public debates regarding research funding. Join us to find out what you can do locally to support reinvigoration of critical research investments.

TOOLS AND TECHNOLOGIES**MaizeCODE Workshop****Saturday, July 14, 9:00 a.m.–11:00 a.m.**

Workshop has a maximum of 20 attendees.

Pre-registration is required. No fee

The goal of this workshop is to describe and teach how to use genome annotation tools we are developing using the latest B73 maize RefGen_V4 genome annotation and possibly the new NC350 assembly. Participants will need to have basic bioinformatics skills and familiarity with genome annotation and databases, such as Gramene and MaizeGDB, are very desirable.

Bioinformatics Workshop**Sunday, July 15, 11:10 a.m.–12:30 p.m.**

This workshop is intended for researchers at all levels but especially those relatively new to Plant Biology who would like to learn more about the tools and resources available on the web. This is a show-and-tell workshop where each speaker will make short presentations giving an overview of the organization, data content and navigation of their resource. Contributions are expected from Araport, Bio-Analytic Resource, CyVerse, Gramene, KBase, Legume Federation, PlantCyc, Planteome and TAIR.

Demonstration of the PhotosynQ Platform

Wednesday, July 18, 12:15 p.m.–1:15 p.m.

Located at the Westin Hotel

Requires preregistration; space is limited

PhotosynQ is an open science platform that allows researchers, educators, farmers, and citizen scientists to collect, analyze, discuss, and share plant photosynthesis-related data using low-cost handheld devices. This demonstration will allow hands-on experience and explanations of the data platform and the MultispeQ photosynthesis monitor. Participants will see the ways this exciting new platform can aid in large-scale photosynthesis data collection and the building of collaborative networks.

Bioinformatics Workshop: Data Carpentry/RNA-Seq Analysis/Custom ePlant

Thursday, July 19, 8:00 a.m.–4:00 p.m.

Requires preregistration: \$25 fee

This postconference workshop, hosted by Jason Williams and Nicholas Provar, will take place at an off-site venue. Space is limited; register now!

TOPICAL AND SPECIALTY WORKSHOPS**Plant Science Training in 2035**

Saturday, July 14, 8:30 a.m.–12:00 p.m.

Requires preregistration; space is limited

The Plant Science Research Network (PSRN), an NSF-funded research coordination network currently composed of 14 professional organizations, will present the results of strategic planning workshops to address the future of training in the plant sciences. In the fall of 2016 and 2017, the PSRN worked with students, faculty, and industry representatives to identify robust and innovative concepts to improve and modernize training to better prepare trainees for diverse careers. To produce the recommendations, we used scenario planning to stretch our thinking. The scenarios, called Imagining Science in 2035, and supporting materials are available on Plantae at <https://tinyurl.com/ycshs59k>. In addition to sharing the recommendations, we will gather feedback from ASPB members.

Reproducibility for Everyone

Sunday, July 15, 11:10 a.m.–12:30 p.m.

Requires pre-registration; space is limited

Science depends on reproducibility to build trust within and beyond the research community. This workshop will introduce you to reproducible workflows and a range of tools, from method sharing websites such as protocols.io, to Jupyter notebooks for documentation of code. This will help you share work with colleagues more effectively and allow others to build on what you have done.

Environmental and Ecological Plant Physiology Business Meeting and Lightning Talks

Monday, July 16, 11:10 a.m.–12:30 p.m.

Lunch will be provided to the first 150 participants!

Please join us for the 2018 Annual EEP Section Business Meeting and Lightning Talks! We will discuss the mission and vision and provide updates on the EEP Section and have lightning talks that span the breadth of our science.

USDA, DOE and NSF Plant Funding Informational Workshop

Monday, July 16, 11:10 a.m.–12:30 p.m.

This workshop will feature talks on Plant related funding opportunities from each agency by program staff and a panel discussion with program staff at the end of all the talks. In addition to the workshop, there will be ample time to meet the Program staff at the Joint USDA, DOE and NSF Booth to discuss the funding opportunities offered by the respective agencies during exhibit hours from Saturday, July 14 through Tuesday, July 17 in the exhibit hall.

NSERC information session on the Discover Grants Program

Monday, July 16, 11:10 a.m.–12:10 p.m.

This presentation by the Natural Sciences and Engineering Research Council will focus on NSERC news, an update on the mandate of NSERC in relationship to other federal granting agencies, and recent results from the NSERC Discovery Grants competition with an emphasis on those from the Biological Systems and functions evaluation group. Time will be allocated for a question and answer period. ■

Plant Scientist Runs for Congress

BY HALLIE THOMPSON

Graduate Student, University of Missouri

I believe science can help us develop solutions to global food insecurity. I study the effects of drought on maize roots at the University of Missouri, and I hope my findings will contribute to improving crop resilience as rainfall patterns change in the Midwest. Currently, I am represented in Congress by an antiscience politician, Representative Vicky Hartzler (R-MO). Hartzler has gone out of her way to make fun of climate science. Unfortunately, denying the realities of climate change goes hand-in-hand with a larger lack of evidence-based approaches to policy making in our current Congress.

I'm running to represent Missouri's Fourth District in Congress because it's time to bring a fresh, pro-science perspective to our federal government. The world's changing climate is no joke to farmers or to consumers. Periods of drought are intensifying, with potentially devastating economic costs to agriculture. Eroding the norms of evidence-



Hallie Thompson

based decision making is bad enough, but politicians also harm our communities across the United States and around the world by denying them the resources and opportunities to adapt. Climate change denial like Hartzler's is an excuse for inaction.

We need problem solvers and advocates holding elected office. In the past, scientists

have stayed behind the scenes in politics and government. We've tried not to get caught up in partisan politics, although that has become more difficult these days. But the reasons scientists give for avoiding politics are the very reasons scientists should be more involved. We understand seriousness of purpose, the humility that accompanies fallibility, and the need to evaluate evidence before making a decision. We are attuned to the limits of our own knowledge and have a sense of being only one small part of systems much larger than ourselves. And we are willing to ask tough questions.

These are all values we could use in Washington, D.C.

I grew up on my family's beef cattle farm in rural Missouri and recently went back to visit the science fair at the small public school I attended through eighth grade. I was particularly inspired by Billi, who, like me, came from a farming family. Billi's science fair project asked, "What is the

best way to stack hay bales?" She bundled minibales and tested them for moisture retention. Her research led her family to stack their bales differently than they did traditionally. It was an important reminder that science—and the innovation it supports—is, at its best, accessible to everyone, regardless of their background. Elected officials don't just need to be using science in policy making; they should be supporting public science education and open research access.

There will be daunting global challenges to face in the 21st century: food security, climate change, inequalities in education, and access to technologies. I'm ready to think forward and take on these challenges. We can't be caught looking backward when the future is here for us to create, together.

Learn more about my candidacy at HallieThompsonforCongress.com. ■

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.

Tetsuya Higashiyama

Vice Director and Professor, Institute of Transformative Bio-Molecules, Nagoya University, Japan, and President, International Association of Sexual Plant Reproduction Research

BY SUBRAMANIAN SANKARANARAYANAN
ASPB Postdoctoral Ambassador, Nagoya University

Tetsuya Higashiyama began his scientific career at the University of Tokyo, Japan, where he obtained his BS in plant biology, master’s in biological science, and PhD. He was assistant professor at the University of Tokyo for seven years before accepting a full professor position at Nagoya University. At Nagoya University, he served as the youngest director of the prestigious Exploratory Research for Advanced Technology funding program supported by the Japan Science and Technology Agency from 2010 to 2017. He is currently serving as vice director of a new interdisciplinary institute, the Institute of Transformative Bio-Molecules, at Nagoya University and as president of the International Association of Sexual Plant Reproduction Research. He has received prestigious awards such as the Kihara Memorial Foundation Academic Award, the Hirase Award, and the Japan Society for the Promotion of Science Prize, to name a few, for his significant contributions to the field of plant biology.



Tetsuya Higashiyama

Tetsuya’s research focuses on plant reproduction, specifically on identifying the key molecules in pollen tube guidance. He and his team have made several key discoveries in the field of plant reproduction that have gained international recognition. He was the first to identify synergid cells as the source of pollen tube attractant. His team later discovered the long-sought-after pollen tube attractant LURE and its receptor PRK6. His group discovered the first competency factor AMOR secreted from

ovules and also reported a new cell fusion process in plants, the synergid endosperm fusion. He is a pioneer who introduced the concept of Live-Holonics, which is a method to understand the dynamic and intricate communication between plant cells by using live-cell biology, nanoengineering, and single-cell *-omics*.

Why did you choose plant science as a career? Did you have childhood experiences that motivated you to study plant biology?

I grew up in the countryside of Tsuruoka, a city in Yamagata Prefecture in Japan. As a child, I enjoyed playing in nature, catching insects, and fishing. I was also interested in electronics and wanted to become an engineer. My interest in biology developed in high school. My father, a professor of soil science, motivated me to pursue my interest in biology. Biotechnology was gaining popularity in Japan while I was in high school, and I found it attractive to pursue my career in biology. My mentor at the University of Tokyo, Professor

Tsuneyoshi Kuroiwa, was a great inspiration; he motivated me to take up plant biology. He discovered the basic mechanisms of mitochondria and chloroplast division and inheritance and was a recipient of many prestigious awards including the Charles Reid Barnes Life Membership Award from ASPB.

What turned you on to plant reproduction research and specifically pollen tube guidance?

I was interested in studying somatic embryogenesis to understand the mechanism of totipotency in plants. My supervisor, Professor Kuroiwa, suggested that I study embryogenesis in seeds. Many questions were unanswered in plant reproduction back then. I decided to study the mechanism of fertilization in plants from its starting point, which is pollination and pollen tube guidance toward the ovules.

Why did you choose to work with *Torenia fournieri*? Did you meet with challenges after

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selecting this plant as a model system for your study?

I read a review article that mentioned that *Torenia* species have a protruding embryo sac and egg cell that could be observed easily. I went to a flower shop and was enthralled by the beauty of *Torenia* flowers. It was then that I decided I would use this plant for my studies. Yes, there were several challenges I met with after choosing this system. I had to develop an in vitro system to study fertilization in this plant. It took me about one and a half years to develop this system and observe the first example of pollen tube attraction toward the embryo sac. It took me another four years to develop the system of laser ablation before I could identify synergid cells as the source of pollen tube attractants. I am not afraid of challenges, and I am happy to struggle to solve difficult problems.

Which work has given you the most satisfaction as a scientist?

Identification of the LURE peptides as the pollen tube attractant in

plants gave me the most satisfaction. It was the most challenging problem before me, and we had to develop several new techniques and technology to solve this problem.

What advice would you give a young scientist who aims to get into academic research? What experience or training do you think is important to have?

Originality is very important in science. Try to ask original questions, and do not be afraid of challenges. You need to be optimistic always while pursuing your research problem. Interacting with other researchers is important for your growth as a scientist. Visiting other countries and labs is an important part of research training that will allow you to acquire new skills and horizons.

What is your idea of a mentor? What is your mentoring style?

A mentor should be able to nurture passion in his or her students and should be able to understand their uniqueness and give them the freedom to grow. It is important to keep students excited about research and allow them to develop original think-

ing. Many unexpected discoveries happen when you give freedom to your students to tackle their research problem.

What do you think is the next big thing in plant biology, and why? What do you think will be the next big thing in your area of study?

Single-molecule imaging is the next big thing in plant biology. It will enable researchers to understand molecular dynamics in real time. This, in combination with structural biology, will enable us to address several important questions. In my research area, understanding the mechanisms of species barriers in plants and overcoming them is the next big thing. I want to study the behavior of attractant molecules and their receptor directly under a microscope at a single-molecule level.

As an employer, what are the key qualities you look for in a potential team member?

I look for curiosity in candidates and try to know why they are interested in my research. I also look for originality in their science from their publications.

Candidates should be really motivated, have a clear career vision, and have the ability to think independently. They should have a friendly personality and quality of gratitude that will enable them to gel with my other lab members.

What do you see as serious issues in science today?

Plant science is very important for our society. It is not receiving the necessary attention and support from policy makers and funding agencies. Innovation in technology is important, but a minimum budget should be kept aside for plant biology. If we fail to support plant research, the next generation of plant scientists will disappear, and it will be a big setback that cannot be recovered. ■

Subramanian Sankaranarayanan was a Japan Society for the Promotion of Science postdoctoral fellow in Professor Higashiyama's lab at the Institute of Transformative Bio-Molecules, Nagoya University. You can follow him on Twitter @subru_16.



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Policy Update

BY LAUREN BROCCOLI
Lewis-Burke Associates, LLC

Appropriations Update

At the time of this writing, the federal government was operating under a continuing resolution (CR) that was signed into law January 22 and ended a partial government shutdown. The fourth stopgap funding bill since the new fiscal year (FY) 2018 began on October 1, 2017, expired on Thursday, February 8.

Congress was expected to vote on a fifth CR that would extend funding under the FY2017 levels until March 23. This will allow more time for Congress to negotiate a bipartisan budget agreement that will address the current statutory spending caps that govern defense and nondefense discretionary spending, which is necessary to advance FY2018 appropriations bills. The House of Representatives has passed all 12 of its FY2018 appropriations bills, and the Senate has marked up most of its bills in committee, including both the Agriculture and the Commerce, Justice, Science bills. Several policy issues continue to complicate budget negotiations, such as immigration reform, the fate of the Dreamers, and raising the debt limit. Moreover, conservative Republicans were pushing to attach the FY2018 defense appropriations bill to the must-pass CR, complicating support from Democrats.

USDA Releases Agriculture and Rural Task Force Report

On January 8, USDA released the *Report to the President of the United States from the Task Force on Agriculture and Rural Prosperity*, an analysis of the challenges and opportunities for growth and prosperity in rural communities. Rural development continues to be a priority for the agency under this administration, and the report provides five calls to action to help facilitate growth, innovation, and prosperity in rural America. As part of the agency's call to harness technological innovation to meet the rising food, fuel, and fiber demands that are projected to grow exponentially by 2050, USDA will focus on public education, engagement, and the streamlining of regulatory policies regarding biotechnology products.

Biotechnologies and genetically engineered crops are a valuable tool for addressing global food insecurity, but the public has yet to accept the safety and efficacy of genetically modified crops. By improving the regulatory landscape around these products, USDA anticipates increased transparency, interagency coordination, and ultimately public confidence and acceptance. The report also recommends a forum led by the White House Office of Science and Technology Policy, which has been largely vacant during the first year of this administration, that would facili-

tate collaboration between regulators and federal research agencies and expedite the commercialization of biotechnology products. This shift in focus from USDA toward biotechnology research and development could be reflected in the FY2019 budget request and future solicitations.

Source and Additional Information

- The full report from the Task Force on Agriculture and Rural Prosperity is available at <https://tinyurl.com/yaq9dwve>.

USDA Releases Legislative Principles for the 2018 Farm Bill

On January 25, USDA released its legislative principles for the upcoming 2018 Farm Bill, which outlines high-level objectives across the agricultural sector, including trade and foreign agricultural affairs, nutrition, regulatory programs, research, and more. Although the principles document offers few specifics, it does provide insight regarding what the scientific community can expect from the next Farm Bill, especially the research title. The report reiterates many of the administration's priorities over the past year.

For Research, Education, and Economics, USDA will pursue research that will keep the United States at the forefront of agricultural innovation, establish public-private partnerships to leverage federal investments, bolster the agricultural work-

force, and pursue investments that address the growing global demand for agriculture products. In a public statement announcing the release of the legislative principles, Secretary Sonny Perdue stated that they will serve as the foundation for conversations with lawmakers moving forward.

Source and Additional Information

- The full 2018 Farm Bill and Legislative Principles document is available at <https://tinyurl.com/yaspr7bb>.

NSF Releases Dear Colleague Letter for Rules of Life Forecasting and Emergence in Living Systems Program

On December 11, NSF released a Dear Colleague Letter (DCL) for the Rules of Life Forecasting and Emergence in Living Systems (FELS) program. This DCL is the most recent attempt to refine one of NSF's Big Ideas for Future Investments, "Understanding the Rules of Life: Predicting Phenotype."

Led by the Biological Sciences (BIO) Directorate, FELS will focus on novel, interdisciplinary approaches to identify "general principles or theoretical constructs that explain and predict the characteristics of living systems." In addition to BIO, the Computer and Information Science and Engineering; Education and Human Resources; Engineering;

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POLICY UPDATE

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Geosciences; Mathematical and Physical Sciences; and Social, Behavioral, and Economic Sciences Directorates are participating.

The broad objective of this program is to deepen understanding of the interactions among organisms at all levels, with an emphasis on research that “considers both genomic and environmental inputs, at all spatial and temporal scales, to identify steps along the critical path to de novo prediction of complex biological systems in a variety of organisms.” Funding will be distributed for three types of activities: Early-concept Grants for Exploratory Research (EAGERs), Research Advanced by Interdisciplinary Science and Engineering (RAISE) grants, and conference awards.

EAGER and conference proposals must involve two or more divisions within the BIO Directorate. Although RAISE proposals will be required to incorporate only one BIO division, projects must also engage with at least one other NSF directorate.

NSF encourages applicants to engage graduate students and postdoctoral fellows in proposals. No specific information regarding the number of anticipated awards or total funding levels was included in the DCL. Deadlines began February 20, 2018.

Source and Additional Information

- The full DCL is available at <https://tinyurl.com/y926tmvk>.

NSF Releases Dear Colleague Letter to Develop Breakthrough Ideas and Enabling Technologies to Advance Crop Breeding and Functional Genomics

On January 5, NSF released a Dear Colleague Letter announcing a joint funding opportunity with USDA's National Institute of Food and Agriculture and the United Kingdom's Biotechnology and Biological Sciences Research Council to pursue innovative technologies in crop breeding. The program will focus on high-risk, high-reward applications that translate existing plant genomics research into practical technologies that facilitate the development of new crop varieties.

Awards will be distributed through the Early-concept Grants for Exploratory Research funding mechanism and should focus on transformative solutions to existing barriers that impede advances in crop breeding and on the development of technologies that “exploit genomics rapidly and effectively.” Specific areas of interest include but are not limited to

- “advancing genome editing technology to generate new phenotypes for greater genetic gain;
- “achieving reliable and high throughput production of doubled haploids from genotypes that are currently recalcitrant to chromosome doubling to accelerate the breeding process in cereals and other crops;
- “controlling and understanding meiotic recombination to tap into inaccessible genetic resources in areas of low recombination and enabling whole genome manipulation;

- “modifying epigenetic inheritance to facilitate phenotypic changes related to environmental responses; and
- “understanding mechanisms of heterosis, thereby generating and exploiting hybrid vigor for crop improvement.”

Collaboration between U.S. and U.K. entities is encouraged but not required. However, proposals from U.K. applicants with no U.S. counterpart will not be accepted. The deadline for summary submissions is March 14, 2018.

Source and Additional Information

- The full DCL is available at <https://tinyurl.com/yc2xpqac>.

ARPA-E Announces Workshop on Energy-Smart Farming

On February 13–14, 2018, DOE's Advanced Research Projects Agency–Energy (ARPA-E) hosted a workshop in Phoenix, Arizona, on the integration of 21st-century technologies into farming practices to maximize crop yields and meet the rising global demands for food, fuel, and fiber. The workshop, titled “The Energy-Smart Farm: Distributed Networks for Highly Variable and Resource Constrained Crop Protection Environments,” convened an interdisciplinary group of experts from the biological, computational, and physical sciences to address the current limitations to agricultural growth. ARPA-E uses the results of its workshops to formulate new programs and funding opportunities.

The workshop specifically addressed inefficiencies in land management practices and the identification of environmental

and biological variables that contribute to growing yield gaps in the agricultural sector. As the agricultural workforce shrinks and farms continue to grow to meet demands, there is an opportunity to use low-cost, energy-efficient technologies to stimulate sustainable growth while limiting energy consumption. ARPA-E's specific technology interests include

- sensors;
- low-cost, small-scale computing “at the edge”;
- wireless sensor networks;
- multiscale, multimodal sensor deployment and integration; and
- analytics and machine learning.

ARPA-E anticipates that the outcomes of this workshop will form the framework of a new research program in the development and deployment of innovative agricultural technologies. To this end, the objectives of the workshop included

- “the identification of specific technical barriers to the development and adoption of the aforementioned tools at acceptable cost to growers;
- “realistic timeframes and technical metrics for successful prototypes; and
- “new professional relationships among disparate technical communities in the biological, chemical, engineering, and computational sciences, which could form the basis for teaming opportunities.”

Source and Additional Information

- More information about the Energy-Smart Farm workshop is available at <https://tinyurl.com/ybs8vtko>. ■

Your Voice Matters

BY TYRONE SPADY
 Director of Legislative and Public Affairs

On January 30, 2018, President Donald Trump delivered his first State of the Union Address before Congress, characterizing his first year as “our new American moment.” As has become the norm, the address was full of partisan posturing and nationalistic statements regarding the greatness of America and the unprecedented prosperity Trump claims his leadership has brought forth.

Given the president’s commitment to U.S. economic growth, one area of federal investment was notably absent from his remarks: science. The president failed to speak to how he would ensure his long-term vision for economic growth and prosperity, growth that is an essential component of Republican modeling regarding the impact and cost of recently passed tax reform legislation.

Our job as the plant science community is to help President Trump see, and to remind congressional Republicans, that research and innovation are foundational to the nation’s long-term economic growth. In an immediate sense, federal science agency funding flows to universities and research institutions across the country, producing immediate and ongoing economic activity in the form of jobs, direct institutional support, and the purchase of goods and services required for the conduct of research and related activities.

Over the longer term, of course, the products of research

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result in increases in our fundamental understanding of the world and the development of novel commercial products, small businesses, and licensing opportunities. The failure to recognize and support this critical role of the federal government in the nation’s innovation enterprise will have lasting and ominous impacts. Specifically, in the realm of plant sciences, this failure could translate into reductions in agricultural productivity and sustainability, diminished capacity to respond to ongoing environmental changes affecting food production, missed opportunities to identify the next generation of life-saving plant-based pharmaceuticals and other commercially valuable compounds, and failure to train the next generation of plant science–literate and plant-focused researchers and associated professionals needed to tackle these challenges.

As a community, we need to highlight the alignment of our interests with those of the administration and congressional Republicans. We need to make the case that investment in science, and specifically plant science, supports the communities of their constituents and will drive a thriving economy. We need to make the case that investment in the nation’s crumbling infrastructure must also include its public research institutions, which have accrued billions of dollars in repair and deferred

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Otto Kandler

1920–2017

BY SUSANNE RENNER

Ludwig-Maximilians-Universität München

Otto Kandler passed away on August 29, 2016, two months shy of his 97th birthday. He was emeritus professor at the Ludwig-Maximilians University of Munich, where he was the head of the Department of Botany from 1968, until his retirement in 1986. His most important research topics were plant carbohydrate metabolism, analysis of the structure of bacterial cell walls, the systematics of *Lactobacillus*, and the chemotaxonomy of plants and microorganisms.

Otto's discovery of the basic differences between the cell walls



of bacteria and archaeobacteria (now Archaea) convinced him that archaeobacteria represent an autonomous group of organ-

isms distinct from bacteria. This was the basis for his cooperation with Carl Woese and made him the founder of research on the Archaea in Germany. Together with Woese, Otto proposed the three-domain concept of life.

Otto was a member of the German National Academy of Sciences Leopoldina and the Bavarian Academy of Sciences, an honorary member of the German Botanical Society, and a member of ASPB for nearly 60 years (since 1959). He received two honorary doctoral degrees, an Order of Merit from the Republic of Germany, and many other awards

and distinctions. The importance of his contributions to the field of microbiology have been described in several publications (e.g., Sapp, 2009; Schleifer, 2011).

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maintenance needs. Finally, we need to highlight that science-based reduction in regulatory burden related to ag biotechnology and its development is an area ripe for collaboration.

How do we do this? As members of ASPB, you have a dedicated team of advocates working on your behalf and in

partnership with scientists and educators across the disciplinary spectrum. Members of the Science Policy Committee are prominent faces of the Society's advocacy efforts, alongside the Society's leadership, all of whom are supported by myself and a team of government relations consultants from the specialty science and education policy firm Lewis-Burke Associates.

In addition to us, we need you. Part of the strength of any community is its ability to amplify messages to Congress and policy makers. Over the coming months, ASPB will be circulating several e-action alerts to the Society's membership regarding the Farm Bill and congressional appropriations for federal agencies and programs that support plant science research and education. We need your voice.

We need you both to act immediately on the alerts and to share them with your colleagues and encourage them to do the same. Please know that, as in the successful effort to push back against the congressional proposal that would have taxed graduate student tuition waivers, your voice matters. ■

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