July/August 2015 • Volume 42, Number 4

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Plant Scientists Elected to Academy

Join ASPB in congratulating plant scientists elected to the National Academy of Sciences

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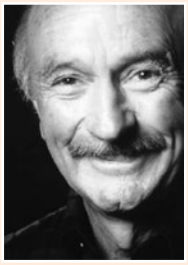
Dancing with Plants

Uma Nagendra wins Science "Dance Your PhD"



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Obituary

Remembering Ian Sussex 1927–2015

ASPB News

THE NEWSLETTER OF THE AMERICAN SOCIETY OF PLANT BIOLOGISTS

President's Letter

Addressing Global Challenges

JULIAN SCHROEDER
University of California, San Diego

Julian Schroeder

Many global challenges facing people around the world are linked directly to plant biology. These challenges include ensuring the sustainable availability of food, fiber, energy, and fresh water for a predicted 9 billion inhabitants in the near future, with many resources already being stretched. Solutions to these and related challenges will depend on scientific innovation and discovery research in plant biology. Investments in these solutions will also be drivers of economic growth—particularly and initially in those countries where the investments are made.

Powerful tools that would help us make significant progress toward addressing these

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ASPB Election Results

Many thanks to those members who took the time to vote this spring, and hearty congratulations to our new officers! They will begin their cycle of service to ASPB on October 1, 2015. Look for more information about our new leaders in an upcoming issue of the *ASPB News*.

Incoming President-elect
Sally Mackenzie
University of Nebraska, Lincoln

Incoming Elected Member
Maureen McCann
Purdue University

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ASPB staff are dedicated to serving our members.
We welcome your questions and feedback.

For quick response, e-mail us at info@aspb.org or visit our FAQ at www.aspb.org/faq.

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, December 5 for January/February publication).

Contact: Nancy A. Winchester, Editor, *ASPB News*, 15501 Monona Drive, Rockville, MD 20855-2768 USA; nancyw@aspb.org; 301-296-0904.

Winning Entries of the April 2015 Teaching Tools Proposal Competition

BY MARY WILLIAMS
Feature Editor, *The Plant Cell*

Earlier this year, we announced a competition for proposals for the "Teaching Tools in Plant Biology" series of educational articles published by *The Plant Cell*. Many excellent proposals were submitted, from which we selected three for further development. The competition has additional submission deadlines of August 31 and December 31, 2015, and full details can be found at http://bit.ly/1NkcZEe.

The following are the three winning proposals and their authors from the first round of submissions.


Csengele Barta


Daniela Dietrich


Katharine Hubbard


Antony Dodd

Biogenic Volatile Organic Compounds: Solving the Puzzle of Plant Communication

by Csengele Barta

This Teaching Tool introduces biogenic volatile organic compounds (BVOCs), which play fundamental roles in plant adaptation to the abiotic environment and function as airborne signal molecules in plant-to-plant communication and multitrophic interactions. Vegetative BVOC emissions are important in shaping regional and global air quality in a warming climate. The Teaching Tool discusses biosynthesis, emission, and roles of BVOCs in plant abiotic stress defense, acclimation, competition, and plant–pollinator, plant–herbivore, herbivore–enemy, plant–pathogen, and plant–virus interactions.

Csengele Barta is assistant professor at Missouri Western State University. She received her PhD from the University of Szeged, Hungary, in collaboration with the Biological Research Center of the Hungarian Academy of Sciences. Her main research interest is investigating the consequences of global climate change for plant survival, plant–environment interactions, and ecosystem health. She teaches upper-division classes in plant physiology and plant morphology, directs the Missouri Junior Academy of Science regional fair, and engages in a variety of other outreach activities, and she enjoys nature photography, hiking, travel blogging, and painting.

Seed Development and Germination

by Daniela Dietrich

This Teaching Tool introduces students to the mechanisms used during seed development that make seeds viable for long periods of time, the ways dormancy can spread the germination of a seed population over time, and the process by which growth is resumed during germination. Particular emphasis is on the integration of internal and environmental signals to control the phase transition from embryo to germinating seed. Examples are included of the impact of seed biology on crop production.

Daniela Dietrich is a research fellow at the Centre for Plant Integrative Biology at the University of Nottingham, England, and is studying the function of abscisic acid in root growth and tropic responses. After obtaining her PhD for work on the contribution of oligopeptide transporters to nitrogen partitioning from the University of Tübingen, she moved to the University of Nottingham to investigate the role of the COMATOSE ABC transporter in seed germination. Since then, she has been teaching seed development and germination to undergraduates.

Teaching Tools in Plant Biology®
ideas to grow on

Rhythms of Life—The Plant Circadian Clock

by Katharine Hubbard and Antony Dodd

For sessile organisms on a rotating planet, coordinating biological processes with daily light and temperature cycles is critical to survival. This Teaching Tool on circadian rhythms introduces students to this fascinating, fast-moving area of plant biology. It also exposes students to approaches used to study temporal processes and provides a vehicle

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PRESIDENT'S LETTER
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challenges are available. However, in many countries, including the United States, funding for plant research is limited despite the pressing need for innovation. The 2014 Farm Bill, passed with bipartisan support last year by Congress and signed into law by President Obama, includes a recommendation for annual funding to the Agriculture and Food Research Initiative (AFRI) of the National Institute of Food and Agriculture (NIFA) of $700 million for competitive merit-based research. This recommendation includes support of a range of research using genomics, molecular biology, genetics, biotechnology, biochemistry, and many other approaches toward making critical advances in the plant sciences.

However, despite the success of Congress in creating AFRI in 2006 and subsequent bipartisan recommendations for increased funding, the fiscal year 2015 funding level of $325 million is far below the authorized level ($700 million) and greatly limited with respect to the research obligations and opportunities we have. This shortfall has resulted in dismally low funding rates in recent years despite many innovative research proposals from the community of scientists. Furthermore, NIFA received recommendations from the National Research Council in its 2014 review of the AFRI program (http://bit.ly/1L7fF8V) to increase its support of basic discovery research, which is likely to have large impact in leading to transformative innovations.

Fundamental discovery research has been a driver of economic growth since the 1950s and earlier. In one not-so-small example, the original discovery of the *Bacillus thuringiensis* endotoxin genes has led to greatly reduced use of chemical pesticides and improved yields in several crops in many countries. For example, a 2014 USDA study found that use of pesticides for corn in the United States dropped by a whopping 90% between 1995 and 2010 due to this innovation (http://1.usa.gov/1fpEIpr). The ongoing revolution in plant and life sciences research opens up many new avenues that are in need of fundamental research to make the required future improvements in agriculture.

Ensuring support of innovative basic discovery research by our funding agencies, including NSF, NIFA, NIH, and DOE, requires vocal and concerted support by all of us—at any stage of our career. ASPB is working to ensure future funding in the plant sciences. If you are interested in becoming more proactive, please contact me or Tyrone Spady, ASPB's director of legislative and public affairs, at tspady@aspb.org. We have efforts in place that require, and can be enhanced by, your support, and we are happy to coach you and introduce you to this work. Your contributions would be most welcome, and we look forward to working with you. Also feel free to contact Tyrone or me if you are a postdoc or graduate student and would like to be considered for membership on ASPB's Science Policy Committee.

It is not only NIFA and AFRI that need a boost. Initiatives are being pursued for increased funding for several other agencies, including NSF and NIH, with proposals being made by representatives from across the political spectrum. The pressure is mounting on our representatives to make the required investments to maintain future competitiveness in science and technology. At this time it is particularly important for scientific societies to have hands-on support from their members.

It is also important for us to work together with other societies in supporting funding increases for the federal agencies that fund plant science, and ASPB is doing so within the context of its participation in the AFRI Coalition (http://africoalition.org/), the National Coalition for Food and Agricultural Research (http://www.ncfar.org/), Supporters of Agriculture Research (http://supportagresearch.org/), the Coalition for National Science Funding (http://www.cnsfweb.org/), and the Energy Sciences Coalition to communicate a consistent message to policymakers. Further, ASPB is also playing a leading role in an effort to develop a unified message across agricultural research, education, and extension communities with several universities, the Riley Memorial Foundation, and AAAS.

In addition, ASPB continues its support of the Decadal Vision for innovation in plant science (http://bit.ly/197Eph9) and the National Plant Science Council. Partnering with the Boyce Thompson Institute, ASPB is the corecipient of a Research Coordination Network (RCN) grant. Although it will function as an independent entity, the RCN program will facilitate many of the community engagement functions of the National Plant Science Council. In addition, the program will serve as a vehicle for the Society's goals with regard to promoting diversity and broadening participation.

It is not only the United States that is dealing with underinvestment in fundamental plant science research; the pressure to increase deprived science budgets is mounting in many other countries. This is one reason that ASPB is working closely within the Global Plant Council (GPC; http://globalplantcouncil.org/home) to push for the investments necessary to address the global challenges I mentioned at the outset. As a member of the GPC, ASPB is working to promote visibility of the plant sciences and of efforts toward addressing global challenges.

The good news is that there is recognition of the growing U.S. workforce needs in the plant sciences and agriculture. For example, Purdue University recently released the report *Employment Opportunities for College Graduates in Food, Agriculture, Renewable Natural Resources, and the Environment* (http://bit.ly/1F9l10H). The report projects an average of over 55,000 annual job openings for bachelor's and graduate degree holders over the next five years in the food and ag space due to a combination of job growth and retirements. While many of these jobs are expected to be outside the research sphere (e.g., in marketing and business), the job market for plant scientists is expected to be among the strongest.

The critical requirement for the next revolution in the plant sciences depends on investment in research made now. The health of the planet and the well-being of 9 billion people depend on it, and ASPB's concerted efforts, with the support of your individual contributions, can go a long way toward meeting our future challenges. ■

79th Northeastern ASPB Annual Meeting Report

BY CAROLYN LEE-PARSONS
Northeastern University

The 79th annual meeting of the Northeastern Section of the American Society of Plant Biologists was held April 11–12, 2015, in the Egan Research Center at Northeastern University in Boston (http://www.northeastern.edu/neaspb/). The meeting was organized by Carolyn Lee-Parsons (Chair, Northeastern University), and the theme was "Advances in Understanding Plant Secondary Metabolism." There were 132 participants, including undergraduate and graduate students, postdoctoral researchers, professionals, and faculty from colleges and universities across the Northeast, including New York, New Jersey, Connecticut, Massachusetts, Rhode Island, New Hampshire, and Vermont.

The meeting opened at 1:00 p.m. on Saturday, April 11, with an introduction to the Keynote Symposium by Carolyn Lee-Parsons. The Keynote Symposium featured talks by four invited speakers: Jing-ke Weng from the Whitehead Institute at the Massachusetts Institute of Technology spoke on "Mechanistic Basis of Metabolic Evolution in Plants," Susan C. Roberts from the University of Massachusetts, Amherst, addressed "Multiscale Engineering of Paclitaxel Synthesis in Taxus Plant Cell Culture," Joe Chappell from the University of Kentucky described "Engineering High-Value Oil Production in Plants," and Daniel Kliebenstein from the University of California, Davis, discussed "A More Precise Transcriptional Regulatory Framework for an Adaptive Metabolic Pathway." Keynote talks were followed by a reception and poster session featuring 60 posters, including 20 presented by undergraduate students, 25 by graduate students, eight by postdoctoral researchers, and seven by either faculty or professionals. The poster session was followed by a dinner banquet and socializing among old and newly made friends.

The meeting reconvened on Sunday morning for a continental breakfast and a morning session of 12 contributed talks, including seven presented by graduate students, three by postdoctoral researchers, and two by faculty or professionals. The business meeting was held before the midsession coffee break and was chaired by Carolyn Lee-Parsons. Om Parkash Dhankher (University of Massachusetts, Amherst), Northeastern Section representative to the ASPB Executive Committee, presented the overview of ASPB's new activities, the benefits of being an ASPB member, the upcoming new plant sciences exchange website (Plantae.org), the new membership structure, and the student/postdoc Ambassador Program. Secretary–Treasurer Subhash Minocha (University of New Hampshire, Durham) read reports on the 2014 meeting and the status of funds. Copies of a new constitution and bylaws were distributed, and members were notified that a vote to approve them would be conducted by e-mail. Joshua Gendron of Yale University, John Celenza of Boston University, and Carolyn Lee-Parsons of Northeastern University were nominated and elected to the Executive Committee. Peter Melcher, Ithaca College, was nominated and elected as the Northeastern Section representative to the ASPB Executive Committee. Peter Melcher invited the section to hold its 80th annual meeting at Ithaca College in Ithaca, New York.

A panel of five judges selected the best contributed talks, and the audience voted for the top posters in each category (undergraduate, graduate, and postdoctoral). The winners selected their book of choice, donated by Sinauer Associates (thanks to Susan McGlew). We thank our sponsors, including ASPB, the College of Engineering of Northeastern University, New England Biolabs, Beckman Coulter Genomics, and Agilent Technologies, and other donors to the Student Travel Fund. ■

WINNING ENTRIES TTPB
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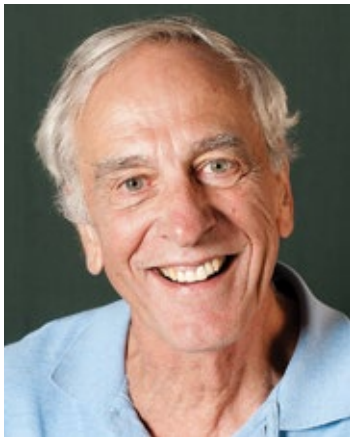
to communicate concepts such as complexity in biology and the importance of model system research.

Katharine Hubbard is a teaching fellow at the University of Cambridge, England. She contributes extensively to undergraduate teaching in plant sciences, including biochemistry, molecular biology, cell biology, and physiology. She is interested in developing teaching resources for key topics in plant sciences and also in teaching transferrable skills such as use of the scientific literature and critical evaluation. Her PhD was in circadian signal transduction, and she did postdoctoral research on guard cell calcium signaling.

Antony Dodd is based at the University of Bristol, England. His lab investigates molecular mechanisms associated with circadian rhythms and environmental signaling. His current interests include the connections between circadian clocks and chloroplasts, the role of the circadian clock in the integration of complex environmental signals, and the circadian regulation of physiology and whole plant performance. ■

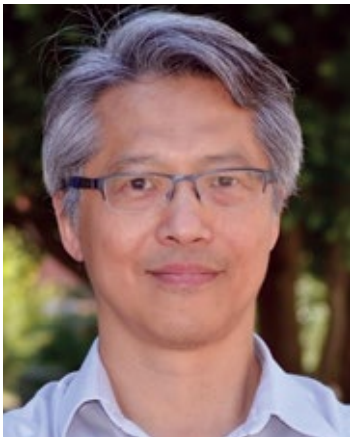
Plant Scientists Elected to the National Academy of Sciences

Several distinguished plant scientists, most of them members of ASPB, have been elected member or foreign associate of the 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 2,250 active NAS members and 452 foreign associates. Seven members of the plant science community were elected to this year's NAS class.



Joseph A. Berry

Sheng Yang He



James C. Liao

Joseph A. Berry

Carnegie Institution of Washington

Joe Berry has been a Carnegie Institution of Washington investigator since 1972. He has developed powerful tools to measure local and regional exchanges of carbon over spaces of up to thousands of square miles. He uses information at the plant scale to extrapolate the carbon balance at the regional and continental scales.

According to the Web of Science (http://scientific.thomson.com/products/wos/), two of Berry's papers passed rarefied citation milestones. The 1980 paper "A Biochemical Model of Photosynthetic CO_2 Assimilation in Leaves of C3 Species" has had more than 1,500 citations. His 1982 paper "On the Relationship Between Carbon Isotope Discrimination and the Intercellular Carbon Dioxide Concentration in Leaves" passed its 1,000th citation mark.

Berry received his BS in chemistry and MS in soil science from the University of California, Davis. He received his PhD in botany from the University of British Columbia. Learn more at http://stanford.io/1eigfnU.

Sheng Yang He

Michigan State University

Sheng Yang He is a Howard Hughes Medical Institute–Gordon and Betty Moore Foundation investigator and Michigan State University distinguished professor in the Department of Plant Biology, Department of Microbiology and Molecular Genetics, and Department of Plant, Soil and Microbial Sciences. He said, "I am extremely honored to receive this recognition and am greatly indebted to my former and current lab members and collaborators for their memorable contributions."

His work has focused on investigating infectious disease susceptibility in plants. This research led to his being honored as an investigator by the Howard Hughes Medical Institute and the Gordon and Betty Moore Foundation in 2011. As a professor and investigator, he continues to explore a molecular understanding of the plant immune system and how bacterial pathogens cause disease.

He received his BS in plant protection from Zhejiang Agriculture and Forestry University and his PhD in plant pathology from Cornell University. Learn more at http://www.thehelab.org/.

James C. Liao

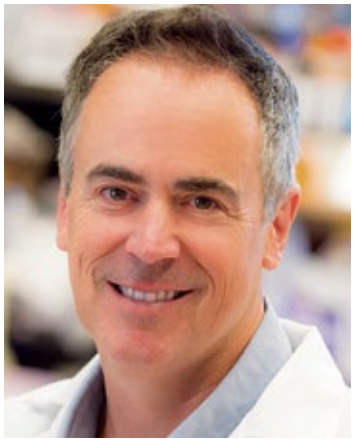
University of California, Los Angeles

James Liao is the Ralph M. Parsons Foundation Professor and chair of the chemical and biomolecular engineering department at the University of California, Los Angeles (UCLA). He is also a member of the National Academy of Engineering and was recently honored with the 2014 National Academy of Sciences Award for the Industrial Application of Science, which is awarded once every three years.

Liao's research focuses on understanding fundamental scientific principles of synthetic biology and metabolism, then using that knowledge to solve problems in the production of fuels and chemicals and in the treatment of metabolic diseases. "Jim has made pioneering contributions at the nexus of engineering, chemistry, and biology. He is truly deserving of this most prestigious of honors, and we are very proud of him," said Vijay K. Dhir, dean of UCLA engineering.

Liao received his BS from the National Taiwan University

Joachim Messing



Julian I. Schroeder

Jonathan D. G. Jones

and his PhD from the University of Wisconsin–Madison. Learn more at http://www.seas.ucla.edu/~liaoj/.

Joachim Messing
Rutgers University

Joachim Messing is director of Rutgers University's Waksman Institute of Microbiology, Selman A. Waksman Chair in Molecular Genetics, and professor of molecular biology. "I am glad and honored that I got elected," said Messing. "When you receive recognition for your work like this, the day becomes a little hectic," Messing said. "But when the day is over, this research will go on."

Besides his early work in molecular biology, Messing has focused on plant genetics. His laboratory has studied in particular genes that are expressed during the development of cereal seeds. He is well known for studies of grass genomes, and his laboratory has contributed to the sequencing of rice, sorghum, maize, Brachypodium, and Spirodela. These genomic sequences have permitted his laboratory to study the organization and evolution of the genes that control the supply of proteins for nutrition. More recently, his laboratory has used RNA interference to study the role of these proteins in seed development and molecular breeding. One of the new initiatives of his laboratory investigates the potential of sweet sorghum and duckweed as alternative bioenergy sources.

Joachim received his BS and MS in pharmacy from the Free University of Berlin and his doctorate in natural sciences in biochemistry and pharmacy from the Ludwig Maximilian University of Munich. Learn more at http://bit.ly/1cWQwzR.

Julian I. Schroeder
University of California, San Diego

Julian Schroeder is the current ASPB president and professor and Novartis Chair in Plant Sciences in the Division of Biological Sciences at the University of California, San Diego (UCSD).

"It is quite an honor, and I am humbled. I am grateful to have had wonderful, supportive advisors, Erwin Neher at the Max Planck Institute in Göettingen when I started out in research and my postdoctoral mentor Susumu Hagiwara at UCLA. I owe thanks to the terrific postdocs and students who have been in my lab at UCSD, who not only have made our research endeavors productive but also have stimulated scientific paths—often into the unknown. I have to say, though, that I am most gratified by their ensuing progress and excited by the questions that lie ahead."

The research of Schroeder's group focuses on elucidating the molecular and cell biological stress-induced signal transduction cascades in higher plant cells, the chain of events by which plant cells respond to elevated CO_2, the drought stress hormone abscisic acid, and salinity stress to mount specific resistance and adaptation responses. A second effort in Julian's lab focuses on identifying genes that mediate salinity stress resistance and heavy metal uptake and detoxification in plants.

Schroeder pursued his undergraduate studies in physics at the University of Göttingen and completed his MS and PhD in biophysics and physics at the Max Planck Institute for Biophysical Chemistry in Göttingen, Germany. Learn more at http://bit.ly/1JDQj1K.

Foreign Associates

Jonathan D. G. Jones
John Innes Centre

Jonathan Jones is a group leader at the John Innes Centre at The Sainsbury Laboratory (TSL) in the United Kingdom. Jones said, "This is an incredible honor, and I'm absolutely thrilled to join the illustrious cohort of great scientists in the NAS. I thank all the fantastic scientists who have worked in my group over the past 26 years at TSL, whose dedication and hard work were indispensable to the track record on which I was elected."

Jones's lab is interested in how plants resist disease and in how resistance is overcome by pathogens. To suppress host defenses, pathogens secrete effector proteins into plant cells or into their apoplastic spaces. How these effectors work, and the identity of their targets in the host, help us understand plant defense mechanisms.

The lab works on the following problems:

1. How do plant nucleotide-binding site leucine-rich repeat disease resistance proteins recognize pathogen effectors and then activate defense?
2. What are the effectors of the Arabidopsis downy mildew and white rust pathogens (*Hyaloperonospora arabidopsidis* and Albugo species), and how do they suppress host defenses?

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ELECTED TO NAS
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3. Can we find and clone new sources of resistance to potato late blight from wild Solanum species?

Jonathan received his BS in natural sciences and PhD from the University of Cambridge. Learn more at http://jones.tsl.ac.uk.

Satyajit Mayor

National Centre for Biological Sciences, Institute for Stem Cell Biology and Regenerative Medicine

Satyajit Mayor is director of the National Centre for Biological Sciences in Bangalore, India, and the Institute for Stem Cell Biology and Regenerative Medicine (InStem) in Stanford, California.

"Satyajit Mayor's election to the National Academy of Sciences is recognition of the extraordinary science that has come from his lab over the past couple of decades," according to his colleague K. VijayRaghavan. "His superb science has defined new directions in cell biology and has been combined with leading an awesome team of imaging scientists and technologists to make the National Centre for Biological Sciences one of the best places for microscopy research and training in the world."

Mayor's research uses a multidisciplinary approach combining cell biology with physics and chemistry to understand the molecular mechanisms of endocytosis in metazoan cells on many scales. On the molecular scale, his group aims to uncover the molecular players in endocytic processes; on the mesoscopic scale, research in his laboratory attempts to provide a physical description of cell membrane structure, organization, and material properties; on the cellular scale, the work is aimed at synthesizing a role for endocytosis in cellular signaling and cell surface homeostasis; and on the scale of tissue, the group seeks to determine how control of endocytosis impinges on many developmental programs in tissue morphogenesis.

Satyajit Mayor

As an undergraduate, Satyajit studied chemistry at the Indian Institute of Technology Bombay. He received his PhD in life sciences from the Rockefeller University. Learn more at https://www.ncbs.res.in/mayor. ■

Where Are They Now?

As the years churn on, many esteemed members of ASPB have passed the torch to their younger colleagues and stepped out of the limelight to allow others to bask in its glory. Yet, many continue their good works to the benefit of plant biology and the world. Edited by Beth Gantt, University of Maryland, "Where Are They Now?" is part of the *ASPB News* suite of columns focused on the personal and scientific life and insights of ASPB members at all stages of their career. This column offers a look into the current activities of influential members of ASPB who continue to make a positive mark on our Society. We hope you all enjoy this addition to your newsletter.

Please feel free to submit your own article to "Luminaries," "Membership Corner," or "Where Are They Now?" For details, please contact David Horvath, Membership Committee chair, at david.horvath@ars.usda.gov. As always, we are open to suggestions for articles or features of interest to readers of the *ASPB News*. Enjoy!

Marvin Edelman

Emeritus Professor of Biology, Weizmann Institute of Science

By the early 1960s, the fact that organelles such as chloroplasts contain DNA had been established, but no one had yet held the stuff in their hand, which would allow physical and biochemical analyses. Two years into my PhD at Brandeis University, after I had isolated chloroplast and then mitochondrial DNA from *Euglena* in a test tube, I was initiated into the "rat race." Then, as now, a finding whose time had come had competing groups working to the same end. I was impressed how my mentor, Jerome Schiff, sat down without delay at the typewriter and, with his student providing details, directly composed a manuscript for submission to PNAS. By my third paper, a year later, I was doing the composing myself, to his and my satisfaction.

In 1967, I applied for a postdoc position to work on the physical properties of mitochondrial RNA in Uri Littauer's lab at the Weizmann Institute of Science in Israel. In a sense, this was a natural step for me. Throughout my teens and up to the year I got married, I had spent summers either visiting family in Israel or at a Hebrew-speaking overnight camp, where one played baseball and went canoeing in Hebrew. Following the postdoc, I stayed on at Weizmann, joining what is now the Department of Plant and Environmental Sciences, and published my way up the ranks to tenured full professor.

Marvin Edelman (left) with Autar Mattoo.

I was very fortunate to have Autar Mattoo join the lab in 1980 for two years as a German Academic Exchange Service fellow. Along with a cadre of gifted students, he and I identified the translation product of the major mRNA of the chloroplast as the D1 protein and showed its rapid metabolism. My close collaboration with Mattoo led to a slew of joint publications on the D1 protein that continue to this day. We realized that the D1 protein, a photosystem II reaction center component, was tightly regulated. Thus, our studies were carried out almost exclusively in vivo under physiological conditions using easy-to-manipulate duckweed plants.

At some point, it became important to try and stably transform the duckweed system to continue in vivo experiments. The difficulty was the multiple layers of meristems present in the vegetatively propagated daughter generation. In collaboration with Avichai Perl, the difficulty was overcome by the mid-1990s. The patented technology eventually formed the basis for a start-up called LemnaGene. Close interaction with LemnaGene introduced me to the biotech scene in its varied aspects, and I continue to capitalize on that to this day.

The sinuous paths of basic research are legendary. By 1990, the structure of the bacterial photosynthetic reaction center had been solved to atomic resolution, but the related photosystem II reaction center from higher plants was still more than two decades away from resolution. I was interested in the quinone binding site of the D1 protein due to its dual proximity to the primary degradation site and herbicide binding site of the protein. As fortune would have it, during this same period I served as Israel's scientific delegate to the European Molecular Biology Laboratory and was thrust into the politics of upgrading its nucleotide sequence data library to what was to become the European

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WHERE ARE THEY NOW?
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Bioinformatics Institute (EBI) in Hinxton, United Kingdom. As chair of the Advisory Committee of the EBI for a number of years, I was exposed to the wonders of bioinformatics, and my research toolbox expanded in kind. With my colleague Vladimir Sobolev, we created a useful model of the D1 quinone binding site based on the resolved structure of the bacterial reaction center and using contact surface between atoms to define the residues in direct contact with the quinone.

The idea of putting the international databases to work on research questions of my own interest was exciting. There was both a gain and a cost in turning to bioinformatics: the gain, a powerful and, at that time, relatively novel research tool; the loss, a drift away from my natural plant science milieu to the wider realm of general biological questions. For the past 15 years I have primarily used database-driven, atomic-level structure information to probe ligand–protein interactions. However, I did not abandon my plant research entirely. I kept up via the biotech scene, and I am currently integrating an applied molecular genetics project in the lab with consulting for an Israeli agrotech start-up, both involving my favorite plant, duckweed.

So, where am I now? Ten years after going on age-mandated pension, I still enjoy doing science. I readily admit to being a workaholic: I'm in the office or lab most of the day, six days a week. Being emeritus and unsalaried has a major perk: no administration. For extracurricular hobbies, I putter in the garden and participate in an evening study group reading the Talmud, a compendium of rabbinic oral law and lore, which was committed to print about 1,500 years ago. We do a page a day, every day. It takes seven-plus years to go through the whole cycle of 2,700 pages. As the saying goes: different strokes for different folks.

But the real story is the tremendous enjoyment my wife and I have from our five children, 14 grandchildren, and currently two great-grandchildren. Israel is a small country, and we are all located within an hour's drive of one another. Now a word about my sponsor: Sara, my wife and partner of 54 years, and a retired English teacher to boot (I hardly ever make it through supper without a syntax correction). Sara typed my thesis, raised the kids, and put up with the long working hours of a research biologist. We first met folk dancing in New York City. Now we find time to play Scrabble (she regularly beats me) and visit our growing brood. We still dance together, but now it's at the weddings. ■

Policy Update

BY LAUREN BROCCOLI
Lewis-Burke Associates, LLC

Congress Agrees on Budget Resolution

In early May, Congress passed the Concurrent Resolution on the Budget for Fiscal Year 2016. The Concurrent Resolution, which governs Congress and does not require a presidential signature, creates a blueprint for the appropriations process, sets overall spending levels, and lays out a framework for future entitlement program changes, such as repealing the Affordable Care Act.

The Concurrent Resolution keeps the sequestration caps and sets overall funding at essentially the same level as fiscal year 2015. However, the resolution uses Overseas Contingency Operations funding to increase defense spending above sequestration levels. Although the House has passed three of the FY2016 appropriations bills, primarily by party-line votes, the president has threatened to veto these and any other bills that adhere to the sequester caps or only increase defense spending, in line with the position of the Democrats in Congress. The appropriations process is expected to be highly partisan and could end in a long-term continuing resolution if Democrats and Republicans are not able to agree on a budget deal to replace sequestration later this year.

Sources and Additional Information

- The Conference Report for the Concurrent Resolution can be found at http://1.usa.gov/1G0B3ZQ.

House Passes Flurry of Science Legislation

The House of Representatives passed several science-related bills on May 20 under suspension of the rules, a method used to pass noncontroversial legislation. The first bill, the International Science and Technology Cooperation Act of 2015 (H.R. 1156), directs the White House to establish a new entity under the National Science and Technology Council that would identify and coordinate U.S. partnerships with international scientific bodies.

The chamber also passed the Research and Development Efficiency Act of 2015 (H.R. 1119). The bill, offered by Congresswoman Barbara Comstock (R-VA), requires the White House Office of Science and Technology Policy to establish a working group to review regulations that impact scientific research at U.S. universities. Specifically, the bill's goal is to harmonize, streamline, and eliminate duplicative federal regulations and reporting requirements, minimize the regulatory burden on higher education institutions performing federally funded research, and ensure good stewardship of taxpayer dollars.

Sources and Additional Information

- The text of H.R. 1156 can be found at http://1.usa.gov/1ASTalp.
- The text of H.R. 1119 can be found at http://1.usa.gov/1KSlIz2.

House Passes America COMPETES Reauthorization

On May 20, the House of Representatives considered and passed the America COMPETES Reauthorization Act of 2015 (H.R. 1806), which would authorize FY2016 and FY2017 funding for the NSF, the National Institute of Standards and Technology (NIST), research at the DOE, the Office of Science and Technology Policy (OSTP), and STEM (science, technology, engineering, and mathematics) education policy. The legislation passed the full chamber on a mostly party-line vote, 217 to 205, following a contentious and highly partisan markup of the bill on April 21 by the House Committee on Science, Space, and Technology. The White House has also threatened to veto the House bill.

The House COMPETES bill is an amalgam of legislation considered by the committee last year, including the FIRST Act (H.R. 4186), which covered NSF, NIST, OSTP, and STEM education, and the Department of Energy Research and Development Act (H.R. 4869), which covered DOE. In the 113th Congress, the FIRST Act was approved by the Science, Space, and Technology Committee but not the full chamber, whereas H.R. 4869 was not considered at the full committee level. The new COMPETES bill retains many of the problematic provisions from last year's bills, including directorate-level authorization for NSF, as well as deep cuts for the Social, Behavioral, and Economic (SBE) Sciences and Geosciences (GEO) directorates at NSF and the Biological and Environmental Research and Advanced Research Projects Agency–Energy (ARPA-E) at DOE. The COMPETES funding recommendations are not binding on the appropriations committees, but they represent the priorities of the Committee on Science, Space, and Technology and the broader House of Representatives.

On the same day the House considered the COMPETES bill, a bipartisan group of seven senators led by Senators Lamar Alexander (R-TN) and Chris Coons (D-DE) introduced a bill (S. 1398) focused solely on DOE Office of Science and ARPA-E programs. This bill would reauthorize the Office of Science and ARPA-E through 2020 and provide annual increases of 4 percent in authorized funding.

Sources and Additional Information

- Full text of H.R. 1806 and a list of amendments considered on the floor can be found at http://1.usa.gov/1eTWqDf.
- Information on the Alexander–Coons DOE bill can be found at http://1.usa.gov/1BPYuBi.

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FY2016 Appropriations Update: House Appropriations Committee Approves Commerce, Justice, Science Appropriations Bill

On Wednesday, June 3, the House of Representatives passed their FY2016 Commerce, Justice, Science, and Related Agencies (CJS) appropriations bill (H.R. 2578) by a vote of 242 to 183, with nearly all Democrats and a handful of Republicans opposing its passage. The CJS bill funds NSF, NASA, the National Oceanic and Atmospheric Administration (NOAA), NIST, and the Economic Development Administration, among other programs. NSF would receive $7.4 billion, a 0.7 percent increase over FY2015. The bill does require about 5 percent of NSF's Research and Related Activities (R&RA) funding to shift from the SBE and GEO directorates to the other research directorates.

During the markup, CJS Subcommittee Chairman John Culberson (R-TX) noted that NSF would receive an increase of $50 million above last year's record high appropriation of $7.3 billion. The chairman noted the importance of scientific research at the outset of his remarks and the excellence of NASA, NOAA, and NSF as the foundation of American innovation.

CJS Subcommittee Ranking Member Chaka Fattah (D-PA) highlighted the favorable increase in neuroscience research funding. The legislation would provide $146 million to the NSF Understanding the Brain initiative for FY2016, an increase of $40 million over the FY2015 level.

The cordial atmosphere during the House CJS subcommittee and committee markups likely will not imbue the Senate's own proceedings. Ranking Member Barbara Mikulski (D-MD) expressed opposition to the subcommittee's allocation and vocalized her intention to introduce a substitute CJS appropriations bill consistent with the president's FY2016 request and the priorities of the Democratic committee members.

The House CJS bill would provide NSF with $7.394 billion, which is $50.0 million (0.7 percent) above the FY2015 level and $329.3 million (4.3 percent) below the president's FY2016 request. Essentially all of the proposed $50 million increase would go to NSF's R&RA account, while the other accounts would stay flat or nearly flat. The legislation would also dramatically change how funds are allocated within R&RA; the following language appears in the committee report: "The Committee directs NSF to ensure that Mathematical and Physical Sciences (MPS); Computer and Information Science and Engineering (CISE); Engineering (ENG); and Biological Sciences (BIO) comprise no less than 70 percent of the funding within Research and Related Activities." The report also directs NSF to allocate no less than FY2015 funding levels for the Office of International Science and Engineering; Integrative Activities; and the U.S. Arctic Commission. This language would result in a $307 million (7.9 percent) increase in funding to the combined budgets of BIO, CISE, ENG, and MPS, while SBE and GEO would be cut by a combined $257 million (16.3 percent) from their FY2015 levels. Relative to the request, BIO, CISE, ENG, and MPS would have an additional $171 million (4.3 percent) more than requested, while SBE and GEO would receive $337 million (20.3 percent) less than requested.

In addition, the committee report

- provides supportive language for collaborations with strategic international partners, including Israel
- directs NSF to develop guidelines to ensure that NSF-supported research is replicable
- directs NSF to allow public and private nonprofit technology transfer organizations to apply directly to NSF for commercialization grants
- supports the Experimental Program to Stimulate Competitive Research program at $160 million, the same as the FY2015 level.

Sources and Additional Information

- Additional information, including the bill text and report, is available at http://1.usa.gov/1HfYw7m.

FY2016 Appropriations Update: Senate Appropriations Committee Approves Energy and Water Development Appropriations Bill and Sets Subcommittee Allocations

On May 21, the Senate Appropriations Committee approved its version of the FY2016 Energy and Water Development and Related Agencies appropriations bill. The bill passed on a largely bipartisan vote of 26 to 4. The bill would provide a total of $35.4 billion to support the operations of the civil works projects of the Army Corps of Engineers, the Department of the Interior's Bureau of Reclamation, the civilian and defense-related programs of the DOE, and related independent agencies. The Senate Appropriations Committee also agreed to appropriations subcommittee allocations for the purpose of writing the 12 spending bills.

This level is just $34 million less than the House-passed Energy and Water bill, which will make negotiations between the House and Senate for the final passage of the bill easier than in prior years. Although the total funding amount is similar, there are significant differences for individual programs that reflect differing priorities in the House and Senate.

Like the House, the Senate Appropriations Committee will adhere to the sequester-level spending caps. House Democrats have stated their intention to oppose the continuation of the caps by opposing all appropriations bills that adhere to them. Similarly, the Obama administration has issued statements of administrative policy that recommend a presidential veto for any bill that adheres to sequestration funding levels.

The Senate bill would provide $291 million for ARPA-E, an increase of $11 million (3.9 percent) over the FY2015 enacted level and the House-passed bill, but still $34 million less than the president's request. The committee is explicitly supportive of ARPA-E's focus on transportation fuels, feedstocks, energy materials and processes, dispatchable energy, and sensors, information, and integration.

The Senate would provide $5.144 billion for the Office of

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FOIAs Chilling a Scientific Dialogue—Your Call to Communicate

BY KEVIN M. FOLTA
University of Florida

One morning in early February, I received an unusual e-mail. It was from my colleague here at the University of Florida, Dr. David Oppenheimer. It simply said, "FYI," and was followed by a note from university general counsel that e-mail records were demanded back to 2012 under the Sunshine Law, Florida's Freedom of Information Act (FOIA) law.

Suddenly a popup window ignited in the corner of my screen—you've got mail! It was a public records demand for my personal interactions with a slate of agricultural companies, trade organizations, communications firms, and nongovernmental organizations (NGOs). What did David and I do to precipitate this intrusive request?

We taught science.

David and I had answered questions on GMOAnswers.com, a website sponsored by companies such as Bayer Crop Science, Monsanto, Dow, and others. The website is intended to provide a portal for public access to independent academic and company experts that could address their questions about transgenic crop technology.

The website launched in 2013, and I was eager to participate. Throughout my scientific career, I've read about transgenic crop technology and today endlessly contemplate its applications in helping the environment and the needy, as well as the farmer and consumer in the industrialized world. I have never shied away from public interaction on the topic. I found activists and concerned citizens to be a lot like me in terms of lifestyle and politics—I just knew more about this technology.

Kevin M. Folta

I've regularly shared this information via my blog (http://kfolta.blogspot.com/) and during frequent public talks, even engaging audiences that do not appreciate the implementation of such technologies. For the most part, these are concerned people who have been fed a steady diet of bad information, and it is a pleasure to introduce them to the facts as presented in the scholarly literature.

From my perspective, the GMOanswers.com website offered a visible venue to continue this outreach. It provided me a place to communicate with a public hungry for independent answers. It was this participation that activated the prying into my personal e-mails.

This public records request claimed to target scientists participating in GMOanswers.com. However, it has a total of 14 public scientists in its crosshairs, scientists who simply interacted with the public around topics of agricultural biotechnology. Many are ASPB members.

The request comes from US-Right to Know (US-RTK), an Oakland-based NGO, that has made the following allegation: "These professors are closely coordinating with agrichemical corporations and their slick PR [public relations] firms to shape the public dialogue in ways that foster private gain for corporations…or…act as the public face for industry PR." They suspect collusion because our interaction with the public matches and reinforces concepts in plant biology espoused by the seed manufacturers.

What they fail to realize is that our words parallel company claims because both are distilled from a scientific consensus built upon decades of data. The answers to the public's questions would be similar from anyone who understands plant biology and the application of transgenic techniques to agriculture. To US-RTK, this isn't a badge of scientific consensus; it is the red flag of conspiracy.

David and I have no research or personal funding from "Big Ag"—only in our dreams. We work for a state where genetically modified crops are just about as rare as snowflakes. We're also rather resilient in our syntheses of

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> "It is our mission to stand up for the truth that science gives us."
>
> —Dr. Jack Payne, Senior Vice President
> University of Florida, Institute of Food and Agricultural Sciences

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Science in FY2016, an increase of $76.1 million (1.5 percent) over FY2015 and $44 million above the House-passed bill, but still $195.9 million below the president's proposed budget. Almost all programs would see an increase above FY2015 enacted levels, with the largest increase going to Advanced Scientific Computing Research and fusion energy being reduced by 42 percent.

Basic Energy Sciences (BES) would be funded at $1.844 billion, an increase of $111.1 million (6.4 percent) over the FY2015 enacted level and $74 million above the House bill but $5 million below the budget request. In contrast to the House-passed bill, research and operations of user facilities within BES would not be reduced but instead increased by $55 million in FY 2016, slightly less than the president's request.

Although the bill does not specifically mention the Energy Frontier Research Center program, it does fully support the two Office of Science–funded Energy Innovation Hubs (Fuels from Sunlight, Batteries and Energy Storage) at the requested levels of $15 million and $24.1 million, respectively. Overall, the bill provides funding to maintain all four Hubs (including the Critical Materials Institute and Nuclear Energy Modeling and Simulation).

The Senate bill would provide $610 million for Biological and Environmental Research (BER), an increase of $18 million (3 percent) over the FY2015 enacted level and $72 million above the House bill but $2.4 million below the request. Like the House bill, the Committee directs $75 million for the three Bioenergy Research Centers. Unlike the House bill, which cuts the climate and environmental research program, the Senate bill would increase these activities by $23 million and, within this amount, would fund BER's portion of the Exascale Initiative at $18.7 million, the same as the president's request.

Sources and Additional Information

- The Senate Energy and Water Development Appropriations Subcommittee website can be accessed at http://1.usa.gov/1H8SWZr.
- The report accompanying the Senate version of the Energy and Water bill can be found at http://1.usa.gov/1Gdw2i5.

White House Unveils National Strategy to Promote the Health of Honey Bees and Other Pollinators

On May 19, the White House Pollinator Health Task Force, cochaired by Secretary of Agriculture Tom Vilsack and Environmental Protection Agency Administrator Gina McCarthy, released a *National Strategy to Promote the Health of Honey Bees and Other Pollinators.* The extensive report includes a separate, standalone *Pollinator Research Action Plan* that identifies five main priority areas: population trends and basic biology, environmental stressors, land management, habitat restoration, and knowledge curation such as data sharing or informatics.

Although the strategy outlines a variety of new initiatives and corresponding metrics for evaluation, it recognizes ongoing federal efforts and urges collaboration rather than duplication across agencies.

Sources and Additional Information

- The announcement from the White House is available at http://1.usa.gov/1FxhBXM.
- The full strategy is available at http://1.usa.gov/1HpQhIf.
- The research action plan is available at http://1.usa.gov/1FwuteH. ■

Blast from the Past

All 36 columns of The Bioethics Imperative, by Dina Mandoli, published in the *ASPB News* between 2001 and 2008, are available online in our archives at http://newsletter.aspb.org/bioethics.cfm. We encourage you to take a look back through these columns, all of which remain relevant and useful tools for teaching ethics.

UPenn Plant Science Graduate Student Goes to DC

BY RUTHSABEL CORTÉS
University of Pennsylvania

I am a PhD student working in plant cell biology, so my work is supported in part by NSF. Every day, I come to the lab and perform my experiments. Because I focus on questions related to biology, I don't generally consider of the origin of the funding for these experiments.

As part of a coordinated effort to advocate for NSF and promote the perspectives of early-career plant scientists on the importance of NSF funding, ASPB and several dozen other national and international scientific and education organizations invited researchers and educators from across the United States to Washington, D.C., on May 13. I had the opportunity to visit with congressional staffers as a representative of ASPB. Along with Tyrone Spady, the Society's director of legislative and public affairs, I met with staff of Senators Robert P. Casey Jr. (D-PA) and Patrick J. Toomey (R-PA) with the goal of articulating the importance of strong federal investment in NSF, the federal agency on which many in our community rely to support their research.

After our meetings on Capitol Hill, I attended the annual Coalition for National Science Funding exhibition. At an energetic reception, investigators and students showcased their NSF-supported research. During this event, I met several important players who oversee science funding and provide congressional oversight, including Congressman Chaka Fattah (D-PA), ranking member on the House Appropriations Subcommittee on Commerce, Justice, Science, and Related Committees, and Congresswoman Eddie Bernice Johnson (D-TX), ranking member on the House Committee on Science, Space, and Technology. In addition, I met the following members of Congress:

Ruthsabel Cortés with Congressman Chaka Fattah (D-PA), ranking member of the House Appropriations Subcommittee on Commerce, Justice, Science, and Related Committees.

The author with Congresswoman Eddie Bernice Johnson (D-TX), ranking member of the House Committee on Science, Space, and Technology.

- Rep. Paul Tonko (D-NY), who serves on the House Committee on Energy and Commerce, which has jurisdiction over DOE
- Rep. John Moolenaar (R-MI), who serves on the House Committee on Agriculture, which has jurisdiction over USDA; on the House Committee on Budget; and on the House Committee on Science, Space, and Technology, which has jurisdiction over NSF (before entering politics, Moolenaar was a chemist with Dow)
- Rep. Jerry McNerney (D-CA), who serves on the House Committee on Energy and Commerce, which has jurisdiction over DOE
- Rep. Mike Simpson (D-ID), who serves as chairman of the House Appropriations Subcommittee on Energy and Water Development, which funds DOE.

My day on the Hill increased my awareness of the process by which Congress makes funding decisions for the federal agencies that facilitate our research and strengthened my appreciation for why we all need to do our part to advocate for plant science. ■

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the literature, and there's not an ag company, PR firm, or ninja rappelling from a Monsanto black helicopter that can coerce our word choices or how we communicate these concepts to a curious public.

US-RTK's actions have been chilling. Such intimidation stymies desires in an already largely silent body of qualified, trusted academic and government scientists to reach out to nonscientists about any ag technology. Notes from postdocs and new professors have stated that US-RTK's unprovoked cyber surveillance is why they decline to interact with the public in "controversial" areas. This is harassment that ices outreach.

That said, should our personal e-mails, which certainly include interactions with these companies, be subject to inferential biased analysis, cherry-picking, and distortion in the interest of tarnishing us? The US-RTK's conclusions, no matter how untrue, will soon resonate and propagate throughout a rabid activist electronic media primed to discredit public scientists, à la Climategate.

Unfortunately, yes, these types of information requests must be allowed. Transparency laws are important. It is the *abuse* of these rules that needs to be stopped. How do we do that?

First, as scientists we need to voice our outrage about such tactics. We need to broadcast our disdain over news, local, and social media, exploiting the same amplification tactics that the US-RTK and their ilk are already using. We must use our credibility to decry the expensive abuse of an important system that is being used to impeach and tarnish the reputations of public scientists to the ironic delight of the activists' own industry supporters (US-RTK is well funded by the Organic Consumers Association). Disgust motivates the middle.

More importantly, as scientists we *all* need to better connect with the public in the pop-controversial areas of science. We must be conversant in the consensus syntheses of climate change, vaccines, and transgenic crop technology. We all need to actively integrate ourselves into the science–society interface, teaching and interpreting the scholarly literature. We must be honest, communicating the strengths and weaknesses, risks and benefits, to maintain and expand public trust.

If everyone in our plant science community was communicating science only a few minutes a week, the paid full-time activist infrastructure would be overcome by expert testimony. We would win the trust of a public that simply does not know what to believe and allows fear to govern its decisions over facts.

We are living in a time when applications of technology in agriculture and medicine will only come faster, and new breakthroughs will coincidentally kindle newfound resistance. A malleable, comfortable, and scientifically unsavvy public will bend to activist-manufactured risk. To move science's discoveries from the laboratory to widely accepted application will require the participation of all of us, and communicating with a curious public must become a priority mission for us as scientists. ■

Fun Forays into Flora

BY KATIE ENGEN
ASPB Education Foundation Coordinator

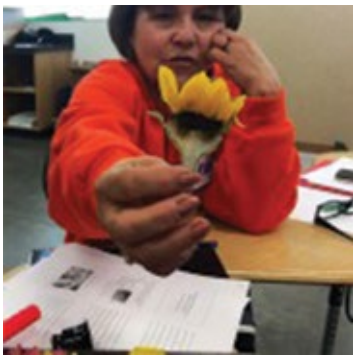
Fascination of Plants Day
May 18th 2015

On May 18, plant scientists all over the world shared how the Kingdom Plantae is essential to the food, pharma, fuels, and fibers integral to our daily lives and a sustainable environment. This date was dedicated to the mission of Fascination of Plants Day (FoPD): to sow constantly germinating seeds in the collective mind of the world public to cultivate the appreciation and understanding that plant science is of critical significance to the social, environmental, and economic landscape now and into the future.

The main FoPD site (http://plantday.org/news.htm) maps out the worldwide celebration. The ASPB FoPD blog page (http://bit.ly/1uybGHf) features the FoPD events hosted in the United States. Here's a look at some of these fun forays into flora.

Leeann Thornton leading pre-schoolers in Hopewell, New Jersey, as they dance as plants: tuck into a tiny seed shape; grow to tall, blooming flowers; drop new seeds; keep roots firmly in place; and let leaves reach, grow, and sway in the wind.

David Puthoff helping a first grader explore tropisms in Frostburg, Maryland.



Still from a short video (http://bit.ly/1QcJ54F) created by students and faculty at the Western Institute for Leadership Development (WILD) in Tucson, Arizona, on the many, many ways WILD explores plant biology every day of the year.

Plant scientists leading themed walks at the Missouri Botanical Garden in St. Louis.

The table is set: Artist-host Maryann Worrell with the Phoenixville, Pennsylvania, community-planted meal to be harvested in August.

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FUN FORAYS INTO FLORA
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Representatives of Florida groups celebrating FoPD (left to right): Mary Echols, from Naples Preserve; Anjali Misra, from Florida SouthWestern State College; and Ms. Trotter and Ms. Rich, from Six Mile Charter Academy.

Plant science students at the University of Maryland, Baltimore County, giving away plants, sharing plant-y jokes, and discussing science during an exam week study break they hosted for students.

Students at the Six Mile Charter Academy in Naples, Florida, first creating posters and then voting for the poster that best shows fascinating plant concepts.

A Virtual Celebration

ASPB's Mary Williams tweeted with #FoPD and posted on Facebook for 12 hours on May 18. "Plant Biology Teaching Resources for Higher Education," the Scoop.it blog Mary curates, features the outcome (http://bit.ly/1AvSH8X). Searching Twitter for #FoPD (http://bit.ly/1HyaBVB) revealed some interesting insights, especially from the Global Plant Council.

Peggy Lemaux and Barbara Alonso of Berkeley, California, offer educators worldwide use of the new "It's All in the Touch!" plant biology learning activities for middle school students (http://ucbiotech.org/allinthetouch/). Logo created by Lemaux and Alonso.

As national coordinator for Fascination of Plants Day (http://blog.aspb.org/fascination-of-plants-day/), ASPB hosted four contests each with a cash prize. Congratulations to the winners!

Petunia Cultivar Naming Contest

Laurie Marx of Lotusland public garden in Santa Barbara, California, submitted the winning name for RevolutionBio's (http://bit.ly/1J90DOt) new color-changing *Petunia hybrida* (a.k.a. *Petunia atkinsiana*) cultivar. It is *Petunia hybrida* "Oz."

Laurie shared,

The horse of a different color from The Wizard of Oz *amazed me as a child when it changed from black and white to color. This petunia is equally amazing.*

As far as my fascination with all plants, I think it began with a love of the colorful bulbs that bloomed in spring after cold Cleveland winters. As an adult, I learned to love to garden from my husband, whose family always kept large flower and vegetable gardens. Now I am fortunate enough to work at one of the most beautiful gardens in the world, Ganna Walska Lotusland. I have become increasingly fascinated with succulents as our drought in California continues, and Lotusland's Aloe Garden has become a favorite of mine. I am inspired on a daily basis by the variety of spectacular plants on display here and cannot think of a lovelier place to spend my days.

For more details, see www.lotusland.org.

Laurie Marx

Leeann Thornton

Winning T-shirt design.

Fashion Statement for Fascinating Plants: Design a T-Shirt

Leeann Thornton of the College of New Jersey explained,

The design depicts the forget-me-not flower, which is small and often overlooked. It is a symbol of the diversity of plants in nature. There is also a rice stalk to represent human uses of plants for food. Together, the two plants help me remember to appreciate the natural abundance of plants and the delicate relationship between humans and plants.

Per contest rules, Leeann used a slogan from the FoPD U.S. media kit. However, this slogan belongs to another organization, so to produce the T-shirts for sale, we will use a new slogan Leeann coined, "Forget-me-not, grains of life."

Leeann shared,

I appreciate that ASPB is getting more people involved in celebrating plants. I really enjoy working with the local schools each May to get kids thinking about plants. It has been fun to introduce new and easy plant activities to some of the teachers.

Fascinating Plant Photos: Give Us Your Best Shot!

Science

The inner workings of plant biology and the people who make it happen.

- Marcia Harrison-Pitaniello of Marshall University, "Autofluorescence in the Purple Passion Plant, Gynura 'Purple Passion'"
- The UV-absorbing chemicals in the trichomes and epidermal cells fluoresce blue, and the purple pigment in the trichomes fluoresces pink. Also, note the autofluorescence in the small red-fluorescing chloroplasts, especially noticeable in the stomata cells of the leaf epidermis. The image was taken with a confocal fluorescence microscope. Marcia not only entered the contest; she also hosted an event. She reported,

Providing a Fascination of Plants display for a local event was great fun! The kids especially loved looking through microscopes. Everyone went home with a basil plant, too.

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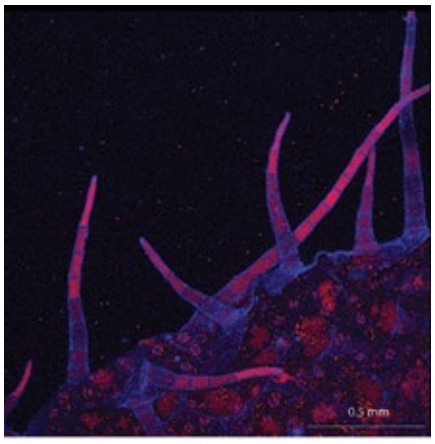
Science

Marcia Harrison-Pitaniello



Autofluorescence in the Purple Passion Plant, Gynura "Purple Passion."

FUN FORAYS INTO FLORA
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Agriculture

Fields, orchards, farming, planting.

- Jason Wallace of Cornell University, "Maize Silks at Flowering Time, with High Anthocyanin Content"
- We normally don't think of corn (maize) when we think of attractive flowers, but varieties like this one that produce anthocyanins (colored compounds) in their silks can be quite striking. Each kernel on the ear produces its own silk, which serves as its connection to the outside world—most importantly, the pollen that has to land on it to start fertilization and kernel development. Jason explained,

  We work with very diverse corn, and since I'm a visual person, I started taking photos of the most interesting ones I saw. I use them in talks to keep things interesting, and the bright magenta in this photo is a good eye grabber. The most challenging thing about taking field photos is that you never have a clean background: there's always more plants or rocks or other things that clutter the photo up and make it hard to focus on the central subject. I'm just glad for digital cameras, since otherwise I'd probably spend a fortune in film.

Nature

Forests, fields, mountains, riparian…as long as plants are the star.

- Lena Struwe of Rutgers University, "Legume Tree Leaf"
- Lena reported,

  The photo was taken during a trip to the Dominican Republic when we explored a collabora-

Maize silks at flowering time, with high anthocyanin content.

Agriculture
Jason Wallace

Legume tree leaf.

Nature
Lena Struwe

Night bloomer.

Gardens
Xinzhi Ni

tion focusing on medicinal plants. The collaboration never happened in the end, but we work on a global scale through our network called GlBEX (Global Institute of BioExploration, led by Dr. Ilya Raskin). I am heavily involved in outreach and teaching, and digital media plays a large role in that.

Lena will explore some of her award-winning teaching strategies in upcoming issues of the *ASPB News* and on our blog, *Plant Science Today.*

Gardens

Flowers, vegetables, landscaping, urban oases.

- Xinzhi Ni of USDA-ARS, "Night Bloomer"
- The photograph is a flower of *Epiphyllum oxypetalum* (de Candolle) Haworth (1829), which belongs to family Cactaceae. The common name is either Dutchman's pipe or night-blooming cereus. The plant blooms only overnight and flowers last about 10 hours. Xinzhi conveyed,

  I deeply appreciate this opportunity to teach unique facts about plants and learn more from others in the contest.

Plant Products

Things humans derive from plants.

- Julia Cavicchi of Skidmore College, "Timber Mill Mosaic"
- Julia noted,

  The photo was taken during a Natural Resources Careers Conference. Sustainable management of plants was a common theme throughout the week. The key idea was that each situation requires a unique approach, and each person brings a unique perspective on the human–nature relationship.

Fascinating Plant Films—Create a YouTube Video

Educational

- Alan Harvey of Georgia Southern University, *Avoiding Inbreeding the Jessamine Way* (http://bit.ly/1FinnqI)
- This video explains how and why some species of plants have two kinds of flowers that differ in stamen and pistil length, illustrated with the native plant Carolina jessamine. Alan's insights on creating and using educational videos can be found on page 29 of this issue.

General

- Ginseng Research Lab at Kyung Hee University, South Korea, *Plant Science for a Better World* (http://bit.ly/1JWOlJV)
- Team representative Yu-Jin Kim noted,

  This video introduces our team members and what motivates us as we do research work in the field and lab. We are happy to work in plant science, and we want to share this excitement with others. We were very pleased to participate in this contest. It reminded us to consider the important roles we play in plant science, society, and the world. We hope our small steps will take us far beyond anything we can imagine. ■

Educational

Alan Harvey

General

Ginseng Research Lab team members (from left to right) Johan Sukweenahdi, Jeniffer Silva, Shadi Rahimi, Yu-Jin Kim, Kwanghoon Seo, and Davaajargal Myagmarjav

Plant Products

Julia Cavicchi

Timber mill mosaic.

The American Society of Plant Biologists invites members to join the 2015–2016 PlantingScience Master Plant Science Team

The Master Plant Science Team is designed to provide compensation for a cohort of 12 graduate students and postdocs who make a substantial contribution as an online scientist mentor. To support their extra efforts, there are extra benefits and support systems.

Members of the Master Plant Science Team receive

- free membership to ASPB for the year commitment
- 50% off meeting registration
- PlantingScience T-shirt

Joining the Team involves

- participating in online mentorship training
- mentoring ~4 student teams via the web during **BOTH** fall and spring sessions (each session lasts ~2 months)
- posting to student web pages ~3 times per week
- providing extra support and facilitating communication for one classroom teacher and his or her teams

Participating as a mentor with PlantingScience has been a tremendously valuable experience! I feel like I have an opportunity to communicate my life's passion as a scientist and researcher to students in a medium that makes such communication possible like no other resource I have seen.

How could any scientist not want to do this? Learning from the students and understanding how they approach scientific topics and the scientific method help me communicate my research to a more general audience. Simply put, PlantingScience makes me a better researcher and teacher.
-Former Master Plant Science Team

One year as a member of the Master Plant Science Team has the potential to positively affect the rest of your professional life and inspire lifelong appreciation for plant science in young learners.

Apply at www.plantingscience.org

Please apply by **August 21, 2015.** For details contact the PlantingScience team: psteam@plantingscience.org.

ASPB membership is not required. Please pass this information on to others who might be interested.

Dancing with Plants

Uma Nagendra Wins *Science* "Dance Your PhD"

BY KATIE ENGEN
ASPB Education Coordinator

Plant biologist Uma Nagendra (University of Georgia, Athens) was one of 12 finalists in *Science*'s seventh annual "Dance Your PhD" contest for the best choreographed interpretation of scientific research. Uma's award-winning production, "Plant–Soil Feedbacks After Severe Tornado Damage," combined her passions for plant biology and aerial dance.

Uma's entry won both the Biology category and the overall Grand Champion, beating out the top entries in the Physics, Chemistry, and Social Science categories. The full announcement is in *Science* magazine (http://bit.ly/1zrOPTY) and also on Vimeo (http://bit.ly/1IJdDvA) with Uma's (written) introduction.

ASPB Director of Publications Nancy Winchester got a chance to meet Uma and view her dance video during the April 2015 HighWire Press meeting in Palo Alto. Nancy told Uma, "I'll remember the images and 'story' for the rest of my life. The dance did a great job showing what happens to plants and the soil after a devastating event like a tornado."

I caught up with Uma to find out a bit more about how she distilled her body of work into a visual and kinesthetic medium while creating a main message for viewers to appreciate.

Uma Nagendra. Photo by Tobin Russell Photography.

Aerial dancers from Canopy Studios.

How would you describe the "Dance Your PhD" program in a two- to three-sentence elevator speech?

The "Dance Your PhD" contest is an international challenge for scientists to take their research out of the lab and onto the stage (although, heck, the "stage" can be anywhere, including the lab!), all for the purpose of spreading the joy of scientific inquiry. Anyone with or working toward a PhD in a scientific field can enter a short video of a dance that explains their dissertation research. Entries come from the Biology, Physics, Chemistry, and Social Science fields—and dances can be in any style or tradition.

How did you learn of it, and what attracted you to entering?

This was my first entry, although I had heard about it a while ago, before I was in the PhD program at the University of Georgia. I'm very interested in art–science collaborations in general. Through elementary and high school, I was very much immersed in arts-based education, more so than science—I discovered my passion for plant science in college. Both are a huge part of my life, and I welcome the opportunity to combine them. I personally think I've benefited greatly from having some background in both areas. I love to dance; it's one of the things I do to relax and unwind as a graduate student. The opportunity to combine dance and science was immediately appealing.

How did you select the video participants?

I'm very lucky to be part of a wonderful aerial dance community at Canopy Studio, where I take trapeze classes. Basically, I mentioned the project to my instructors and classmates, and a lot of people were immediately excited to jump on board and try it out! The trapeze artists in the video are myself and my classmates, most of whom have about two years' experience with dance trapeze. The soil organism dancers mostly consist of fellow graduate students, plus a few other friends from around town. Everyone seemed to welcome the opportunity to get out of the lab and roll around on the floor. I guess it's not often you get a

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DANCING WITH PLANTS
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chance to "unleash your inner nematode" (that's what I said in my Facebook call for dancers).

What took the lead in the choreography? Was it the genre's or dancers' upper limits, a scientific concept, or a balance?

The overall structure of the dance was driven mainly by a scientific concept, the Janzen–Connell hypothesis in intact forest and predictions about how it might be altered after a disturbance. The specific choreography was a function of the dancers' physical limits and comfort and my dance vocabulary, certainly. When I first started putting it together, I started by trying to mimic the movement of a seedling growing. I imagined the bar as the line between above- and belowground and tried to find ways to slowly move higher and higher in the air while allowing for plant "roots" to interact with the soil organism dancers.

What were the benefits to you and the other dancers of doing this project?

I was actually surprised by the effect this project had on myself, as a researcher, and on the other dancers involved. The process of translating a scientific concept into the language of dance really forced me to distill the message and think critically about the most important, salient points. Each of the captions that show up on the bottom of the screen was rewritten several times, just to make them more clear and concise. I chose which words, and where to place them, extremely carefully.

I heard from my fellow dancers that the act of physically dancing allowed them to really embody the scientific concept and that muscle memory helped them remember and understand the idea much better. This experience made me want to know more about the possibility of integrating the arts into science education, both to present material and to have students engage with and apply the material.

Graduate students and a few of Uma's friends dance as soil organisms.

Translating scientific concepts to the language of dance takes careful choreography and practice.

What would you do differently, if anything?

I would probably try to make the dance less tiring! I made the choreography before I was completely set on the music, and it ended up being rather fast.

Although the experience of presenting my own research through dance was very rewarding, I am looking forward to using dance to illustrate broader scientific concepts. I love my research, but it asks one very specific question (as dissertations tend to do). There are many other topics and concepts that would be more immediately relevant to a public audience—and in some cases urgently needed. Applying a "dance transformation" to climate change, vaccines, genetic engineering, invasive species, or water conservation could be a very valuable endeavor.

What do you advise future PhD dancers to do or consider?

I definitely recommend the "Dance Your PhD" contest! Regardless of what happens with your video, the process itself is valuable, and you end up with a great way to introduce your research ideas to friends, family, and others.

My general advice is to start early, get organized, and have fun! I was surprised by how much of my work as choreographer/director involved managing people and scheduling. Particularly if you are working with a somewhat large crew, the more organized you can be, the easier it will be on everyone. Try not to give yourself too many roles. It's pretty hard to act as a director and give people comments and directions while you're also dancing, as I found out.

Who would you love to know has seen the video (such as a specific person or type of audience)?

Other than this wide ASPB readership, I would love to know whether leaders in temporal changes to plant–soil feedback studies have seen the video. ■

Planet Forward: 2015 Feeding the Planet Summit

Food + Innovation = #FoodFWD

BY KATIE ENGEN
ASPB Education Coordinator

Organized by Planet Forward* at George Washington University in Washington, D.C., the 2015 Feeding the Planet Summit (April 23–24) offered concrete and clever options for mixing media, agricultural expertise, and scientific thinking to help foster sustainable solutions for feeding 9.6 billion people by 2050. See http://bit.ly/1KdqnI2 for event highlights.

The summit aspired to be a significant event for catalyzing connections on food issues among decision makers, young people, journalists (i.e., "storytellers"), and the general public. And apparently the event was significant; by noon on April 23, it had made 6.5 million impressions on Twitter and was trending in Washington, D.C.

Summit participants included students from several universities and colleges, food industry leaders, conventional and biotech-oriented farmers, communications experts, and representatives from federal agencies and a variety of nongovernmental organizations (NGOs). Everyone was unified by a drive to build on current successes and catalyze next-generation programs for sustainably eliminating hunger and malnutrition.

Meeting infographics (http://bit.ly/1OXt4nH) created in real time by an artist feature key input and interactions from all participants. Topics included how research science, diversity breakthroughs, cross-cutting innovation, storytelling, and even parody can synergize varied avenues of expertise to end hunger.

Agency and industry leaders spoke passionately to the audience and via interactive panels or short interview series about resources and goals they hoped the next generation would advance effectively. The following comments were salient:

- "We feed people." —Krysta Harden, USDA deputy secretary of agriculture, relaying her father's quote on why farmers' devotion to agriculture of all kinds is meaningful
- "Hunger is a political issue. We know how to solve hunger. Do we have the will?" —Rep. Jim McGovern (D-MA)

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*Planet Forward is part of the Center for Innovative Media at George Washington University's School of Media and Public Affairs. The program identifies, celebrates, and unifies innovators and established policy makers, academicians, the private sector, and the general public. Frank Sesno is director of this creatively staffed program.

2015 Plant BLOOME Winners

Plant Biology Learning Objectives, Outreach Materials, and Education Grants

BY KATIE ENGEN
ASPB Education Coordinator

ASPB funds members as they create innovative instructional resources via an education and outreach grant program called Plant BLOOME (http://bloome.aspb.org), which stands for Plant Biology Learning Objectives, Outreach Materials, and Education. Established in 2004 (under a different name), Plant BLOOME incentivizes ASPB members to create programs that advance knowledge of and appreciation for plant biology. Successful projects enrich K–16 students' and the general public's understanding of

- the importance of plants for the sustainable production of medicine, food, fibers, and fuels
- the critical role plants play in sustaining functional ecosystems in changing environments
- the latest developments in plant biotechnologies, including genetic modifications of crops
- the contributions and discoveries from plants that improve human health and well-being
- the range of careers related to plant biology or available to plant biologists.

Congratulations to the 2015 ASPB Plant BLOOME grant recipients!

Connecting with Plant Science: Backyard Phenology Project

Lead PI: Oriana Chafe, Sierra Streams Institute
Coinvestigator: Joanne Hild, Sierra Streams Institute

Sierra Streams Institute (SSI) proposes to provide high school students with a curriculum that demonstrates the concept of global climate change through its observable impacts on the plant communities found in their schoolyard. The overall goal is to use plant phenology as a means to transform the issue of climate change from an abstraction to an observable reality for young people in order to produce a generation that is equipped to manage this global challenge.

With many years of experience in hands-on, standards-based science education and curriculum development, SSI will create a curriculum that illuminates coupled systems between plants and climate; develops students' observation skills, particularly of local plants; and introduces them to the role of the citizen scientist in expanding global data collection efforts to shed light on long-term and worldwide trends. The curriculum will include lectures, fieldwork, data entry and analysis, nature journaling, and the creation of field guides to local plants, providing peer-to-peer learning opportunities as students share their discoveries.

Oriana Chafe

The primary evaluation will follow a pilot implementation of the curriculum in two local high school classes located 20 miles apart at contrasting elevations and ecosystems. Students in the pilot program will respond to pre- and postproject surveys designed using best available practices in environmental education. Participating teachers will be surveyed regarding project implementation, and the curriculum will be modified as necessary in response to the outcome of the evaluation.

The project will result in a curriculum guide, nature journals, and a field guide that will be disseminated through established communication networks of the applicant and partners, as well as through presentations and articles submitted to recognized environmental education conferences and publications and through outreach to local media. Copies of the field guide will be made available to hikers along a local trail.

On learning that she had received the award, Oriana stated, "We are excited to create a platform for teaching accessible plant biology and climate change curriculum by bringing phenology into the classroom. Through the botanical lens, students will have the opportunity to study and share their observations of shifting ecological interactions. We thank ASPB for their support of our project and advancement of plant science education."

Plant Biology Exhibit Development in a Service Learning Plant Physiology Course

Lead PI: Marcia Harrison-Pitaniello, Marshall University

The primary educational goal of this program is to broaden access to plant biology information through museum-type exhibits developed by students in a service learning plant physiology course. Quality plant science exhibits are not generally accessible to

> Grass is the forgiveness of nature—her constant benediction. Its tenacious fibers hold the earth in its place…. Should its harvest fail for a single year, famine would depopulate the world."
>
> **—John James Ingalls, 1872**

Marcia Harrison-Pitaniello

Gloria Muday

the Huntington community and southern West Virginia.

The Clay Center for the Arts and Sciences is 50 miles from Huntington, and other science museums are over 100 miles away in Kentucky and Ohio. In addition, these museums offer little plant biology content. The proposed exhibit will be developed for a general public audience but also will include educational materials (e.g., videos, activities, games) that can be disseminated online. The proposed exhibit development through a service learning course will provide unique professional development training for Marshall University biology students. The project objectives are to

- develop interactive exhibits to educate and stimulate public interest in plant biology
- offer a service learning plant physiology course that will develop the materials for each exhibit in collaboration with a local organization
- display each exhibit at local venues annually and establish other venues in West Virginia
- broaden dissemination of exhibit content using Internet resources, presentations, and publications.

The PI's range of experience in fulfilling these objectives includes

- developing educational resources for a plant physiology course
- presenting materials at community events, on YouTube, for the PlantED Digital Library (http://planted.botany.org/), and at conferences
- working as part of the West Virginia State Leadership Team for the Development of Next Generation of Science Standards
- piloting preliminary project components at a community event for the May 18, 2015, Fascination of Plants Day.

A new website (http://bit.ly/1eLjEeM) with video to accompany the display is available already. New material will be added to this site as it becomes available.

Marcia shared this about her Plant BLOOME experience: "I found that the process of applying for the BLOOME grant helped me rethink my outreach approach for plant biology. I focused on connecting more with the local community while still working on Internet resources for dissemination. Physically making a prototype plant biology display and participating in a local event allowed me to think through what needs to be done to make high-quality displays that plant physiology students can routinely use for outreach projects."

Purple Tomatoes, Genetically Modified Organisms, and Food in a Changing Climate

Lead PI: Gloria Muday, Wake Forest University
Coinvestigators: Carole Gibson and Hanya E. Chrispeels

Tomatoes are an excellent model system for teaching concepts of genetics because of their vast diversity in traits such as color, size, shape, and flavor; their familiarity as a food; and their importance as an agricultural species. For the past five years, the Muday team has successfully implemented a service learning program (SLP) that teaches genetics using heirloom tomatoes in an active-learning curriculum. This SLP trains undergraduate students enrolled in a non–science major introductory biology course in the SLP curriculum and takes them to middle and high school classrooms to lead younger students through the curriculum.

Although this curriculum has been effective in teaching undergraduates genetics and biotechnology, which has been documented through publications, the assessments have demonstrated that this curriculum is not leading the students to make connections to real-world issues that build on plant genetics. So the team will retain this effective model of undergraduates teaching more than 1,300 local students each year but plans to update the curriculum to help students better see how plant genetics is pertinent to their world. Specifically, the project will

- connect the curriculum to the increasing need for drought-tolerant crop plants
- tie the curriculum to current research in the Muday lab by using mutants altered in anthocyanin content and root architecture, which include those that overproduce these healthy antioxidants and appear a striking shade of purple
- explain the technology of genetically modified organisms (GMOs) and traditional plant breeding so students

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PLANT BLOOM
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can make informed decisions about this technology

- use the 5E instructional model (engage, explore, explain, elaborate [or extend], evaluate) as a pedagogical basis for the curriculum.

With these changes, the team predicts that students will realize the same learning gains seen with the previous curriculum but will have an increased understanding of the relevance of plant genetics to solving real-world problems, an important goal for educating students to be scientifically literate and to appreciate the importance of plant biology. The initial project website (http://bit.ly/1LWRqbm) features the outcomes achieved with prior funding.

Gloria explained, "With prior support from ASPB, we developed an exercise that teaches plant genetics to Wake Forest University students, who learn through teaching local middle and high school students. The middle and high school students benefit from participation in this case study exercise, in which they learn genetic principles through mutant and heirloom tomatoes that are memorable examples. The support of a Plant BLOOME grant will allow us to expand this curriculum from Mendelian genetics to molecular genetics as we teach students about how changes in climate affect plant growth and development and about the potential of plant biotechnology to improve plants to deal with the resulting environmental stress. In today's society, GMO crops receive much criticism, and it is important to teach both secondary and university students how these crops are made and their potential to positively impact agriculture so that the students can make informed decisions about this technology."


Eva Strand

Creating a Field Guide for Grasses and Grasslike Plants of Idaho

Lead PI: Eva Strand, University of Idaho
Coinvestigators: Karen Launchbaugh and graduate student Justin J. Trujillo

This project will create a user-friendly field guide, with accompanying K–12 lesson plans, for identifying Idaho grasses and grasslike plants, intended for K–16 educators and students, ranchers, landowners, recreationists, and nature enthusiasts in Idaho and adjacent states. In the form of both a printed book and an offline app for iPhones and Androids, the guide will include colorful images showing detailed characteristics and vegetative features of each grass, an easy-to-use dichotomous key, and information on each plant's history, forage value, fire resistance, and other details.

The team will select, locate, and photograph 60 individual grasses, compile information about each plant, design a user-friendly identification key for people with a limited background in botany, and develop K–12 lesson plans. Working with an app developer, they will create an offline app identical in content to the field guide. This dual resource will meet the needs of land managers making economic decisions regarding livestock production and field treatments; university students in wildlife and range sciences conducting class exercises and field research; K–12 educators conducting field botany excursions, teaching the use of dichotomous keys, and teaching ecosystem studies; and recreationists engaged in nature study.

Both book and app will be distributed via the University of Idaho Rangeland Center and the Idaho Rangeland Resource Commission. The guide will be promoted in each center's website and newsletters, as well as to extension offices, 4-H groups, local media, and school districts.

To evaluate the guide's functionality, guidebooks will include addressed, postage-paid survey postcards, and the app will provide a link to a Qualtrics online survey. Selected individuals from each intended user group will be interviewed before, during, and after using the field guide to gather feedback for use in improving subsequent editions. Lesson plans will be tested and evaluated by teaching staff at the McCall Outdoor Science School.

Eva stated, "Our group of plant enthusiasts at the University of Idaho Rangeland Center was thrilled to discover the funding opportunity provided by ASPB and Plant BLOOME to promote public awareness of the role of plants. We had been looking for a while to find a way to spread the word about the importance of grasses and grasslike plants for rangeland ecosystems in Idaho and across the globe. Funding from ASPB and Plant BLOOME catalyzes a project that integrates and leverages efforts by the University of Idaho Rangeland Center, the Idaho Rangeland Resource Commission, and the McCall Outdoor Science School focusing on K–12 education, teacher training, and graduate work at the University of Idaho. Long term, the field guide and app will be distributed by the University of Idaho Rangeland Center, a group of scientists, educators, and practitioners working to advance the ecology and economy of western rangelands."

Eva's team will create and maintain a web page directly related to the development of the *Field Guide to Grasses and Grasslike Plants of Idaho*. This project page will reside on the University of Idaho Rangeland Center website (http://bit.ly/1LWSmN3). ■

Videos in the Classroom: More than Moving Pictures

Insights for Producing Educational Videos

ALAN HARVEY
Georgia Southern University

I started producing educational videos when the Georgia Southern University department of biology moved into our new Biological Sciences building in 2013. One of the striking features of this building is the 65-square-foot Christie MicroTile display in the main lobby. This spectacular digital display uses vivid colors, high-resolution visuals, and high-bandwidth video—along with a considerable amount of biologically relevant material—to maintain the attention of biology students. As a photographer who also uses video as a standard research tool, I somewhat naively volunteered to take on the responsibility of providing this content for the Christie MicroTile display. This has become one of the biggest, and most gratifying, challenges in my career. I've learned that the great power of video lies in its ability to bring a story to life and that good videos are stories, not factual snippets, not lectures. This emphasis on storytelling makes video production profoundly different from photography.

Planning

As a photographer, I can grab my gear, head out somewhere, and just be alert to any interesting photographic opportunities I happen to encounter. Video requires much more planning. I did not use my video field time effectively until I realized that I need to know what stories I have in the pipeline and to have a script (or at least an outline) of the story, a shot list, and specific times and places for getting those shots. This is not to say that there's no place for spontaneity in video; I try to be a video opportunist in the field, which has given me excellent inspiration and some great clips, but I can't see how one could reliably construct a coherent video story that way.

Collaboration

In contrast to the largely solitary nature of photography, video is inherently collaborative. This will seem obvious to anyone who has had the opportunity to work with experienced film crews, which minimally require coordination among the producer, director, director of photography, sound guy, editor, and talent. But collaboration is fundamental even for an SPC (single-person crew) like me.

Interviewing students and professors is a surprisingly invasive and intrusive process, and a successful interview demands collaboration between you, your subject, and your environment. Collaboration, or at least cooperation, is just as important for field shots of animals and even plants. For example, I was repeatedly thwarted in the simple task of filming bees visiting Gelsemium flowers by uncooperative weather that for weeks was either too cold or too windy for the bees. Even under excellent conditions, I couldn't get a close-up shot of a bee visiting a flower until one chose, out of all the thousands of flowers on a single Gelsemium plant, the one flower on which my camera was trained!

Katy Banderet, a Georgia Southern University graduate student, at the Christie MicroTile display.

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Time

Telling a story through video is a surprisingly time-consuming process, especially for an SPC. Even for a three-minute video, preproduction and production activities such as conducting background research, preparing scripts and shot lists, scheduling, and shooting video can take as much time as designing and running a series of experiments. Likewise, postproduction editing of audio and video are as time intensive as writing and illustrating a manuscript. It's time well spent; a well-planned video can have positive impacts for years to come.

Not Just Motion

By definition, motion is what sets video apart from photography, but good video treats this distinction as a mere starting point. Pans, zooms, and transitions allow you to imbue still photographs in videos with a sense of movement. Wind can be your friend when filming plants, giving action to an otherwise inert subject. However, shaky cameras impart the wrong kind of motion to video, so a sturdy tripod is essential. Surprisingly, the quality of a video depends less on the quality of its visuals than on the quality of its audio (whether environmental, voiced over, or music). Fortunately, you don't need to bankrupt yourself to get quality audio. I recorded the narration for the Gelsemium video (http://bit.ly/1FPfoUr) in my walk-in closet using a shotgun mic connected to my iPhone. There are several online sites where you can get top-notch music and sounds at no charge.

I show these videos in our lobby and also in particular classes (e.g., I use the Gelsemium video in various classes to discuss coevolution, modes of pollination, and our local flora). Perhaps more importantly, however, these videos consistently manage to reach out to intrigue, inspire, and educate passing students of biology. In the coming year, though, I plan to involve students directly in the most important aspect of educational filmmaking: how to tell a compelling story.

Audio Options

I haven't done an exhaustive survey of the Creative Commons options out there, but these have worked well for me:

- incompetech by Kevin MacLeod (http://incompetech.com/wordpress/)
- Audionautix by Jason Shaw (http://audionautix.com/)
- Bensound (http://www.bensound.com/)
- FMA (http://freemusicarchive.org/)
- FreeSound: nonmusical sounds (e.g., traffic, static, flowing water, rain) (https://www.freesound.org/)

Check out Alan's winning entry for the education category of the 2015 Fascination of Plants Day video contest on page 21 of this issue. ■

PLANET FORWARD
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- "Yes, we need transformative approaches…*-omics,* nanotech, new ideas. Just pick a niche and do it well." —Sonny Ramaswamy, USDA director, National Institute of Food and Agriculture
- "It takes all forms of agriculture…and they must be smart and sustainable for their location." —Julie Borlaug, associate director for external relations, Borlaug Institute
- "We need to replace the concept of 'not this' with the attitude of 'this AND this' to unite conventional and technical farming." —Chris Policinski, Land o' Lakes president and CEO

Young leaders were integral to the event. Winners of the student competition StoryFest were announced at the summit. Some of their stories about dynamic food solutions are at http://bit.ly/1F44RYq. Also, some winners of the Global Food Challenge (http://bit.ly/1uHeL8i) shared clever and diverse projects. One winner, Mandi Egeland, explained with her video on genetically modified organisms (GMOs), *Driving Acceptance of GMOs to Feed the World,* "If we are going to rely on GMOs as part of the solution to feed the world, …we must reduce the fear associated with GMOs to increase their use around the world."

New and newly energized stakeholders in the fight to end hunger are quite serious about taking action now. As a result, there are internships available—both formal and informal—for creative and skilled (or at least motivated) sustainability innovators interested in feeding the planet and willing to work on Planet Forward goals. Anyone in higher education is encouraged to contact these speakers, each of whom is eager to work with new talent (yes, you really can e-mail them):

- Krysta Harden, USDA deputy secretary of agriculture (Krysta.Harden@usda.gov)
- Sonny Ramaswamy, USDA director, National Institute of Food and Agriculture (@usda_nifa; sonny@nifa.usda.gov)
- Aviram Rozin, international director, Sadhana Forest (@SadhanaForest; sadhanaforest@gmail.com)
- Congressman Jim McGovern, #endhungernow campaign (@RepMcGovern; http://mcgovern.house.gov/contact/email-me)
- Volunteer learning experiences with the NGO-oriented Andean Alliance (@AndeanAlliance; e-mail via http://alianzaandina.org/)

Campus action is important for a future in which people are fed sustainably. Planet Forward works with universities across the country to trade ideas and unify innovators, especially students, through campus consortia. Preview the Consortium Resources (http://bit.ly/1JoDAh6). To learn about setting up a campus feature with Planet Forward, contact them at the link above. ■

What Do Fairies and Elves Need to Know About Plant Science?

Sex, Maize, and how to Feed the World (despite herbicide tolerance) at Balticon 49

BY BURKHARD SCHULZ
University of Maryland, College Park

Established in 1967, Balticon is the annual convention sponsored by the Baltimore Science Fiction Society (http://www.balticon.org/). This year, Balticon 49 was held May 22–25 in Baltimore, Maryland. The event offered everything surrounding science fiction, including comic books, movies, kids' programs, the presentation of the prestigious Robert A. Heinlein and Compton Crook Awards, and also lots and lots of real science. The science fiction fans, science-interested participants, and (presumably costumed) elves, fairies, and comic book heroes at Balticon had plenty to keep them engaged on many levels.

The Balticon program includes many thematic tracks. One track celebrates science because science often catalyzes or reflects science fiction. So in tandem with lots of information about science, such as space shuttle flights, the moon landing, the Hubble telescope, and the number of universes counted, the program included many recent updates from scientific fields, including the population dynamics of blue crabs in the Chesapeake Bay, proton therapy to treat cancer, the biology of cloning, and the biology of allergies. And this year, ASPB brokered an invitation so I could offer two workshops dedicated to plant biology.

Burkhard Schulz

I spoke on a "field of dreams" close to many ASPB members' hearts during two interactive talks. In the first, "Sex, Maize, and How to Feed the World," I reported on recent findings from my research team in the plant science department at the University of Maryland on how sex determination decisions in maize (who becomes the male tassel, and who becomes the female ear?) are regulated by steroid hormones, which fulfill the same role of information molecules as during sex determination in animals and humans. The separation of sexes in maize, which provided the basis of the revolutionary hybrid seed technology and led to tremendous yield increases during the last century, generated lots of interest with the audience.

My second talk featured the currently more and more relevant topic of "Herbicide Resistance in Plants." I focused on the spread of herbicide resistance in weeds since the introduction of herbicide-tolerant crops and the high-level adoption of this technology in U.S. farming systems. The audience was interested in the recent multiple-herbicide-resistant weed epidemic, which has had a major impact on weed control and pest management approaches. We enjoyed good interactions over the why and how of novel integrated management strategies that do

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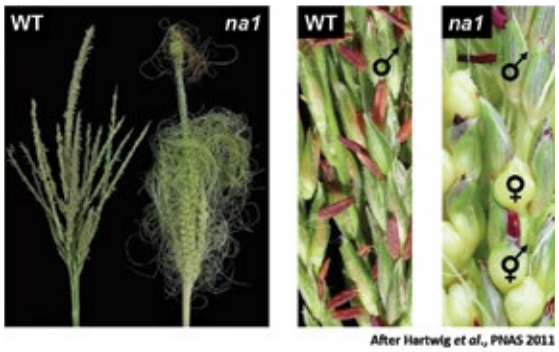
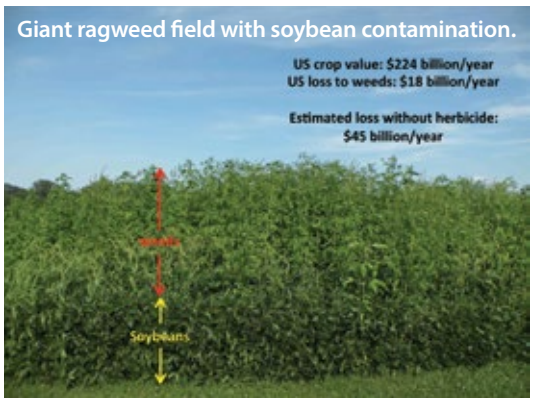
Science? So what?

Interestingly, a number of Balticon presentations dealt with the general fields of reliability of science and scientific information, ways to analyze the scientific merit of peer-reviewed scientific publications, the question "why science matters," and a historic overview of women of science.



Sample slide for "Sex, Maize, and How to Feed the World."



Sample slide for "Herbicide Resistance in Plants."

Undergraduate Science Education—Transforming the Campus

Evidence and Funding for Effective Undergraduate Life Science Learning

BY KATIE ENGEN
ASPB Education Coordinator

PULSE Community

Partnership for Undergraduate Life Science Education

The Partnership for Undergraduate Life Science Education certification process for undergraduate biology education in the 21st century is an ambitious endeavor designed to motivate important changes in life sciences education nationwide. This plan for motivation is aimed at campus administration and relies on the activation energy and teaching expertise of faculty involved as members of the growing Partnership for Undergraduate Life Science Education network (PULSE www.pulsecommunity.org).

More than 70 life science departments applied to be part of the pilot certification project, funded by an NSF grant, and several were selected based on initial evidence of transformed and innovative educational practices, including Gaston College, Whatcom Community College, Davidson College, Stony Brook University, Georgia Southern University, University of Wyoming, and Morgan State University. These programs represent a variety of two-year colleges, liberal arts institutions, regional comprehensive colleges, research universities, and minority-serving institutions. The departments used the Vision & Change Rubrics developed by a PULSE Certification Team and released by them in a letter to the editor in *CBE Life Sciences Education* (http://bit.ly/1FlZgX9). More information about the experience on different campuses and the ongoing alignment with the Vision & Change initiative are detailed in *PULSE Progression Levels Announced!* (http://bit.ly/1RFaoHc).

hhmi Howard Hughes Medical Institute

Howard Hughes Medical Institute

The Howard Hughes Medical Institute (HHMI) Inclusive Excellence competition will award $60 million to colleges and universities interested in increasing their capacity to effectively engage all students in science throughout their undergraduate years, especially those who come to college via nontraditional pathways. The new competition is open to U.S. colleges and universities that award the baccalaureate degree in the natural sciences and are fully accredited, not-for-profit, four-year institutions. It does exclude the 40 universities already awarded 2014 HHMI grants.

Announced May 12, the first winners will be named in May 2017. As announced June 1 in ASPB social media, the Intent to Apply deadline was July 14, 2015. Preproposals are due December 1, 2015. Complete details are available at the competition's web page (http://bit.ly/1I53TsW). ■

FAIRIES AND ELVES
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not exclusively rely on chemical weed control. Participants at this session were very well informed, with interesting (not polarizing) questions.

It is good that ASPB supports events like this in order to reach a wide variety of audiences. Overall, the audience reaction to the presentation of plant topics was very positive. Cutting-edge plant science research can sometimes sound like science fiction, so representing just what plant scientists do to address societal and global challenges—which, of course, present themselves to us in everyday life—was an excellent fit for this crowd. The fairies, elves, comic heroes, and just plain humans at my Balticon workshops truly were intrigued by plant science. As one participant stated, "Plants are so cool!" Nothing else needs to be added to this point. ■

Fun Freebies

- Participants at both workshops eagerly accepted a free DVD of the short film *Popped Secret: The Mysterious Origin of Corn* (http://bit.ly/1FEQ01l), created and donated by the Howard Hughes Medical Institute's BioInteractive.
- ASPB's *My Life as a Plant* activity and coloring book (www.aspb.org/coloringbook) flew out the door in the hands of USDA representatives, educators from all walks, and science-savvy families; it seemed to suit everyone's playful nature.
- The 12 Principles of Plant Biology bookmarks (http://bit.ly/1AXYtAz) were also quick to be picked up by all comers.

Remembering Ian Sussex

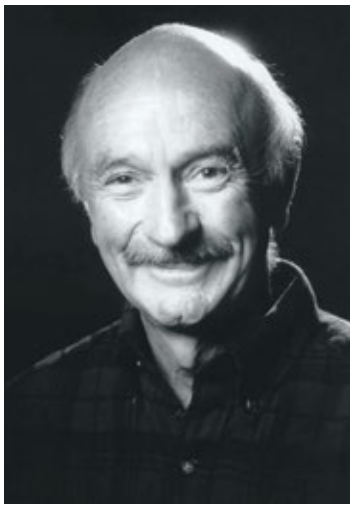
1927–2015

BY SHARON LONG and VIRGINIA WALBOT
Stanford University

Ian Mitchell Sussex passed away in New Haven, Connecticut, on May 10, 2015. He was the preeminent plant developmental biologist of his generation and a deep scholar of all of developmental biology as a discipline. In his long career, Ian was a driving force through his research, his books, his mentoring, and his work to make animal biologists aware of plant development.

Born in New Zealand in May 1927, Ian received his undergraduate education at the University of Auckland and then moved to the University of Manchester, England, for PhD studies with C. W. Wardlaw, professor of cryptogamic botany. Ian related that Professor Wardlaw told him, "First, go to the lab and do experiments for a semester. Then go to the library and read what others have done." This may account in part for Ian's own mentoring style, granting independence and flexibility to his students to encourage creativity and depth of inquiry. It likewise may explain his emphasis on a simple and clear experimental style and interpretation, unconstrained by the prevailing hypotheses.

Following graduate school, Ian worked with Georges Morel in Versailles and carried out a postdoctoral fellowship with Ralph Wetmore at Harvard. Working with cryptogams (an old-fashioned term that refers to "plants" that reproduce without



Ian Sussex

flowers or seeds, which in the 1950s included mosses, ferns, and the fungi) and angiosperms, he defined cell interactions in apical meristems. He carried out experimental manipulations to define how cells communicate in normal growth and during restoration of meristem function.

Many of his experiments used simple tools but required great insight and exceptional dexterity—for example, inserting slivers of glass to cordon off a shoot apex from initiating leaves, resulting in radial organ symmetry and the insight that the primordia and apex communicate. Ian carried out the original definitive studies on cellular organization and morphology during leaf primordium development. He loved working with his hands and continued to produce solo papers through his career.

Ian's first academic appointment was at Victoria University in New Zealand; he then became a faculty member at the University of Pittsburgh. In 1960, Ian joined the faculty in the biology department at Yale University. He and his wife, Nancy Kerk, moved to the University of California, Berkeley, in 1990, and Ian taught and worked there until he retired in 1997. He returned to Yale, where he held the post of senior research scientist. There, he continued to be active in teaching and seminars for another 18 years.

Science from the Sussex Group

Ian attracted and encouraged students and postdoctoral fellows who shared his enthusiasm for designing simple experiments that could yield definitive distinctions between competing models of how nature works. With his students, Ian continued the study of meristems and began a long engagement with experimental embryology and other methods to study cell fate. These studies demonstrated the effect of sucrose and other environmental inputs on developmental decisions in leaf culture. Ian's interest in organogenesis and determination of developmental fate led him and his group to experiments on plant embryo development. These included analyses on protein and RNA synthesis in developing and germinating embryonic axes and important early work on embryo-lethal mutants in *Arabidopsis thaliana*.

To study developmental decisions, Ian and his students used organ transplants and periclinal chimeras. They showed that cell lineage is the major factor defining leaf organization and that the leaf margins are almost completely inactive after the leaf reaches one-tenth of its final size. These findings overturned a previously held view of how leaves develop. Other work showed that the size and floral organ set for the flower are determined not by the outer two (L1, L2) layers of the shoot meristem, but by the inner (L3) layer.

At an age when many faculty settle into retirement, Ian continued expanding and extending his interests and his reach. Using the new genetic and molecular tools that became available in the 1980s and 1990s, Ian joined with students and colleagues to study homeotic flowering development genes and to define the way that apical cells establish sectors in the shoot. He participated in an early use of laser-capture microdissection in plant tissues and worked on establishing biochemical and molecular parameters for novel plant genes.

Teacher, Mentor, and Author

Ian's research influence has extended far beyond his own lab efforts through his clear and el-

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IAN SUSSEX
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egant writing. In textbooks such as *Patterns in Plant Development* (coauthored with Taylor Steeves) and in review articles, his mastery of the developmental biology literature was used to illustrate and consolidate material for new generations of researchers. A benefit from his broad interests and long experience was his ability to identify patterns; he was able to connect what appeared to be diverse events. That did not result in neglect of details: anyone who worked or talked with him will tell you that he could pull up from memory almost any detail about plant development in systems from Selaginella to orchids, and most plants in between!

His amazing ability to visualize in 3-D astonished generations of students—he could mentally reconstruct tissue organization and branching patterns from quick glances at boxes of slides containing serial sections of a root or a shoot. He was remarkable for his superb intuition about how living systems work. He was always looking for experiments that were not just doable but centrally important: many of his trainees cite this as one of his most enduring and important lessons.

The special Sussex magic in teaching by example, critiquing without being critical, and valuing each person's unique perspective and talents permitted diverse individuals to work together and teach each other through conversation, careful reading of scientific papers, and real debate about the interpretation of results. Although each person conducted distinctive, personal projects while in the Sussex lab and the group later pursued diverse careers, they traced many aspects of their scientific acumen to Ian's lessons and to the group impact on their logical and analytical thinking. Former students still treasure the individual conversations they had with their adviser as a method for testing and refining ideas, and all awaited his insightful edits of written work—not delivered quickly, but always with great care to preserve each student's core ideas while clarifying the logic, grammar, and presentation. The speaking and writing styles of Sussex lab alumni were polished by Ian's emphasis on simple,

Lessons I Learned from Ian Sussex

BY MARY WILLIAMS
Feature Editor, *The Plant Cell*


Ian Sussex

Ian Sussex was an important figure in my life and in the world of plant science, and I want to share three important lessons I learned from him.

"Animals respond behaviorally; plants respond developmentally."

For me, coming from a background in which plants were often considered green yeast, the biggest lesson I learned from Ian was that plants have a different ethos. They've been doing things their own way for millions of years, and it's hard to understand them without first shedding our animal biases. Ian's encyclopedic knowledge and powerful intellect gave him an unparalleled intuition about plants. As he described to me and in his autobiographical sketch published in 1998 in *Annual Reviews of Plant Biology,* his curiosity about plants stemmed from his childhood and the freedom he had to wander and explore in his mother's garden and beyond: "I was born and grew up in a semirural suburb of Auckland.…We had access to pastures, salt marshes, mud flats, beaches, and native bush. It was easy in this environment to develop an interest in plants." One of the biggest challenges in teaching plant science is to help students who grow up without such easy access to the natural world to find their plant curiosity and develop their plant intuition.

"Don't ask what experiment you can do; ask what experiment you should do, and then find a way to do it."

Ian was a phenomenally good teacher, and my enthusiasm for teaching is a direct consequence of the time I spent working with him. Walking back to the lab after a seminar, he'd ask the group what we thought the next experiment ought to be. Our replies tended to focus on what the speaker *could* do next, whereas Ian was able to see what they *should* do next. A lot of Ian's research success came about because he found ways to answer important questions, even when this meant inventing a new approach. We praise and reward students for figuring out what *could* be done, but it's important to also ask them what *should* be done, even if at the time it seems impossible (and this applies to life as well as science!).

"Does this say exactly what you want it to say in the best way possible?"

Ian enjoyed writing and was able to bring clarity to complex ideas. I'll never forget the moment I learned how this clarity came about. I'd written a draft of a postdoctoral grant proposal and arranged to revise it with him. I sat down beside him at his desk, and he read aloud the first sentence. He then turned to me and said, "Does this say exactly what you want it to say in the best way you can possibly say it?" Indeed, we went through the entire proposal, line by line and word by word, asking this question—the best lesson in how to write I've ever had.

effective communication and his patient encouragement during innumerable drafts and practice sessions.

In his work as author (e.g., the textbook *Interacting Systems in Development,* with James Ebert) and as scientific citizen (e.g., president of the Society for Developmental Biology), Ian also worked to teach plant development to wider communities. His ability to elucidate patterns was a key factor in his success. The inclusion of plant biology in broader developmental biology meetings, although still slim, was begun in earnest due to Ian's efforts. Ian's educational legacy also includes his role as one of the founders of the Cold Spring Harbor Laboratory plant course and his shared authorship of *Molecular Biology of Plants: A Laboratory Course Manual* based on the Cold Spring Harbor series. Until past the age of 85, he was still teaching and presenting review lectures at conferences.

A Strong and Original Spirit

Photos of Ian give a hint of the twinkle in his eye. He smiled and laughed easily. If you talked with him about your research, he would listen, frequently nodding his head, saying "Yeah, right . . . yeah . . ." in his wonderful New Zealand accent as he took in all the details. He was a realist about the world and about the vagaries of academic science, but he was also positive and always forward looking. It was an inspiration to be around him.

He loved the outdoors, especially sailing, and was an excellent athlete. One day he mentioned to his students that on the previous evening, he thought it might be nice to try jogging, so he had put on a pair of his boating shoes and went running—for 10 miles. He grew enthusiastic and built up his long distance running to become a competitor in marathons, qualifying for and running in the Boston Marathon for the first time in 1981 at the age of 53. Diagnosed with cancer while in his 60s, Ian found treatments and pushed on. He was tired and more frail in the past few years, but the twinkling eye and the bright, interested mind were still very lively.

Ian running in the Boston Marathon for the first time at the age of 53.

Ian leaves behind his wife and colleague, Nancy Kerk, and a large community of students, postdocs, and colleagues both close and distant. For his inspiration, lifelong guidance to those who sought his opinions, and gift of freedom to become an independent thinker, all of his trainees are forever grateful and will strive to guide the next generation in that tradition. And whenever we try to think of the best and most important experiments, we will hear a voice saying, "Yeah, right . . . yeah." ■

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