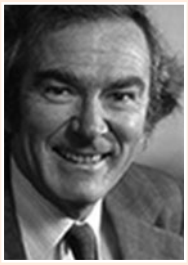
September/October 2015 • Volume 42, Number 5

p. 10
Highlights from Plant Biology 2015
Bringing together plant biologists and science communicators

p. 15
Joe Ecker Elected to American Academy of Arts and Sciences



p. 26
Obituary
Lloyd T. Evans
1927–2015

ASPB News

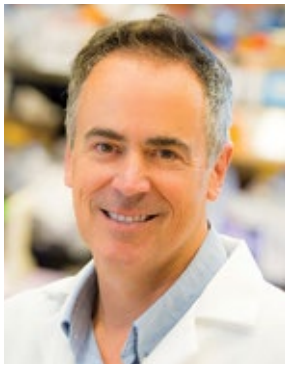
THE NEWSLETTER OF THE AMERICAN SOCIETY OF PLANT BIOLOGISTS

President's Letter

What's Cooking

JULIAN SCHROEDER
University of California, San Diego

We plant biologists live in exciting times, in terms of both scientific advances and the relevance of our collective research. Your professional organization, ASPB, is working hard to ensure that we all can stay productive and effective in our endeavors. Having returned home from Plant Biology 2015 in Minneapolis, and as my year as president of ASPB draws to a close, I consider this a good time to reflect on some of the efforts and initiatives we have been working on this past year.



Julian Schroeder

First off, this year's Plant Biology 2015 meeting was another stimulating gathering of plant scientists, and my thanks goes to ASPB staff, led by Jean Rosenberg and ASPB's Program Committee, for creating a compelling scientific program and a very well organized event. By the way, many thanks to those attendees who offered their feedback via our annual postmeeting survey; your input is valuable and is used by the Program Committee to further improve our annual meeting (and feel free to contact me, incoming Program Committee Chair Alice Harmon, or ASPB if you have suggestions that were not posted).

In addition, over the past 6 months, ASPB has launched a new Meeting & Event Solutions unit (http://meetings.aspb.org/) to serve the needs of plant scientists. This new resource provides tailored meetings services, such as registration and abstract submission or full-service conference and event management, and can help you reduce the cost in money and certainly in time of a meeting you wish to organize, whether large or small. ASPB is already working on support for several meetings through this new service.

Plantae Is Coming!

Over the past year, ASPB has continued to work hard on Plantae, a major initiative that will provide many new opportunities to ASPB

continued on page 4

Rick Dixon Assumes Presidency October 1

Rick Dixon

Rick Dixon is ASPB's new president. He succeeds Julian Schroeder, University of California, San Diego. The Society's new president-elect is Sally Mackenzie, University of Nebraska–Lincoln.

continued on page 6

Contents

1 President's Letter

1 Rick Dixon Assumes Presidency October 1

3 Sally Mackenzie Elected to Lead ASPB in 2016–2017

5 Maureen McCann Elected to Executive Committee

7 Plant Science Research Network Officially Launches

9 New Edition of Biochemistry & Molecular Biology of Plants Launched in August!

Plant Biology 2015

10 Highlights From Plant Biology 2015

11 "Standing Up for Science" Workshop

People

15 Joseph R. Ecker Elected to American Academy of Arts and Sciences

15 Our 2015 ASPB/AAAS Mass Media Fellow Reports Back From a Summer of Science Journalism

Luminaries

17 Sudhir Kumar Sopory

Science Policy

19 Policy Update

Education Forum

21 Plantae @ Plant Biology 2015

22 Plant Biology 2015: Education Workshop

23 PB15 Education and Outreach Minisymposium

25 Outreach and Education Posters

Obituary

26 Lloyd T. Evans

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.

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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).

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Sally Mackenzie Elected to Lead ASPB in 2016–2017

Sally A. Mackenzie is the Ralph and Alice Raikes Professor of Plant Science at the University of Nebraska–Lincoln (UNL), and from 1999 to 2010 she was founding director of the Center for Plant Science Innovation at UNL. Before that, Sally served on the faculty from assistant to full professor at Purdue University, which she joined in 1988.

A native Californian, Sally's family was involved in fresh market vegetable agriculture, and she gained an interest in agricultural innovation from this experience. Sally earned her bachelor's degree in botany from the University of California, Davis, and she received her PhD training from the University of Florida in Gainesville, where she worked with Mark Bassett in plant breeding and Daryl Pring in plant molecular biology. From 1988 to 2003, research in Sally's lab focused on plant mitochondrial genome recombination behavior, in particular investigations of the dynamic process of substoichiometric shifting and its nuclear control. Under natural conditions, mitochondrial DNA recombination confers the ability of the plant to transition between male sterility and fertility, an important component of facultative gynodioecious plant species. These studies have lent insight into the inherent instability of cytoplasmic male sterility systems for agriculture, as well as the evolution of mitochondrial genome structural diversity and DNA sequence stability among plant lineages.

Sally Mackenzie

In studies of nuclear–organellar interactions, several nuclear-encoded organellar proteins are shown to co-localize to mitochondria and chloroplasts. Studies of dual targeting protein behavior in Sally's lab have demonstrated the role of alternative translation initiation in facilitating the regulation of dual targeting proteins. During studies of organelle behavior, Sally's lab cloned the *MSH1* gene and demonstrated its involvement in mitochondrial and plastid genome stability. Recent and more detailed studies have shown that disruption of *MSH1* in plastids also results in epigenetic, heritable, and programmed changes in plant development.

These observations represent the first and most direct indication of linkage between organellar signaling and epigenetic response in plants. These studies suggest that organelle-triggered epigenomic changes may participate in plant environmental sensing and transgenerational response. Incorporation of *MSH1*-modified crop lines into a plant breeding strategy have produced measureable enhancements in both crop productivity and abiotic stress tolerance. The *MSH1* effect has, therefore, opened the door to epigenetic plant breeding as a novel non-GMO agricultural strategy, influencing plant growth potential with the possibility of significant agricultural benefit in both perennial and annual crops.

Sally was appointed a Quishi Chair Professor at Zhejiang University in Hangzhou, China, in 2012. She was elected fellow of AAAS in 2004 and fellow of ASPB in 2013. She served on the ASPB Executive Committee as chair of the Publications Committee from 2007 to 2014, and she has been a member of the Science Policy Committee since 2009. She participated with others in development of the recently released ASPB-sponsored document *Unleashing a Decade of Innovation in Plant Science: A Vision for 2015–2025*, also referred to as the Decadal Vision. The document was designed to inform U.S. policy makers about national priority research objectives in the plant sciences as a means of encouraging support for U.S. plant science research. The document underscores the value and immense potential contribution of fundamental plant science research to addressing the food security issues facing the United States as we confront climate change. As a follow-up to release of the Decadal Vision, Sally is participating with others in the development of a National Plant Science Council (NPSC) that will seek to heighten national visibility of plant science research, inform the public about issues related to crop production and modern plant improvement technologies, and enhance the alignment among various entities within the plant science community so that they are able to speak with one voice to policy makers. Sally is strongly committed to these goals and currently serves as chair of the NPSC as it launches these new efforts. The immediate goals of this council will be to identify ways to unify a community vision and draw greater attention to the outstanding achievements of plant science research in the United States in order to convince Congress of the significant long-term negative implications of recent funding reductions. ■

PRESIDENT'S LETTER
continued from page 1

members and plant scientists around the globe. Plantae is our new interactive digital platform that will be launched in beta this fall. This platform will be the central place where plant science students, professionals, small groups, and large organizations can come together in groups of their own choice and share resources, apps, and tools. It will provide a secure home for groups and other collaborative communities to gather, share, communicate, and participate. (Private groups and communications will be shielded from data mining and targeted advertising, in contrast to many other media.)

A large directory of plant science students and professionals, including more than 30,000 plant biology–linked individuals, has been developed for and will be available through Plantae. Plantae will include a jobs board, job listings, mentors and online resume reviews, and a collection of career guides, templates, and related resources. Plantae will provide centralized access to teaching resources, including those developed through ASPB's Plant Biology Learning Objectives, Outreach Materials, & Education (Plant BLOOME) grants. Plantae will also provide a means to develop and launch crowdsourced projects.

ASPB plans to build further resources on top of the foundational platform. To that end, your own Plantae initiatives, ideas, and suggestions are welcome and will help shape Plantae's future.

ASPB's Governance Model Updated

Following an initiative from last year, ASPB's Executive Committee proposed changes to the Society's constitution to implement a restructuring of the Executive Committee into two collaborative bodies: a larger council and a board of directors. ASPB posted descriptions of the governance change and received suggestions from members before this past spring's election. ASPB members voted by overwhelming majority to approve this restructuring of ASPB's governance.

In brief, this new structure was developed to be more nimble and forward-looking; it will allow more frequent meetings and discussions than the present twice-annual Executive Committee meetings. ASPB's work and impact are increasingly international, and the larger council will be tasked to take a long-term view, developing ASPB's strategic plan with input from many ASPB members. The board of directors will be made up mostly of colleagues who have been directly elected by the membership and will make operational decisions in support of the council's priorities.

Moreover, board members are also members of the council, ensuring effective communication and close collaboration. Furthermore, because ASPB's work is more and more international, the board will have at least one elected representative from outside the United States. The new governance structure is designed to more effectively serve the community's needs by rapidly working on new initiatives and responding in an informed manner to issues that arise in today's faster paced world.

Research Funding

ASPB pursues concerted efforts to support the needs of plant scientists on various initiatives and fronts. We have in the past 10 months more proactively communicated with funding agencies on the needs and opportunities provided by the plant science community, and we also have received helpful feedback from those agencies on how we can better support federal funding for plant science research. We have developed a new plan for reaching out to our elected representatives and communicating the relevance of plant science funding, a plan that is being implemented by ASPB's Science Policy Committee and that you are invited to contribute to.

In addition, ASPB President-elect Sally Mackenzie and David Stern at the Boyce Thompson Institute for Plant Research (BTI) have continued work in support of the Plant Science Decadal Vision (http://tinyurl.com/p9dapxv). The Decadal Vision, which covers the years 2015 to 2025, was developed to empower plant scientists across many societies and fields of research to speak with a unified voice. The Decadal Vision continues to play an important role in informing our elected representatives of the value and pressing importance of innovation in the plant sciences. In follow-on work, the BTI with ASPB as a collaborator has been awarded a research coordination network grant from NSF to strengthen the impact of the Decadal Vision and ensure that progress is made on the priorities it articulates (http://tinyurl.com/q7n37lq).

Genome Editing

The past few years have seen a dramatic improvement in genome editing technologies. Panels are being convened by the Office of Science and Technology Policy of President Obama and by the National Research Council in reference to the impact of these new technologies. We have proactively nominated expert plant scientists in this field to serve on these new panels. Looking back in time, when the Asilomar Conference on Recombinant DNA took place 40 years ago to review newly emerging recombinant DNA technologies (http://tinyurl.com/qzor7hq), no plant scientists were invited. Some will argue that the plant community would have been much better served and much confusion avoided if plant scientists had been invited. ASPB is working to ensure that plants are properly considered in the wake of recent technological advances in genome editing.

Journals

On January 1, 2015, Sabeeha Merchant came on board as the new editor-in-chief of ASPB's flagship journal, *The Plant Cell*. Sabeeha and her editorial team have already instituted a number of welcome and important innovations, some of which were highlighted in my May/June 2015 President's Letter "Time to PhD—Time to Publish" (http://tinyurl.com/p3zrj3z).

In addition, after many discussions and thorough review, ASPB's Executive Committee and Publications Committee voted at Plant Biology 2015 to establish a new open-access journal for the plant sciences that will help serve the growing needs of plant scientists for rapid publication of diverse scientific advances. As part of ASPB's work for global participation and cooperation, ASPB developed a vision for this new journal together with

the Society for Experimental Biology (SEB) in England, and the societies are working to establish the new journal as a joint endeavor and a search for a founding editor is being initiated. Moreover, *The Plant Cell* and *Plant Physiology* have this year joined *Nature, Science,* and *PNAS* to permit authors to make manuscripts publicly accessible any time before publication on preprint servers, including bioRxiv (http://biorxiv.org/) at Cold Spring Harbor Laboratory, thereby providing early access to scientific advances for the community.

In Closing

ASPB has pursued numerous other key activities in the past year, some of which have been highlighted in my previous President's Letters (http://newsletter.aspb.org/presletter.cfm), as well as in recent issues of the *ASPB News* and elsewhere in this issue. In closing, I would like most of all to express my thanks to the tireless ASPB staff, ASPB's Executive Director Crispin Taylor, and the many ASPB members involved in making these and many other advances possible over the past year. It is an honor to serve the Society, and I look forward to seeing you all next year at Plant Biology 2016 in Austin, Texas—also known as "The Live Music Capital." ☺

Maureen McCann Elected to Executive Committee

Maureen McCann is a professor of biological sciences at Purdue University and director of Purdue's Energy Center. She obtained her undergraduate degree in natural sciences from the University of Cambridge, United Kingdom, in 1987, and then a PhD in botany at the John Innes Centre, Norwich, United Kingdom. She stayed at the John Innes Centre for a post-doctoral appointment, partly funded by Unilever, and then as a project leader with her own group from 1995, funded by The Royal Society. In January 2003, she moved to Purdue University as an associate professor. She is also the director of the Center for direct Catalytic Conversion of Biomass to Biofuels (C3Bio), an interdisciplinary team of biologists, chemists, and chemical engineers in an Energy Frontier Research Center funded by the U.S. Department of Energy's Office of Science.

Maureen McCann

The goal of Maureen's research is to understand how the molecular machinery of the plant cell wall is constructed and modified during cell growth and differentiation, and how it may be deconstructed and used as a source of partially reduced carbon for liquid hydrocarbon fuels and high-value chemicals. A frontier in bioenergy research is to develop technologies that maximize the energy and carbon efficiencies of biofuel production by the rational and synergistic design of both thermal and chemical conversion processes and the biomass itself. She aims to tailor biomass for its end use using transgenic and synthetic biology approaches.

Maureen served as a monitoring editor for *Plant Physiology* between 2008 and 2012 and on ASPB's Public Affairs/Science Policy Committee between 2010 and 2014. She believes strongly that ASPB should build on its role as a trusted source of information for advising policy and decision makers and educating the public with regard to the importance of plant sciences for global food and energy security. By gaining wide support from a range of constituencies, ASPB can advocate to boost the research investments that underpin the support of young scientists in our labs, a pipeline of talent critical for a sustainable future. ■

RICK DIXON
continued from page 1

Rick is distinguished research professor in the Department of Biological Sciences at the University of North Texas, Denton (UNT). He was previously founding director of the Plant Biology Division at the Samuel Roberts Noble Foundation, Ardmore, Oklahoma, where he worked from 1988 to 2013.

He was born in South Africa of British parents and moved to the United Kingdom at the early age of 3 months. Rick grew up in the UK and pursued his bachelor's and PhD degrees in biochemistry and botany, respectively, at the University of Oxford; did postdoctoral work in plant biochemistry with Derek Bendall at the University of Cambridge; and spent nine years as lecturer and then reader in plant biochemistry at the Royal Holloway College, University of London. During his Oxford days he established a collaboration with Chris Lamb, with whom he copublished, between 1978 and 2004, more than 100 papers and review articles documenting the molecular basis of plant defense responses, including the roles of hydrogen peroxide and nitric oxide as signal molecules.

Rick's early research led to an understanding of the biosynthesis of plant phenylpropanoid natural products at the enzymatic level. Rick developed an elicitor-induced cell suspension culture system for studying the biosynthesis of isoflavonoid defense compounds and, with Chris Lamb, applied the new tools of molecular biology to show that elicitor-mediated defense responses in plants involve transcriptional coactivation of suites of genes encoding biosynthetic enzymes.

Rick's lab went on to pioneer the molecular identification of enzymes of the phenylpropanoid biosynthetic pathways, and this work has formed the basis for his subsequent studies on metabolic pathway engineering. Breakthroughs identified key enzymes dedicated to the formation of isoflavonoids and condensed tannins.

Shortly after moving to Oklahoma in 1988 to establish the Plant Biology Division at the Noble Foundation, Rick turned his research focus to alfalfa. A series of transgenic alfalfa plants was generated in which the lignin pathway was downregulated at each known step. This resource revealed the relationships between forage quality (digestibility) and lignin content and also provided material for breeding programs with an industrial partner that have resulted in deregulation, for commercial release in 2016, of low-lignin alfalfa with improved forage quality.

In parallel, Rick's lab took a leadership role in demonstrating the feasibility of designing improved lignocellulosic biomass sources for production of liquid biofuels, applying the lignin technology to the bioenergy crop switchgrass. In addition to these applied studies, Rick's group has recently discovered transcription factors facilitating ectopic secondary cell wall formation in pith tissues, allowing for biomass densification, and demonstrated genetically the critical role of laccases in lignin polymerization.

Since moving to UNT in February 2013, Rick is continuing to maintain a similar balance of fundamental and applied science. His recent publications reporting the discovery of novel linear lignin polymers in plant seed coats should facilitate exploitation of lignins for production of bio-based products.

Rick has been a member of ASPB since 1988 and has served on the ASPB Publications Committee. He was awarded the doctor of science degree for his research achievements by Oxford University in 2004. He has published more than 450 papers, and he has been named by the Institute for Scientific Information as one of the 10 most cited authors in the plant and animal sciences. He is coeditor-in-chief of the journal *BioEnergy Research,* a member of the editorial boards of four other international journals, a member of several international scientific advisory boards, and recipient of many awards, including Oklahoma Scientist of the Year, the Groupe Polyphenols Scientific Prize, the Shang-Fa Yang Memorial Lectureship of Academia Sinica, and the Phytochemical Pioneer Award of the Phytochemical Society of North America. He is a fellow of the AAAS and was elected member of the U.S. National Academy of Sciences in 2007, and he serves on the National Research Council Board on Agriculture and Natural Resources. He holds 21 issued U.S. patents and was elected a fellow of the National Academy of Inventors in 2014.

Rick is a strong advocate for maintaining funding for basic science. As a scientist who has worked with industry to develop commercial products, he understands that science has its greatest impact when people can focus on what they do best. In this respect, he is a firm believer in strong interactions between basic and applied scientists for projects that have applied drivers. At the same time, he believes that today's plant scientists must have a broader understanding across the continuum from basic to applied science than they had when he entered the profession.

It has never been a more exciting time to work in the plant sciences, Rick noted, but it is certainly not an easy time. The membership of ASPB represents the brightest and the best in plant science, and he will support the organization in making the case to policy makers that the United States must remain at the forefront of innovation in basic and applied plant science. He also feels strongly about the need to better explain the benefits of biotechnology to an evermore skeptical consumer base and to update the regulatory system for biotech products so that it keeps pace with the remarkable advances in technology.

Finally, he is committed to the open exchange of ideas on these and other topics within the broad community represented by ASPB. "I think I am a good listener," Rick says, "and I am looking forward to active participation in this dialogue, both formally and informally." ■

Plant Science Research Network Officially Launches

BY NATALIE HENKHAUS
Boyce Thompson Institute and PSRN Executive Coordinator, ASPB

To harness the collective vision and broad expertise of the plant science research community, the Boyce Thompson Institute (BTI) and ASPB recently announced the formation of the Plant Science Research Network (PSRN). Founding members of the PSRN include ASPB, the Alliance of Crop, Soil and Environmental Science Societies (ACSESS), the American Phytopathological Society, the American Society for Horticultural Science, the Botanical Society of America, the Genetics Society of America (GSA), and the Council on Undergraduate Research.

NSF awarded BTI President David Stern and ASPB Executive Director Crispin Taylor $730,000 in support for five years to realize the full potential of plants through the advancement of research and education. The PSRN builds on the success of the Decadal Vision (http://bit.ly/1Fj1IC3) report, *Unleashing a Decade of Innovation in Plant Science: A Vision for 2015–2025*, the culmination of a multiyear effort to unite a broad spectrum of plant scientists around a scientific agenda. The Research Coordination Network award from NSF will provide support for new collaborations, especially related to the development of community-wide standards for exchanging data and metadata.

"The network represents a tremendous opportunity to bring the plant science community together to meet the food, fiber, fuel, and environmental needs of our future," said David Baltensperger, who represents ACSESS as a member of the PSRN Steering Committee.

Plant Science Research Network Focus Areas

- Discovering Plant Traits, Biological Meanings, and Exploiting Their Potential
- Improving Data Access and Analysis
- Reimagining Graduate Training
- Broadening Participation in the Plant Sciences
- Updating the Decadal Vision

Plant Science Research Network leaders David Stern (left) and Crispin Taylor at Plant Biology 2015 in Minneapolis.

Within the overarching goal of promoting innovative research and collaboration in the greater plant science community, the PSRN has two major goals: (1) to catalyze interdisciplinary training and research by encouraging and facilitating the exchange of information among its seven founding member societies, a number intended to grow, and (2) to use dedicated workshops to seek novel solutions to broadening participation and modernizing graduate and postdoctoral training in the plant sciences.

ASPB member Jim Birchler, a geneticist at the University of Missouri who represents GSA on the PSRN Steering Committee, noted, "As someone who works in both plant and non-plant systems, I see enormous potential not only to unite a diverse group of plant scientists, but to promote ways for the broader plant science community to benefit from closer interactions with colleagues working in other biological systems."

In an era in which population growth and environmental pressures require careful stewardship of natural resources, the PSRN will improve cross-talk among different stripes of experimental plant scientists, leading to exciting and empowering fundamental discoveries about the wonders of plants. Activities led by the PSRN will directly benefit member societies and associated plant scientists by ensuring that researchers are aware of each other's efforts, which will yield more opportunities for collaboration, especially on interdisciplinary projects that enrich the body of plant science knowledge. The network will promote a cohesive message from the plant science community and actively engage other organizations. The PSRN will also create recruitment and training opportunities for young scientists and broaden participation of underrepresented groups in the plant sciences.

"The PSRN is an ambitious effort to make it easy for plant scientists to acquire and deploy a range of experimental and soft skills. The diversity of plant science represented in the members is a tremendous strength, but also a challenge to developing a cohesive vision for research and training. Our hope is to accelerate the building of knowledge and careers that will be needed to meet our society's challenges," said Stern.

continued on page 9

ASPB/AAAS 2016 Mass Media Science & Engineering Fellows Program

Are you interested in science writing?

Do you want to help people understand complex scientific issues?

Apply for the ASPB/AAAS Mass Media Science & Engineering Fellows Program and learn how to increase public understanding of science and technology. Fellows in the 10-week 2016 summer program will work as reporters, researchers, and production assistants in mass media organizations nationwide. **Deadline: January 15, 2016.**

Visit **http://www.aaas.org/MassMedia** for more details and to download an application brochure, or call 202-326-6441 for more information.

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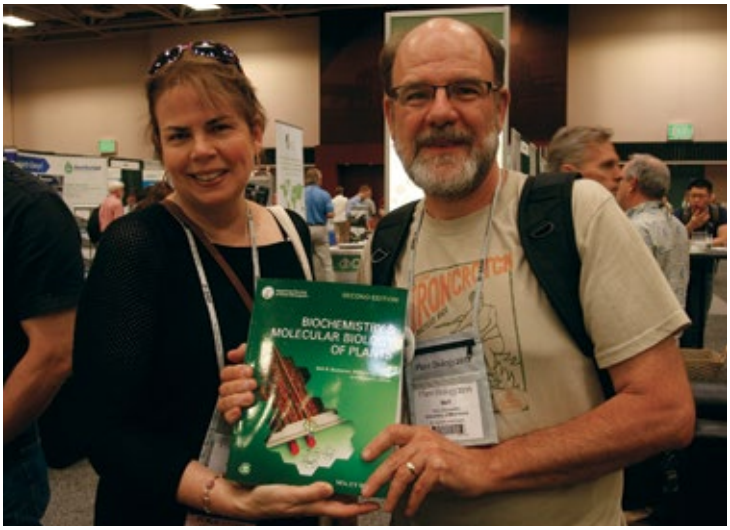
New Edition of *Biochemistry & Molecular Biology of Plants* Launched in August!

Since its publication in 2000, *Biochemistry & Molecular Biology of Plants,* edited by Bob Buchanan, Wilhelm Gruissem, and Russell Jones, has been hailed as a major contribution to the plant sciences literature, and critical acclaim has been matched by global sales success. The second edition, known as BMBP-2, launched in Minneapolis during Plant Biology 2015. Maintaining the scope and focus of the first edition, the second edition provides a major update, including new material and reorganized chapters to further improve the presentation.

Like the first edition, this new book is meticulously organized and richly illustrated, having over 1,000 full-color illustrations and 500 photographs. It is divided into five parts, covering Compartments, Cell Reproduction, Energy Flow, Metabolic and Developmental Integration, and Plant Environment and Agriculture. The second edition offers

- A complete revision, with more than half the chapters having a major rewrite
- Two new chapters on signal transduction and responses to pathogens
- A restructured section on cell reproduction for improved presentation
- A dedicated website to include all illustrative material.

Biochemistry & Molecular Biology of Plants holds a unique place in the plant sciences literature, providing the only comprehensive, authoritative, integrated single-volume book in this essential field of study. Said Bob, Willi, and Russell, "As editors, we are delighted that the second edition is now available and that the quality of the text and illustrations is, as in the first edition, superb."



Nancy Winchester (ASPB director of publications) and Neil Olszewski (ASPB Publications Committee chair) at the BMBP-2 launch party during Plant Biology 2015.

ASPB members are eligible for a 35% discount with the code ASPB at www.wiley.com. ■

PLANT SCIENCE RESEARCH
continued from page 7

The launch of Plantae.org, the new digital ecosystem for the global plant science community, will enable effective data management and sharing among PSRN members. Plantae will also facilitate connections among the members of multiple scientific societies, and it will be used to share information about meetings and events, job postings, educational programs, and opportunities for funding in the plant sciences.

For further information, contact PSRN Executive Coordinator Natalie Henkhaus (nhenkhaus@aspb.org).

The Plant Science Research Network receives funding from National Science Foundation award #IOS-1514765. ■

Highlights From Plant Biology 2015

BY NATALIE HENKHAUS
Boyce Thompson Institute and PSRN Executive Coordinator, ASPB

Arriving in Minneapolis, I was eagerly looking forward to Plant Biology 2015 (PB15). Instead of coming to the meeting with a poster describing my research, this year I found a spot nestled in the ASPB booth between ASPB Education Coordinator Katie Engen and the Society's Director of Digital Strategy and Member Services Susan Cato. I am a Cornell University–trained scientist and one of the newest members of the ASPB staff as the executive coordinator for a new NSF Research Coordination Network grant to the Boyce Thompson Institute (BTI) and ASPB.

ASPB meetings are always a place to reconnect with old friends and colleagues, to get feedback on one's research, and to hear about cutting-edge plant biology. In this article, I recap some of the highlights of PB15.

One of the first sessions of the meeting was "Rethinking Biotech Literacy and Communication," with presentations by Kevin M. Folta (University of Florida), Vance Crowe (Monsanto Corporation), J. J. Jones (Center for Food Integrity), and Anastasia Bodnar (USDA and Biology Fortified, Inc.). In this day and age, it is important for researchers to interact with the public, and the presenters encouraged ASPB members to get out and talk about plant science and its contribution to society. Kevin Folta's session on science communication stressed the importance of using social media, blogs, and one-on-one conversations to reclaim the science from those who contribute to the distribution and amplification of misinformation.

"Major Symposium I: Hormones in Plant Development," organized by Elliot Meyerowitz (California Institute of Technology), revealed how researchers Enrico Scarpella (University of Alberta), Ari Pekka Mähönen (University of Helsinki), and Ottoline Leyser (University of Cambridge) are able to manipulate the shape of plant leaves and veins by modifying the transport of cytokinins and auxin.

On the second day, "Major Symposium II: Interactions in the Rhizosphere and the Root Microbiome" was organized by BTI's Maria Harrison. Later that evening, Diane Okamuro from NSF led the workshop "Cultivating Broader Impact Programs" on how to develop successful training experiences for undergraduates. I was impressed by the successful collaboration between Ketia Shumaker (University of West Alabama) and Hardwood Genomics researchers at Pennsylvania State University. During this workshop, we learned that preparing students for an internship must go beyond teaching lab-based technique to include informational sessions with students and their support team about what they can expect from the experience.

My favorite session of the meeting was "Major Symposium III: Epigenetic Variation in Plants"; not coincidentally, my own dissertation focused on epigenetic variation in Arabidopsis. Joe Ecker opened the session by presenting work from his lab at the Salk Institute, which has sequenced 1,001 Arabidopsis genomes and abundant epigenetic variation. Mary Gehring (Massachusetts Institute of Technology) discussed how differentially methylated regions are used to predict genes that may be influenced by allele-specific imprinting. Nathan Springer (University of Minnesota) discussed genetic and epigenetic variation in maize and how this may contribute to phenotypic variation. Bob Schmitz (University of Georgia) has begun sequencing many nonmodel organisms and is encouraging plant scientists to submit samples from their favorite plant for high-throughput DNA methylation analysis.

(from left) Postdocs Daniela Floss (Boyce Thompson Institute), Sarit Weissmann (Donald Danforth Plant Science Center), and Natalie Henkhaus at the Plant Biology 2015 annual party, held at Orchestra Hall in Minneapolis.

Matt McKenna, a representative from the newly formed Foundation for Food and Agricultural Research (FFAR), provided an update of ongoing efforts to launch the foundation. FFAR will focus on funding projects related to improving plant efficiency, optimizing water usage, and transforming human health. This exciting new funding opportunity provides $200 million in federal matching funds for agricultural research.

"Minisymposium 27: Education" presented the work of ASPB Plant BLOOME fellow Marian Quain of the Crops

continued on page 14

"Standing Up for Science" Workshop Brings Together Plant Biologists and Science Communicators

BY REBECCA HARRISON
Cornell Alliance for Science

Following Plant Biology 2015 in Minneapolis, Sense About Science USA, the Cornell Alliance for Science, and the Boyce Thompson Institute for Plant Research (BTI) cosponsored a Voice of Young Science communication workshop on plant biotechnology, "Standing Up for Science Workshop: Plant Genetics & Biotechnology." The event, held on July 30, attracted about 20 young scientists from the United States and around the world.

"We have to remember history," Sense About Science USA Deputy Director Neda Afsarmanesh reminded the group. "The history of science puts scientists at odds sometimes. There's a historical reason for some of the distrust in science, and it's important to remember that." Science communication strategies are needed to help navigate this divide.

To discuss such strategies, workshop participants were treated to three interactive panel discussions, one featuring scientists, the second journalists, and the third a "nuts and bolts" group of scientists actively engaged with the public outside the laboratory.

University of California, Davis, plant biologist Doug Cook and University of Nebraska–Lincoln plant scientist and ASPB President-elect Sally Mackenzie addressed their experience as scientists interested in sharing their work in public forums. For Mackenzie, "The more scientists are willing and feel confident to give talks to the public" and "the more we [scientists] act as a community and start sharing our information," the more effective science communication will be. "People need to hear the argument more than once to shift their value system."

Cook pushed back, however, suggesting that "educating" the public about scientific facts will not make them believe the argument. "I don't try to give [naysayers] facts," Cook said. "I ask about values. They're not thinking about the science."

In Session 2, freelance journalist Emily Sohn and radio journalist Elizabeth Dunbar (Minnesota Public Radio) provided an inside look at what it takes to turn a scientist's work into a compelling narrative. Very rarely does the end product of a story mirror the scientists' expectations, but better understanding the role of a journalist can help ease the process. Sohn suggested not only attending communications workshops such as this one, but also using tools designed to train science journalists, such as the popular Science Writers' Handbook website (http://pitchpublishprosper.com/).

Finally, Session 3 featured a variety of scientist-communicators, including Natalie Henkhaus (BTI), Karl Haro von Mogel (Biology Fortified), and Eric Hamilton (Washington University in St. Louis and ASPB/AAAS Mass Media fellow). The panelists discussed the many ways—as Hamilton recognized—that journalism and science are inherently similar processes of asking questions, conducting background research, analyzing data, and telling a story.

What it comes down to, however, is what Haro von Mogel summarized best: "I love science. I love doing science. And I also love talking about science." ■

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*Rebecca Harrison is the social media lead of the Cornell Alliance for Science (*http://allianceforscience.cornell.edu*). The Alliance for Science, a global biotechnology communications initiative funded in 2014 by the Bill & Melinda Gates Foundation, uses new media and a campaign approach to build a global network to help move the conversation around agricultural technologies toward one that is evidence based. Follow them @ ScienceAlly.*

2015 ASPB award winners: (back row, from left) Keiko Torii, Joe Louis, Maria Harrison, Renate Scheibe, Kazuo Shinozaki, David Fischhoff, and Bob Goldberg; (front row, from left) Stan Roux, Wendy Boss, Cyril Zipfel, Caren Chang, Sherri Brown, Fred Perlak, and Daniel Chitwood, with ASPB President Julian Schroeder.

Minneapolis, Minnesota

HIGHLIGHTS FROM PB15
continued from page 10

Research Institute in Ghana, who introduced basic biology training techniques in her community with the goal of increasing education about biotechnology. Mark Lubkowitz, from Saint Michael's College in Vermont, also discussed his program, called Leaves of Green, in which high school students conducted science experiments on questions posed by local farmers. He followed these students' careers and found that a majority went on to college and pursued STEM-related fields. For educational professionals, a new journal called *CourseSource* is a free and open access resource for publishing teaching materials on how to run a successful workshop or teach a full course.

On the last day of the meeting, "Major Symposium V: ASPB President's Symposium: Global Water and Salinity in Plants" focused on how plants respond to abiotic stress with presentations by Rob Horsch (Bill & Melinda Gates Foundation), Jose Dinneny (Carnegie Institution for Science), Julia Bailey-Serres (University of California, Riverside), and Mike Nuccio (Syngenta Biotechnology).

Following this symposium was one last workshop, "Standing Up for Science Workshop: Plant Genetics & Biotechnology," co-organized by the Cornell Alliance for Science, Sense About Science USA, and BTI. ASPB President-elect Sally Mackenzie (University of Nebraska–Lincoln) and Doug Cook (University of California, Davis) had a lively discussion about the need for plant scientists to engage with the public and media. Two local journalists from the Twin Cities—freelancer Emily Sohn and Elizabeth Dunbar of Minnesota Public Radio—also spoke during the workshop about their experiences as science writers and gave advice on how to pitch a story. The workshop wrapped with a panel discussion with scientists who are currently working as science communicators, such as Karl Haro von Mogel (Biology Fortified) and Eric Hamilton (Washington University in St. Louis and ASPB/AAAS Mass Media fellow).

All in all, PB2015 was a great success, and I hope everyone is looking forward to Plant Biology 2016 in Austin, Texas! ■

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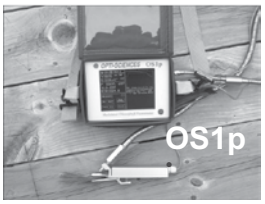

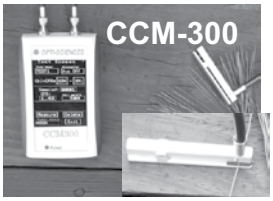

(Loriaux 2013, Loriaux 2006) - F_M' correction is necessary at high actinic light levels or errors as large as **22%** can occur in Y(II) or $\Delta F'/F_M'$, or Φ_{PSII} and errors as large as **41%** can occur in "*J* " or ETR in chlorophyll fluorescence.

(Cazzaniga 2013, Dal'Osta 2014) - Chloroplast migration replaces acute photoinhibition and state transitions as the source of intermeditate chlorophyll fluorescence change! Chloroplast migration only occurs under intense blue light or intense **white light** but not intense red light! It is responsible for up to **30% of non-photochemical quenching!**

(Gitelson 1999) - Absorbance style **chlorophyll content** meters work well at medium to low chlorophyll content levels. The correlation falls off above 400 mg^{-2} m^{-2}. Ratio - fluorescence style meters can be used up to 675 mg^{-2} m^{-2}.

Joseph R. Ecker Elected to American Academy of Arts and Sciences

Joe Ecker

Salk Institute professor and ASPB member Joseph R. Ecker has received the prestigious honor of being elected to the American Academy of Arts and Sciences class of 2015. One of the nation's most prominent honorary societies, the American Academy recognizes accomplished leaders from academia, business, public affairs, the humanities, and the arts.

Joe is a professor in the Salk Institute's Plant Biology Laboratory and one of the nation's leading authorities on the molecular biology and genetics of plants. Joe was a principal investigator in the multinational project that sequenced the genome of *Arabidopsis thaliana.* He is also widely regarded as one of the foremost experts on how the gaseous hormone ethylene regulates a variety of basic plant processes. For agriculture, ethylene gas is a vital chemical messenger important for such processes as fruit ripening and plant responses to pathogenic organisms.

Members of the 2015 class, of whom there are 197, include winners of the Nobel Prize; the Wolf Prize; the Pulitzer Prize; the National Medal of the Arts; MacArthur, Guggenheim, and Fulbright fellowships; and Grammy, Emmy, Oscar, and Tony Awards. The complete list of new members is located at https://www.amacad.org/members.

Since its founding in 1780, the American Academy has elected leading thinkers and doers from each generation, including George Washington and Benjamin Franklin in the 18th century, Daniel Webster and Ralph Waldo Emerson in the 19th, and Margaret Mead and Martin Luther King, Jr., in the 20th. The current membership includes more than 250 Nobel laureates and more than 60 Pulitzer Prize winners. ■

Our 2015 ASPB/AAAS Mass Media Fellow Reports Back From a Summer of Science Journalism

ASPB/AAAS Mass Media fellow Eric Hamilton.

Crunching through waist-high prairie grass, the scientist-turned-journalist scrawls chicken scratch in his notebook as the conservationists he is following keep their eyes peeled for an increasingly rare butterfly that they do not expect to find. The overcast sky and cool temperatures dampen the flights of butterflies. Still, the researchers march into the small patch of prairie between two country roads and scan the butterfly's preferred food source, black-eyed Susans. Ultimately, they simply bear witness to the mysterious decline of the Poweshiek skipperling—the butterfly is nowhere to be found today.

When I returned from this excursion with my notebook full of nearly illegible handwriting, I found that the writing came much easier than for most of my stories—I could describe the action and emotion and provide a sense of place to my readers better than I ever could by phone. That was the day I learned that getting out of the newsroom elevated my writing and my story instantly. It was just one of many lessons I learned during my 10-week

continued on page 16

ASPB/AAAS FELLOW
continued from page 15

stint as a science journalist at the Milwaukee *Journal Sentinel* (http://www.jsonline.com/) in Wisconsin, where I was assigned as the ASPB/AAAS Mass Media fellow (http://www.aaas.org/MassMedia) this summer.

I had applied for this fellowship because I realized after a time that more than *doing* science, I wanted to *talk* about it. I wanted to share with non scientists how integral science is to everyday life, and the familiar story of struggle and occasional success that scientists face in their work. After all, our mandate as scientists is not only to probe how the world works, but then to report back and tell others about what we've found.

Journalists and scientists even use the same language. *Reports* is the main section of *Science* magazine; reporting is what I did at the *Journal Sentinel*. Both professions peer into the world and then try to communicate what they know to be true.

Because I worked at a regional newspaper, every story I wrote had to have a local angle. Fortunately, Wisconsin universities produce a wide range of excellent research, and all sorts of local events have a science angle.

I wrote about how physics applies to baseball pitches, how light pollution spoils events like the Perseid meteor shower; how researchers are using eggs to try to replace livestock antibiotics; how scientists are trying to reduce carcinogenic chemicals in fried potatoes; what the pope has to say about climate change; and how a new laser surgery technique saved a man from disruptive seizures. In all, I wrote 25 stories on a wide range of topics, few of which relied directly on my training in plant science, or even biology. But my scientific background helped me decode papers from foreign disciplines and connect with scientists about not only their successes but their obstacles.

And I was only a five-and-a-half-hour drive from Plant Biology 2015 in Minneapolis, where I joined the "Standing Up for Science Workshop: Plant Genetics & Biotechnology" on communicating about science in the media (http://bit.ly/1fS8zbK). The panelists included science journalists, GMO advocates, and Sally Mackenzie, president-elect of ASPB. We talked about the challenge, and the importance, of ushering science through the mass media, where most non-scientists get their scientific information. One of the clear takeaways was how important training in communication is for scientists, whether they stay at the bench or leave it.

The ASPB/AAAS Mass Media Fellowship is one of many excellent programs that provide this needed training. But all graduate programs should ensure that their students graduate with the skills to speak not just to their peers, but also to the public that funds their work and benefits from it (http://1.usa.gov/1IAlF4l).

A number of scientists I spoke to for my articles—and several at the "Standing Up for Science" workshop—said they had been "burned" by bad journalism. They were wary about speaking with me. They often asked to see the draft before it was published to fix any errors (an awkward request; see below). These sources wanted to know more about me—who was I, anyway, and how could they trust me to get the science right? Usually when I explained that I was a scientist, too, they softened their tone. I think I could hear them relax a bit in their office chair over the phone. I might not be in their field at all, but the kinship we shared was enough to open them up anyway.

I think these are the moments that the Mass Media Fellowship is designed for. Communication is hard, and although most science journalists have no scientific background, they are professionals and usually do an excellent job. But there is also value in having scientists learn how to distill complex, technical information down into an understandable story.

(It's a journalistic sin to send out a draft before it is published, so the answer to "Can I read a draft?" is going to be "No." If you're afraid that errors will creep in, instead ask the reporter to call back and read you the lines that describe the science so you can work together to fix inaccuracies. You'll get a better reception. And remember, you're on the same team.)

My time in Milwaukee solidified my commitment to pursue science communication professionally, and greatly increased my interest in journalism specifically. That experience alone is invaluable, but with a 41-year-old network of accomplished alumni, the Mass Media Fellowship provides a lifelong support structure for scientists and communicators of all kinds. I am enormously grateful to ASPB for the support, to AAAS for organizing the program, and to the *Journal Sentinel* for letting me pursue my interests.

If you know a young scientist who is an excellent communicator and enjoys that challenge, please encourage them to apply for a fellowship (see the announcement on p. 8 of this issue). ■

Editor's Note: *Thomas Koetting, deputy managing editor/News and Enterprise, Milwaukee* Journal Sentinel, *sent ASPB the following comments about Eric and his 10 weeks at the* Journal Sentinel:

"In his application, Eric articulated that he sees science as a societal endeavor, from public funding to actual research to the applications of that research. For the process to work, he said, we need people who can translate the science—and science methods—in a way that the public can understand and embrace. That really caught my attention, because it describes what news organizations do with so many subjects—politics, education, crime, even sports—but struggle to do with science. It also interested me because the Journal Sentinel *continues to have staff writers with expertise in medicine, health, and the environment—subjects that many regional newspapers have abandoned. I thought Eric could benefit from exposure to our people and our processes and also bring an added dimension to our coverage.*

"His summer in Milwaukee was a runaway success. He covered a host of issues—from whooping cranes to acid whey, climate change to cosmic phenomena—and in each case not only explained the science for a general readership, but also pointed out the scientific underpinnings of topics that our readership might not connect to science at all. In one-on-one editing sessions, editors worked with him on language choices and narrative flow so we wouldn't lose readers along the way. He welcomed the feedback and got better and better with each week.

"We will truly miss him in our newsroom. His desk was in one of the most boisterous areas, and he seemed to enjoy the culture—and in return, was embraced fully."

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

Sudhir Kumar Sopory

Vice Chancellor, Jawaharlal Nehru University, New Delhi, India

BY PRATEEK TRIPATHI
ASPB Student Ambassador, Postdoctoral Fellow at University of Southern California, Los Angeles

What got you interested in plant biology in general, and what influences directed you to your specific area of research?

I think it was not by choice but by chance. When I was doing my bachelor's degree at Kashmir University, the college where I was studying started a new BSc(Hons) program in botany. I thought I should opt for this, and luckily I was admitted. Since then, I have remained attached to plant biology. I did my master's and PhD in the same field, and I have continued my interest in plant research for the past 40 years. Every day I learn of new findings that reveal more about my ignorance of the subject than the knowledge I have gained.

Who influenced your scientific thinking early in your career, and how?

There are two teachers I would like to mention. The first was my master's teacher, Dr. A. K. Kaul. I liked his teaching style and learned a lot from him about how to teach and make the topic interesting to students. He taught us by raising doubts and questions that induced random thinking processes within us and motivated us to explore more. The second was my PhD adviser, Professor S. Maheshwari. He was one of the most instrumental people not only in my professional career, by teaching me the basics of how to deal with science, but also in my personal life. He was very meticulous and always emphasized being perfect. He insisted that his students also read in areas of research not directly related to their topic, which has helped me a lot to stay motivated with the flow of new ideas.

What do you think are good career moves for young scientists?

Young scientists can opt for an academic research career in a university or join a private-sector organization. Important principles to stay alive in research are to remain curious, which will direct you to your ultimate goal, and to concentrate on scientific questions you wish to address in the future.

Curiosity leads to discoveries. At some point, if you feel that research is not what you would like to pursue further, you can choose other options in industry, the media, or law (e.g., intellectual property rights).

Sudhir Kumar Sopory

If you were able to repeat your years as a graduate student or your early years as a postgraduate student, would you do anything differently? If so, why?

During my PhD studies, the problem I was given was not to my interest. I always wanted to do more of biochemistry and molecular biology, but during my PhD I did tissue culture, which did help me in later years. Part of the reason for this assignment was availability of resources and infrastructure. It happens with many students, I guess. I would like to have taken up projects that have social relevance.

What journals do you regularly follow?

In plant biology, I have always tried to follow the top 20 journals, like *The Plant Cell, Plant Physiology, The Plant Journal, Plant and Cell Physiology,* and others, not because of the impact factor but because of the content, new science, and new concepts. Certainly I also look at *Cell, Nature,* and *Science,* especially news and views, but I also continuously try to follow journals that publish new methods and technologies. I prefer to also follow journals not related to my area of research, and now being in administration as vice chancellor of the university, I have started to follow some social sciences–related journals, too.

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

Being in the International Centre for Genetic Engineering and Biotechnology and leading the abiotic stress group, I found the work on stress perception and signaling revealing. The work on light and hormone regulation

continued on page 18

LUMINARIES
continued from page 17

and mechanisms thereof and on development of plant organs and differentiation is very interesting, and this work is now slowly revealing the secrets of plant life.

What do you think is the next big thing in plant biology?

How plants survive. How they adapt to different niches. The sensing mechanism is very important to examine to have a better understanding of plant systems. Understanding plant evolution will be a really big thing, as well as evolution of polyploids and apomixis and so forth.

What do you think will be the next big thing in your specific area of study?

People have to understand the basic signature of gene expression and proteome, how it is linked with adaptation, and whether it is genotype specific or species specific. This aspect is not yet clear. In the field of transgenics, where people have used different genes for stress tolerance, one needs to understand how different gene products lead to the same phenotype. What is the molecular footprint that drives these behaviors?

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

First of all, a candidate's CV speaks for itself in terms of publication records, references, reports, and so forth. However, the CV contributes only to initial attention to the candidate. The major thing one needs to judge, in my perspective, is the candidate's real motivation and ability to engage in independent thinking. These are the qualities that direct a researcher to be a leader in science.

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

Be curious and be committed. Plant biology is an amazing field, and a lot has yet to be explored. Move away from Arabidopsis and rice, and discover further facts about the beauty of plant life.

How do you look at the future of basic plant science as part of a policy-making body?

Research in plants can have an impact in the field of agriculture, the energy sector, and livestock improvement. Work on plants can also help us fulfill our social commitments. Plant science needs more funding for both basic and applied research. ■

NEW

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By Erich Grotewold, Joseph Chappell, and Elizabeth A. Kellogg

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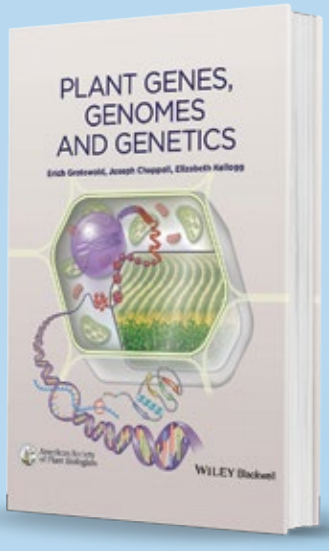

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Policy Update

BY LAUREN BROCCOLI
Lewis-Burke Associates, LLC

FY2016 Appropriations Update

Congress departed for its annual month-long August recess without having passed a single appropriations bill for fiscal year 2016. The House recessed on July 31, and the Senate remained in session until August 7. Both chambers return to Washington to resume session on September 8, leaving a limited number of days before the start of the new fiscal year on October 1.

Passing the FY2016 spending bills through regular order is highly unlikely, as Democrats and Republicans remain divided on adherence to the budgetary caps established in the Budget Control Act of 2011. Alternative options include passing a Continuing Resolution (CR) to maintain funding at current FY2015 levels or crafting a new budget agreement similar to the Budget Control Act of 2011 with new caps agreeable to both Democrats and Republicans. If Congress fails to reach an agreement or pass a CR by October 1, a government shutdown would occur.

Meanwhile, the White House Office of Management and Budget (OMB) and the Office of Science and Technology Policy (OSTP) have started the process of preparing President Obama's budget request for FY2017. On July 9, OMB and OSTP issued guidance to federal agencies detailing science and technology priorities for FY2017. Many of the priorities listed are the same as those in memos from previous years of this administration, including global climate change; innovation in life sciences, biology, and neuroscience; and science, technology, engineering, and mathematics education.

Sources and Additional Information

- The OMB memorandum outlining FY2017 priorities is available at http://1.usa.gov/1Gc8Dsy.

Appropriations Committees Approve Versions of FY2016 Agriculture Appropriations Bills

In July, both the House and Senate appropriations committees marked up and approved their respective versions of the FY2016 Agriculture, Rural Development, Food and Drug Administration, and Related Agencies appropriations bill.

The House Appropriations Committee approved its version of the bill July 8. The House bill totals $20.7 billion in discretionary spending, which represents a decrease of $175 million from the current enacted level. The National Institute of Food and Agriculture (NIFA) would receive $1.284 billion, which is $5 million below the FY2015 enacted level. Within NIFA, the Agriculture and Food Research Initiative (AFRI) would receive $335 million, an increase of $10 million (3 percent) above the FY2015 enacted level. Although this falls far short of the president's requested $450 million, given that the total allocation of the bill is down from last year, a 3 percent increase signals the committee's support for this program. For ARS, the bill would provide $1.167 billion, including $45 million for buildings and facilities.

The report accompanying the House bill also includes language recognizing the need for classical plant breeding and encourages NIFA to invest in research to advance this work. In addition, the report includes language to encourage ARS and NIFA to support the research on, education about, and conservation of native plants.

The Senate Appropriations Committee approved its version of the bill on July 16. The Senate version includes a total of $20.5 billion in discretionary spending, slightly lower than the House bill. NIFA would be funded at $1.294 billion, which is $4.2 million (<1 percent) above the FY2015 enacted level, and AFRI would receive $325 million, flat funding consistent with FY2015 levels. For ARS, the Senate bill would provide $1.137 billion, a decrease of $40 million (3.5 percent) from the FY2015 enacted level. Unlike the House bill, the entire allocation would be for the salaries and expenses budget line, with no money appropriated for the buildings and facilities budget line. Considering the president's requested amount of $205 million and the FY2015 enacted level of $45 million for the buildings and facilities budget, zeroing out the account would be a significant cut.

Neither the House nor the Senate bill would fund the administration's two proposed USDA Innovation Institutes, requested at $40 million each. Like the House report, the Senate report also highlights classical plant breeding; in addition, it mentions invasive annual grasses as a critical challenge.

Again, Democrats and Republicans remain divided on adherence to the budgetary caps established in the Budget Control Act of 2011. Until a budget agreement or alternative plan is reached, it is unclear how the programs in a final version of the FY2016 agriculture appropriations bill will fare.

Sources and Additional Information

- The full text of the House bill is available at http://1.usa.gov/1g1H4gm.
- The House's accompanying report language is available at http://1.usa.gov/1DlrZBm.
- The full text of the Senate bill is available at http://1.usa.gov/1IkugJH.
- The Senate's accompanying report language is available at http://1.usa.gov/1MHyfoQ.

NASA and USDA Announce Plans for Increased Collaboration

On July 13, NASA and USDA pledged to increase collaboration on Earth science research, agricultural management, and a host

continued on page 20

POLICY UPDATE
continued from page 19

of other issues. The NASA–USDA Memorandum of Understanding (MOU) is the latest in a series of MOUs between the two agencies, the most recent of which was signed in 2010 and expired this year.

Although the text of the MOU is not publicly available, this latest iteration is meant to spur cooperation on issues like use of NASA's Soil Moisture Active Passive satellite and other assets to partner on climate and drought monitoring and to stimulate the formation of interagency working groups. However, it is unlikely that any new extramural funding opportunities would stem from this increased collaboration.

Sources and Additional Information

- A press release announcing the NASA–USDA Memorandum of Understanding is available at http://1.usa.gov/1hfXBy9.

Foundation for Food and Agricultural Research: Executive Director Appointed; Feedback Sought

In June, ASPB sent a letter congratulating Dr. Sally Rockey on her selection as the first executive director of the Foundation for Food and Agricultural Research (FFAR). Dr. Rockey, who is an insect physiologist by training and holds a PhD in entomology from Ohio State University, will assume her new role in September 2015. She has been deputy director for extramural research at the National Institutes of Health since 2005, and before that she oversaw the competitive research program at USDA.

FFAR was newly established in the 2014 Farm Bill with $200 million in mandatory funding and the goal of leveraging public and private resources to increase scientific and technological research, innovation, and partnerships to strengthen the agricultural enterprise. Since the foundation's board meeting on June 11, FFAR has released a list of initial research areas it is considering targeting for funding. These areas include seven subtopics under two overarching topics:

- More productive, sustainable agriculture
  1. Improving plant efficiency
  2. Optimizing agricultural water use
  3. Transforming soil health
  4. Enhancing sustainable farm animal resilience, productivity, and health
- Better health through food
  5. Achieving a deeper understanding of nutrition and healthy food choices
  6. Managing food production systems for enhanced human nutritional outcomes
  7. Spurring food system innovation.

Although FFAR is not accepting formal research proposals at this time, it is currently seeking feedback from the stakeholder community to further identify research gaps and potential funding partners. The next in-person FFAR board meeting will take place in October 2015.

Sources and Additional Information

- More information about the FFAR announcements, including instructions on submitting input on suggested research target areas, is available in the "Recent News" section of the FFAR website at http://bit.ly/1eOe3no.

White House Orders Review of Regulatory Policies for Biotechnology Products

On July 2, the White House Office of Science and Technology Policy (OSTP) announced a federal review of the regulatory policies for biotechnology products in a memorandum titled "Modernizing the Regulatory System for Biotechnology Products." The objective is to develop transparent and efficient regulatory practices for the Environmental Protection Agency (EPA), USDA, and the Food and Drug Administration (FDA) that will facilitate access for researchers and small businesses and instill consumer confidence.

The memorandum directs the launch of a Biotechnology Working Group under the Emerging Technologies Interagency Policy Coordination Committee that includes representatives from the White House, USDA, FDA, and EPA. The three main goals of the memorandum include

1. updating the current Coordinated Framework for the Regulation of Biotechnology (CF) to clearly describe the roles and responsibilities of EPA, USDA, and FDA in the regulatory process
2. developing a strategy, including user-friendly systems, to ensure the adaptability of the regulatory system to advances in biotechnology products
3. requesting a forward-looking National Academy of Sciences study to analyze the future landscape of biotechnology products.

The White House is planning to organize upcoming listening sessions and other opportunities for stakeholders to provide input in the coming months, and ASPB will actively engage in this process. Last year, ASPB released a position statement on plant genetic engineering, which was shared with OSTP, urging a review of the CF.

Sources and Additional Information

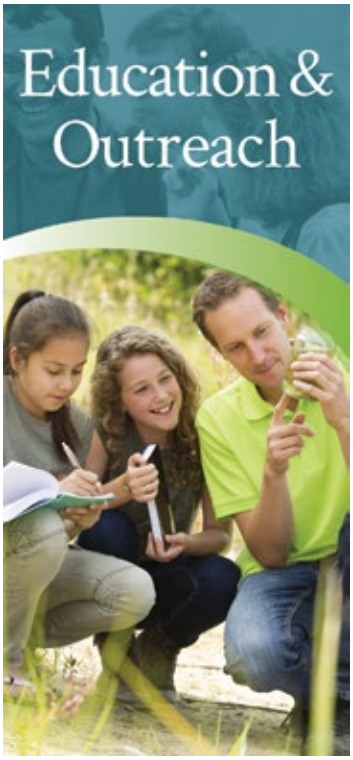
- The memorandum is available at http://1.usa.gov/1JJeuKN.
- The blog post announcing the memorandum is available at http://1.usa.gov/1KLn2SR. ■

Plantae @ Plant Biology 2015

The Education & Outreach Hub

BY KATIE ENGEN
ASPB Education Coordinator

Plantae



A microcosm of the Plantae Education and Outreach Hub was featured in the Plant Biology 2015 Exhibit Hall. This hub is one of five units that make up the upcoming virtual plant science community, Plantae.org. To highlight this year's progress, new partnerships, and aspects of Plantae's future, the Education Committee curated a booth full of expert guests, teaching resources, and information useful for K–16 learning as well as public engagement in plant biology.

Thank you to everyone who made this Plantae-come-to-life hub such a fun and productive success! Included are the invited specialists, behind-the-scenes planners and laborers, members of the Education Committee, and of course the many curious and enthusiastic booth visitors.

The booth presented a preview of the rich network of talent and resources that will be just a few clicks away when all of Plantae's hubs launch this fall.

(from left) Booth visitor and all-around helper Suzanne Cunningham, expert guest Marceline Egnin, and Education Committee member Scott Woody enjoying their collaboration.

Publishing

- Discipline-based education research journals
  - *CourseSource* is a journal of evidence-based teaching resources for undergraduate biology education. Submit your plant biology resources at http://bit.ly/1NWFEz3.
  - *CBE Life Sciences Education* (www.lifescied.org) publishes peer-reviewed articles on life science education at the K–12, undergraduate, and graduate levels. It is written by and to serve professionals engaged in biology teaching in all environments.
- *New partner:* Wiki Education Foundation (http://wikiedu.org/) and ASPB have formed a new partnership to enhance plant science content on Wikipedia. Opportunities are available to pilot a new course with the foundation; contact Katie@aspb.org to get connected.

Teaching

- The University of Wisconsin's Fast Plants self-compatible program provides plant-based resources for integrating genetics, evolution, and genomic sciences education (http://fpsc.wisc.edu).
- *New partner:* Howard Hughes Medical Institute (HHMI) BioInteractive developed a new video, *Popped Secret: The Mysterious Origin of Corn* (http://bit.ly/1NWFV4U). The HHMI-based team will collaborate with ASPB to disseminate this video, create ancillary teaching resources, and consider future titles for plant biology.
- Teaching Tools in Plant Biology (http://bit.ly/1f121nN) is a higher education resource aligned with *The Plant Cell.* High schools in the United States can use both *The Plant Cell* and *Plant Physiology* journals via the Free Journal Access Program (https://journalaccess.aspb.org/).
- PlantingScience (www.plantingscience.org) offers free research modules and online mentoring to help middle and high school students conduct authentic plant science research.
- The Life Science Teaching Resource Community (www.LifeSciTRC.org) provides peer-reviewed, active learning resources for K–16 students and welcomes submissions by educators.

Model Programs

- The Plant Biology Learning Objectives, Outreach Materials, & Education (Plant BLOOME) grant (https://bloome.aspb.org) funds education and outreach projects. Recent projects include a research project in plant biotechnology for high school students in Ghana; Plant Educational Experience in Research, a Northern New Mexico College boot camp; and

continued on page 22

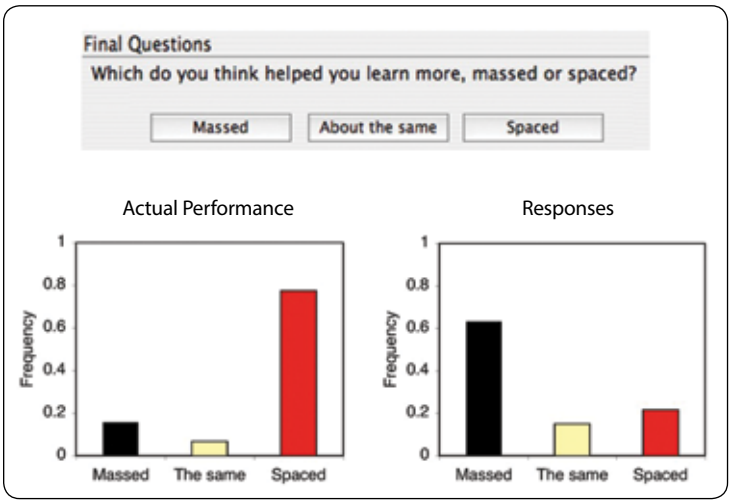
Plant Biology 2015: Education Workshop

Cognitive Psychology for Teaching Well

BY KATHLEEN ARCHER
Trinity College

Is there something you've been trying to learn but just can't seem to remember? Are you pretty good at something but don't seem to be improving as much as you'd like? And do your students tell you they've studied for hours and hours and can't understand why they've scored only a C on your exam? There are effective solutions to these problems. Nate Kornell, a cognitive psychologist at Williams College, discussed what cognitive psychology research shows can work to improve learning during his engaging education workshop at Plant Biology 2015.

Nate Kornell



Actual performance on later recall versus responses to the question, Which [study method] do you think helped you more, massed or spaced?

First, Nate observed that we tend to practice what we can already do with some success and to put off practicing what is really hard for us. For example, if you are learning a new language and find adding vocabulary words easy, you may tend to spend more study time on that and much less time on verb conjugations if those are difficult. To improve more quickly, however, you should do the reverse, spending the most study time on your areas of weakness.

And how should that study time be structured? Nate compared study in concentrated blocks of time, called *massed study,* with study time interspersed with other activities or the study of other topics, called *spaced study.* His data, along with data from numerous other studies, show convincingly that spaced study is superior. Students using the spaced study method had much better recall of what they learned later, retaining more and retaining it longer. Interestingly, most people perceive that they learn better using massed study, despite the evidence (see graphic).

Spaced study is best not only for factual learning, but also for learning that involves problem solving. In math courses, for example, problems associated with a certain solution strategy should be mixed with problems from previous lessons. Otherwise, a learner associates a solution strategy with a chapter and is unable to solve a problem removed from that context. Mixing problems with different solution strategies requires students not only to learn how to implement a solution, but also to discern when it should be used.

Another aspect of efficient learning is that difficulty is desirable. Learning tasks that are easy makes you feel successful, but learning tasks that are hard yields a greater gain for the effort.

Lastly, frequent attempts at recall strengthen learning. Scheduling many quizzes helps students by forcing attempts at recall, so students benefit whether they studied for a quiz or not. And if you include a few questions on the previous week's topics, it's even better (because of the benefits of spaced learning).

So, practice on your weaknesses, space your study times, make yourself do challenging tasks, and repeat! ■

PLANTAE @ PB15
continued from page 21

development of the *My Life as a Plant* activity book (in English and many translations).

- The Partnership for Undergraduate Life Science Education's Vision and Change Campus Certification Program (http://bit.ly/1f121nN) is an ambitious endeavor designed to motivate important changes in life sciences higher education in the United States.

Public Engagement

- Winning Fascination of Plants Day contest T-shirts are available at http://bit.ly/1hhuGtl. Buy a shirt to show your roots and be a walking billboard for plant biology. ■

PB15 Education and Outreach Minisymposium

Evidence for Excellence

BY ERIN FRIEDMAN
Lynchburg College

Sounds of Science Collaboration

Berkley Walker (USDA/ARS, University of Illinois) described an ongoing project that pairs scientists with musicians to create data-based compositions. Inspired by his mother, a voice teacher, Berkley described his drive to use music as a tool to communicate scientific results and to engage a novel audience in research. Berkley began with a broad question,

> What happens when we mix Mendel with Beethoven?

As demonstrated in a five-minute video (http://bit.ly/1VdUaXi), the answers to this question varied greatly. Collaborators created musical compositions and artistic animations based on actual experimental data. Berkley reported that both the scientists and the artists felt that the collaborations were beneficial. Aleel Grennan (University of Illinois) described her specific collaboration, called "Illumina! *Arabidopsis Thaliana*." Her project traced the path of a photon through chlorophyll to produce starch; she wanted to create a piece in which the audience would be "in the chloroplast sitting on the thylakoid." The products of these collaborations are being screened at music festivals and will be available online (http://bit.ly/1KQp6FL).

Sharing the Wealth: Mentoring Undergraduate Teachers in Scientific Teaching

Sue Wick (University of Minnesota) highlighted efforts to improve undergraduate teaching by mentoring colleagues and undergraduate teachers in implementing evidence-based teaching methods, also known as *scientific teaching*. Scientific teaching can be targeted to any discipline and involves active learning, backward design and assessment, and student inclusivity. Sue described programs at the University of Minnesota she designed to relay these teaching methods to her colleagues. Although the programs used different formats, lengths, and meeting frequencies, the outcomes were similar; professors learned to move beyond straight lecture to develop active learning activities for their students.

Sue stressed that scientific teaching can be implemented to various degrees and in any setting. Although active learning classrooms are desirable, active learning can be implemented even in a large lecture hall with some creative thinking. The workshops described were all beneficial, regardless of the target audience (seasoned professors or future faculty). But why is it so important to move beyond the lecture and incorporate active learning activities into courses? According to Sue,

> The person who does the work does the learning.

Basic Biotechnology Teaching Techniques in Ghana High Schools

Marian Quain (Crops Research Institute, Council for Scientific and Industrial Research, Kumasi, Ghana) and her colleagues have reached thousands of teachers, students, and farmers in sub-Saharan Africa through their biotechnology workshops. In Ghana, agriculture is the largest employer, and a 2011 law states that all people should understand biotechnology. However, the high school textbooks in Ghana do not mention biotechnology. Using an ASPB Plant BLOOME grant (https://bloome.aspb.org), Marian developed workshops targeting high school teachers in Ghana, providing them with materials to lecture and teach dry and wet labs to their students.

During the workshops, the teachers first learn material and techniques. Next, the teachers teach their own students while Marian and her staff observe. Marian and her colleagues have reached teachers from all 10 regions of Ghana. Additionally, she has conducted workshops to teach local farmers about DNA by demonstrating DNA extraction from plants (which many farmers do not realize contain DNA!).

The program has an additional goal of continuing mentoring; past trainees are trained as mentors so that they can, in turn, relay their knowledge to other high school teachers. Ghana's Ministry of Education is tracking Marian's program with great interest. The impact of the Ghana experience extends far beyond the current list of 1,400 trainees.

CourseSource: A Journal of Evidence-Based Resources for Teaching Undergraduate Biology

Jessamina Blum (University of Minnesota) introduced *CourseSource* (http://www.coursesource.org/), a new open-source journal for evidence-based teaching resources. The lessons and reviews in *CourseSource* target undergraduate students in biology and are peer reviewed to ensure repeatability and clarity. Jess first summarized the website, demonstrated its use, and showed the attendees the power of the search utility. By applying

continued on page 27

CALL FOR APPLICATIONS

American Philosophical Society, Research Programs

Information and application instructions for all of the Society's programs can be accessed at our website, http://www.amphilsoc.org. Click on the "Grants" tab at the top of the homepage.

Information About All Programs

Purpose, Scope

Awards are made for noncommercial research only. The Society makes no grants for academic study or classroom presentation, for travel to conferences, for non-scholarly projects, for assistance with translation, or for the preparation of materials for use by students. The Society does not pay overhead or indirect costs to any institution or costs of publication.

Eligibility

Applicants may be citizens or residents of the United States or American citizens resident abroad. Foreign nationals whose research can only be carried out in the United States are eligible. Grants are made to individuals; institutions are not eligible to apply. Requirements for each program vary.

Tax information

Grants and fellowships are taxable income, but the Society is not required to report payments. It is recommended that grant and fellowship recipients discuss their reporting obligations with their tax advisors.

Contact information

Questions concerning the FRANKLIN and LEWIS AND CLARK, programs should be directed to Linda Musumeci, Director of Grants and Fellowships, at LMusumeci@amphilsoc.org or 215-440-3429

Questions concerning the LIBRARY RESIDENT Research Fellowships should be directed to Earle Spamer, Library Programs Coordinator, at libfellows@amphilsoc.org or 215-440-3443.

Brief Information About Individual Programs

Franklin Research Grants

Scope This program of small grants to scholars is intended to support the cost of research leading to publication in all areas of knowledge. The Franklin program is particularly designed to help meet the cost of travel to libraries and archives for research purposes; the purchase of microfilm, photocopies or equivalent research materials; the costs associated with fieldwork; or laboratory research expenses.

Eligibility Applicants are expected to have a doctorate or to have published work of doctoral character and quality. Ph.D. candidates are not eligible to apply, but the Society is especially interested in supporting the work of young scholars who have recently received the doctorate.

Award From $1,000 to $6,000

Deadlines October 1, December 1; notification in January and March.

Lewis and Clark Fund for Exploration and Field Research

Scope The Lewis and Clark Fund encourages exploratory field studies for the collection of specimens and data and to provide the imaginative stimulus that accompanies direct observation. Applications are invited from disciplines with a large dependence on field studies, such as archeology, anthropology, biology, ecology, geography, geology, linguistics, and paleontology, but grants will not be restricted to these fields.

Eligibility Grants will be available to doctoral students who wish to participate in field studies for their dissertations or for other purposes. Master's candidates, undergraduates, and postdoctoral fellows are not eligible.

Award Grants will depend on travel costs but will ordinarily be in the range of several hundred dollars to about $5,000.

Deadline February 1 (letters of support due January 29); notification in May.

Library Resident Research Fellowships

Scope The Library Resident Research fellowships support research in the Society's collections.

Eligibility Applicants must demonstrate a need to work in the Society's collections for a minimum of one month and a maximum of three months. Applicants in any relevant field of scholarship may apply. Candidates whose normal place of residence is farther away than a 75-mile radius of Philadelphia will be given some preference. Applicants do not need to hold the doctorate, although Ph.D. candidates must have passed their preliminary examinations.

Stipend Stipend $3,000 per month.

Deadline March 1, notification in May.

Information updated July 2015

Outreach and Education Posters

A Continuum of Engaging Strategies to Attract Excellent Young Minds

BY KENNETH HELM
Siena College

When I first began perusing the Outreach and Education posters at ASPB meetings some (rather large) number of years ago, the major focus of the posters seemed to be education rather than outreach. In fact, many of the posters, my own included, were oriented toward sharing novel and creative exercises for laboratory instruction in plant biology. Since then, it seems there has been a realization that we need to be more inclusive in our efforts to engage people outside plant biology. Here I briefly describe some outreach highlights of the poster session at Plant Biology 2015, giving poster numbers for reference.

The breadth of outreach approaches and ideas at the 2015 poster session was truly impressive. There were posters describing new approaches to engaging science undergrads, discovering what actually motivates these students, training teachers, engaging precollege students, and engaging the broader public.

A number of excellent posters focused on the traditional challenge of motivating undergraduate students, both science and nonscience majors. For instance, Andrew Woodward described an intriguing biology course on medicinal botany designed to lure students interested in careers in the health care sector to an appreciation of plant biology via a study of the biology of plant-derived drugs (1200-009-Y). Similarly, Ashleigh Teten and her group used current interest in biofuel production to introduce undergraduates to sophisticated lab techniques through the biochemical assessment of the suitability of wild algae as biofuel producers (1200-007-Z).

Bridging science and the arts, Berkley Walker et al. described a fascinating course in which music students interacted directly with plant scientists and ultimately composed and performed musical compositions reflecting the science to which they had been introduced (1200-003-Z). Anjali Misra and Joe vanGaalen provided a novel survey method to ascertain what actually motivates—and doesn't motivate—first-year biology students (1200-013-Y). Finally, a poster by Sue Wick and colleagues about *CourseSource* introduced a new, peer-reviewed journal that publishes unique and creative approaches to biology education for the entire biology education community (1200-005-Y).

Many excellent posters addressed the area of outreach to current teachers, future teachers, and K–12 students. Sue Wick described a crash course for time-strapped K–6 teachers (1200-004-Y) and, along with Robin Wright, presented information on a series of evening workshops aimed at introducing current grad students and postdocs to the fundamentals of teaching undergraduate biology courses (1200-002-Z). Perhaps the most ambitious of this teach-the-teacher outreach, funded by an ASPB Plant BLOOME award, was a project in which high school science teachers in Ghana were trained in modern biotechnology and genetics for four days and then took their expertise back to their schools to pass along to young students throughout Ghana (1200-001-Y).

Closer to home, Amy Clore et al. reported the results of a large outreach program in Florida that introduced Title I middle school students to plant biology via the study of grain biology, cultivation, and nutrition through classroom, on-site, and community garden activities (1200-015-Z). The students then visited the New College of Florida campus, where they interacted directly with plant biologists. There was also an excellent poster about how plant biology is being introduced to Pennsylvania high school students through fun, interactive programs at the Jennings Environmental Education Center with the aim of expanding the program to some of Pennsylvania's many state parks (1200-006-Z). So, as you can see, there are many creative strategies for engaging upcoming students long before they enter college.

In addition to issues directly related to K–16 education, other posters described creative approaches to connect plant biologists with the broader, often nonscience, community. Likely the broadest of all was a poster by Don Gibson advocating the placement of Barbara McClintock's portrait on the $10 bill (no number). Although a bit of a long shot, having Dr. McClintock on the 10-spot would certainly increase the public's awareness of plant biology!

The Biology Fortified group, another Plant BLOOME grant winner, presented two posters. One described the organization's efforts to connect the public with the scientific literature in an effort to educate people about biotechnology and genetically modified organisms (1200-011-Z). The other was aimed at helping grant writers with the "broader impacts" portions of their grant proposals (1200-012-Y). Both were worthy and important efforts.

Bessie Splitt and Edgar Spalding presented a poster about the many approaches the Spalding Lab takes to public outreach in Wisconsin (1200-008-Y). Michael Schläppi described a neat program at another Wisconsin lab that trains community members and organizations, including senior citizens from Cambodia, to screen promising rice cultivars for chilling tolerance and that develops and disseminates optimal cultivation practices for farmers and gardeners, including urban gardeners (1200-014-Z).

These creative and diverse posters provided a compelling and exciting set of approaches to increasing public awareness of plant biology and to attracting excellent young minds to our vitally important discipline. ■

Lloyd T. Evans

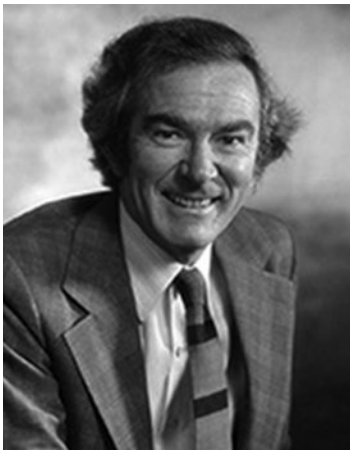
1927–2015

BY RUSSELL JONES
University of California, Berkeley

Lloyd T. Evans died on March 23, 2015, in Canberra, Australia, where he had lived and worked for almost 60 years. He was born in Wanganui on the North Island of New Zealand on August 6, 1927. Lloyd was a plant and crop physiologist whose expertise was in the physiology of flowering, especially in cereals and grasses. He was eminently successful in every aspect of his career, becoming one of Australia's preeminent scientists. He became chief of the Division of Plant Industry at CSIRO in 1971, served as president of the Australian Academy of Science, and was an adviser to the Consultative Group for International Agricultural Research (CGIAR), among many other leadership roles that he assumed.

After graduating from the University of New Zealand's Canterbury College in Christchurch with bachelor's and master's degrees, Lloyd was selected as a Rhodes Scholar at Oxford University in the early 1950s, where he received his DPhil. In those days, Rhodes Scholars were selected as much for their sporting prowess as for their scholarship, and Lloyd averred that it was his talent as a field hockey player that helped him win his Rhodes. He was also a keen mountain climber and marathoner.

Lloyd obtained a PhD from Oxford University in soil science,



Lloyd Evans

working with the eminent soil scientist and director of the Rothamsted Experimental Station Sir John Russell. In 1954 Lloyd went to the California Institute of Technology (Caltech) as a postdoc to work in the first phytotron with the legendary Frits Went. Caltech was a mecca for plant physiologists interested in plant development and the effects of hormones and light. In addition to Went, other notables at Caltech were James Bonner, Arthur Galston, Anton Lang, Johannes van Overbeek, Kenneth Thimann, and Folke Skoog, all central figures in early discoveries with auxins and cytokinin.

Otto Frankel, chief of CSIRO's Division of Plant Industry, visited Caltech in 1955, where Lloyd gave him a comprehensive tour of the facilities. As a result, Otto persuaded CSIRO and the

Lloyd Evans working on wheat ears in the phytotron. PHOTO COURTESY OF CSIRO, PLANT INDUSTRY.

Australian government to fund a phytotron in Canberra. He recruited Lloyd to Canberra in 1956 as a research scientist at CSIRO, specifically to design and manage the building of the phytotron. Lloyd later served as chief of CSIRO's Division of Plant Industry from 1971 to 1978.

Around the time Lloyd arrived in Canberra, he began his research with the grass *Lolium temulentum*. He chose Lolium for his work on flowering because it could be induced to flower after an induction period of only one long day. He continued to work on flowering in Lolium for another 40 years, during which time he developed a strong and fruitful collaboration with Rod King, who was also a CSIRO researcher. Lloyd and Rod showed that gibberellins are key regulators of flowering in Lolium. Lloyd had earlier discovered that there are inhibitors of flowering, an observation that was disputed by others such as Anton Lang for a long time. Lang later proved Lloyd to be correct on this score.

Lloyd is internationally known for his work in the area of crop physiology, especially for work that led to defining parameters such as sink strength and yield potential. The success of Lloyd's crop physiology research program was greatly facilitated by access to the Canberra Phytotron, which he and then–CSIRO Chief Otto Frankel helped design, raise funds for, and build. Although the Canberra Phytotron opened in 1962, this facility remains one of the best of its kind in the world. It was recently renovated and houses the High Resolution Plant Phenomics Centre. The International Rice Research Institute (IRRI) in the Philippines is currently building a phytotron, the Lloyd T. Evans Plant Growth Facility; ground breaking on this facility was begun in January 2015.

Lloyd's work with Lolium laid the foundation for his work on crop physiology, specifically work that would lead to an increase in the yield of wheat. He found that Lolium was a good model for

barley and wheat, but eventually he settled on wheat to investigate mechanisms to increase grain yield. Among his discoveries was that sink demand (i.e., more grains per ear) was as important as sugar supply for improving wheat yield. His expertise as a crop physiologist led him to edit several books in this area and later to author two books that have had a major influence on agricultural research and policy. *Crop Evolution, Adaptation and Yield* (Cambridge University Press, 1993) is still considered one of the best books published in this field, and *Feeding the Ten Billion: Plants and Population Growth* (Cambridge University Press, 1998) should be mandatory reading for all plant biologists and agricultural policy makers.

Lloyd's administrative expertise and in-depth knowledge of crop physiology led to his appointment to several important international oversight committees, where he also greatly influenced the field. These duties included membership on the CGIAR Technical Advisory Committee and the boards of trustees of IRRI and the International Maize and Wheat Improvement Center.

Lloyd Evans's influence on science, and plant science in particular, in Australia was widely felt through his presidency of the Australian Society of Plant Physiology and of the Australian Academy of Sciences. Among the many honors conferred on Lloyd are Officer of the Order of Australia in 1979, one of Australia's highest civilian honors, and the Centenary Medal of Australia in 2003. These awards are given only to the most accomplished Australians. He has also received many awards that reflect the acclaim of his peers, including election as a fellow of the Australian Academy of Sciences and of the Royal Society of the United Kingdom, honorary memberships in the Royal Society of New Zealand and the Royal Agricultural Society of the United Kingdom, and membership in the Norwegian Academy of Sciences and Letters and the Indian National Academy of Agricultural Sciences. Last but not least, Lloyd was honored by ASPB with his election as a corresponding member of the Society in 1978.

Lloyd Evans's accomplishments and their impact are extraordinary both in breadth and in depth. In addition to his sharp intellect, much of Lloyd's success was attributable to the force of his magnetic personality. What was even more remarkable about him was that he was a truly humble, kind, and generous individual who had nothing but good to say of others. Lloyd was dedicated to his family and very much admired by them. Lloyd and his wife Margaret were gracious hosts. They welcomed to their home on the coast of New South Wales many friends and colleagues who became part of the Evans's extended family. He will be forever missed for his generosity of thought and mind. ■

MINISYMPOSIUM
continued from page 23

detailed filters, users can search for content by parameters such as topic, resource type, class size, discipline, and difficulty. Next, Jess emphasized the need for the submission of plant biology articles. Although the journal is being populated with articles in many scientific disciplines, the plant biology section is currently quite limited.

The submission and review process was described as being rapid and straightforward (and without publication costs). Peer-reviewed article types include Lessons, Science Behind the Lesson, and Reviews, and editor-reviewed article types are Essays and Teaching Tools and Strategies. Authors retain the copyright to their articles. Jess emphasized that all of the article types are unique and directed participants to the templates found in the Instructions for Authors page.

Blum emphasized the need for the submission of plant biology articles.

Leaves of Green: A Project-Driven Workshop for Plant Biology in High School

Mark Lubkowitz (Saint Michael's College) wants to help high school teachers

> Talk less…do more.

To that end, he has created a workshop (http://epscor.w3.uvm.edu/2/node/143) to teach high school teachers to implement inquiry-driven plant biology modules in their schools. Mark's interest in carbohydrate partitioning inspired him to generate a toolbox of a few assays (e.g., photosynthetic rate, starch content, stomatal impressions) that can be performed using limited equipment and reagents that are provided to the teachers as part of their workshop attendance. After learning to use the tools, the teachers then generate custom modules for their courses using these assays.

The goal of these modules is for student–teacher teams to generate a question that can be answered by performing the assays in the toolbox. The modules are all inquiry based, curiosity driven, and team designed and tested, and students communicate their results using chalk talks and posters. Mark described several of the modules teachers have produced, which varied in topic and scope.

Because of the success of this program, Mark modified the project for college students. In his plant biology course, he taught his students to use the tools, and they attempted to answer questions posed by local farmers. Although many questions were left unanswered after the experiments were performed, several problems were solved successfully, emphasizing the program's potential benefits outside the classroom. ■

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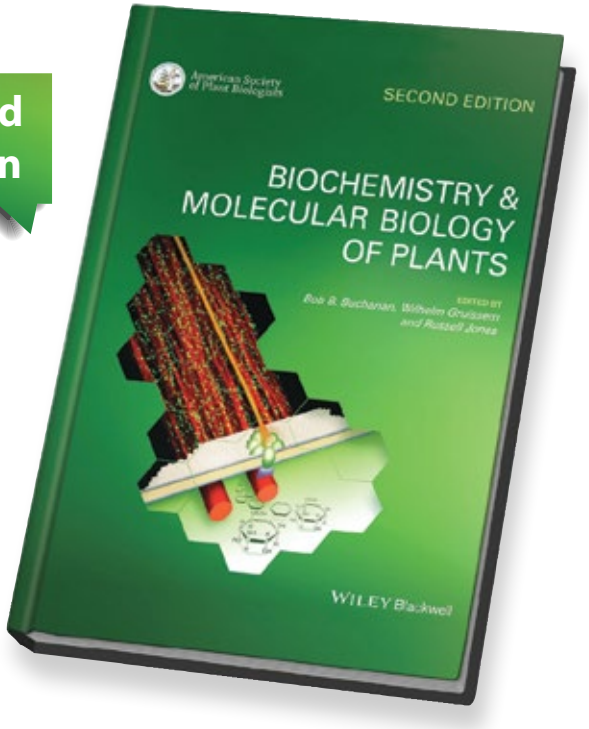

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