March/April 2014 • Volume 41, Number 2

p. 8

Child Care at Plant Biology 2014

On-site child care will be provided at Plant Biology 2014

p. 15

Dr. Moehs Goes to Washington

Raising awareness among U.S. politicians and policy makers about the issue of climate change

p. 24

AAAS Family Science Days in Chicago

The cold weather was no match for the hot plant biology activities shared in the ASPB education and outreach booth

ASPB News

THE NEWSLETTER OF THE AMERICAN SOCIETY OF PLANT BIOLOGISTS

Looking Back and Looking Ahead

The Perks of Being a Scientist—Or Why I Keep Coming Back to Plant Biology Meetings

BY SUSANNE HOFFMAN-BENNING
Michigan State University

I attended my first Plant Biology meeting as a graduate student—and I was in awe. So many people, and I didn't know a soul. It was scary, and I thought I would drown in anonymity. I was completely overwhelmed by the sheer amount of scientific presentations. That changed very quickly, though, when my PI introduced me to his fellow scientists. The more I went, the more people I got to know. As my knowledge increased, so did my enjoyment of the presentations—and I was hooked.

After my son was born, my option to attend meetings was limited. Both my husband and I work with plants, and bringing a child to a meeting didn't seem like a great idea. But ASPB is very family friendly, so my husband, my son (then four years old), and I attended the ASPB meeting in

continued on page 9

President's Letter

Provide Vision

BY ALAN JONES
ASPB President
University of North Carolina

Alan Jones

The economic health of many of our countries is clearly improving, and we can hope that our governments, although not dealing with income surpluses just yet, will nonetheless soon leave their panicked "survival-only" mentality for attentiveness to our future needs. Given that climate change and continued population growth are already straining our capacity to sustainably produce sufficient food, now is the time we plant scientists must provide vision for our government representatives. We must not wait until the tax coffers are filling up again to point the way to invest.

Considering this urgency, I thought it would be useful to discuss what is going on in a

continued on page 3

Contents

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

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

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

Copy deadline is the 5th day of the preceding even-numbered month (for example, December 5 for January/February publication).

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

PRESIDENT'S LETTER
continued from page 1

number of countries where ASPB has members. No matter where we live, we all benefit when plant research is supported, so I am hoping that this news article will provide a little ammunition if you need it to strengthen your case for increased investments in plant research in your country.

You've read in the past few issues of the *ASPB News* that ASPB facilitated the creation of a compelling, long-term vision for plant science that is aimed squarely at attracting the attention of U.S. policy makers. Five areas for immediate investment are highlighted in the resulting document, *Unleashing a Decade of Innovation in Plant Science* ("the Decadal Vision"): (1) increase our ability to predict from plant genomes all plant traits in diverse environments; (2) translate this knowledge to solve agricultural problems; (3) realize the potential of diverse plant-derived chemicals; (4) increase our ability to handle huge data sets; and (5) train future plant scientists to meet these goals. Finally, to keep all this on track, the Decadal Vision proposes a national council to provide oversight.

We have a long way to go, but in February, with passage of the Farm Bill, Congress set aside $200 million in new money to establish the Foundation for Food and Agriculture Research (FFAR). Modeled after the NIH foundation, FFAR is intended to be a public–private partnership that supports research throughout the agricultural space and across the continuum from basic to applied (see article on page 17 of this issue). This is new territory for American plant and agricultural scientists, and we look forward to a positive outcome for this experiment.

The United Kingdom has an impressive plant research history, and the country is efficient with its plant research funds as measured by the number of publications per pound sterling allocated. However, funding is up and down, and plant scientists in the United Kingdom are therefore urging for strategic funding and more stability in the plant research infrastructure. A January 2014 report by the UK Plant Sciences Federation (UKPSF) titled *UK Plant Science: Current Status and Future Challenges,* is forward thinking by proposing to increase translation of basic plant biology to application through increased public–private partnerships and to decrease unnecessary, burdensome regulation of new agricultural products. And, just as proposed in the Decadal Vision on this side of the Atlantic, the UKPSF proposal calls for increased training in plant biology customized to the challenges we face in the next few decades, challenges that are nicely stated in the report's opening salvo pleading for more plant research support:

> *"The world faces rapid global population growth, climate change and the depletion of natural resources. Improving sustainability and supporting economic growth are global and domestic priorities. Plant scientists have a vital role in developing better food and non-food production systems, biodiversity management and conservation of the natural environment. The need for solutions from them has never been greater."*[1]

Thus, it is clear that the United Kindgom and the United States are on the same page with respect to their visions; perhaps we can coordinate and cooperate to create synergy in outcomes.

What about the rest of Europe? Horizon 2020, a comprehensive plan released in December 2013 by the European Union (EU), describes the consolidation of three previously separate funding programs into one. Although this document does not announce increased funding for plant research specifically, it does call for nearly 40% of the EU's research budget to be spent on societal challenges. This is an area in which European plant scientists ought to be highly competitive. But even with that glimmer of hope in the EU's long-term budget plans, it is fair to say that *basic* plant research in the European community may still be in jeopardy (see briefing for European Plant Science Organization at http://www.epsoweb.org/file/1592).

The present and future for plant science research in South America is spotty. Brazil and Chile both increased overall research support that benefits the plant sciences, and in both countries the job market for plant scientists looks good. Brazil enhanced training though a mentoring abroad program called Science without Borders (http://www.cienciasemfronteiras.gov.br/web/csf-eng). Chile is reaping the benefits of its Millennium Initiative a decade ago, and support for research in plant sciences increased 50% in just the past three years. Sadly, I have been told (but have not been able to confirm) that funding for plant science in Argentina has steadily decreased over the past decade; however, there is still merit in expressing a long-term vision, even while the short-term economic prospects are challenging at best.

In February, the Mexican Department of Agriculture stated in a press release that it will invest more than $225 million on research and technology to increase agriculture yields and productivity (http://www.sagarpa.gob.mx/saladeprensa/2012/Paginas/2014B079.aspx). However, the aim is to increase the productivity of the food industry by supporting investment and technological development applied to the rural sector and does not seem to be for basic plant research.

Along with Mexico and many other countries, Saudi Arabia shares the need to solve the problem of agriculture on arid land. Saudi Arabia made major investments in abiotic plant stress research and spent millions to create a world-class center for desert agriculture (http://cda.kaust.edu.sa/Pages/Home.aspx) at their King Abdullah University of Science and Technology, a gem in the desert. ASPB members Mark Testor, Heri Heribert, and Nina Federoff were recently brought on board to provide vision for this center. Translational research or direct support of agriculture production seems to be a common theme for many of our ASPB member nations.

Our Pacific Rim members also have mixed news regarding future support for plant biology. South Korea has not only maintained its investments in plant research during a fiscally austere six years, but also ASPB member Hong

continued on page 4

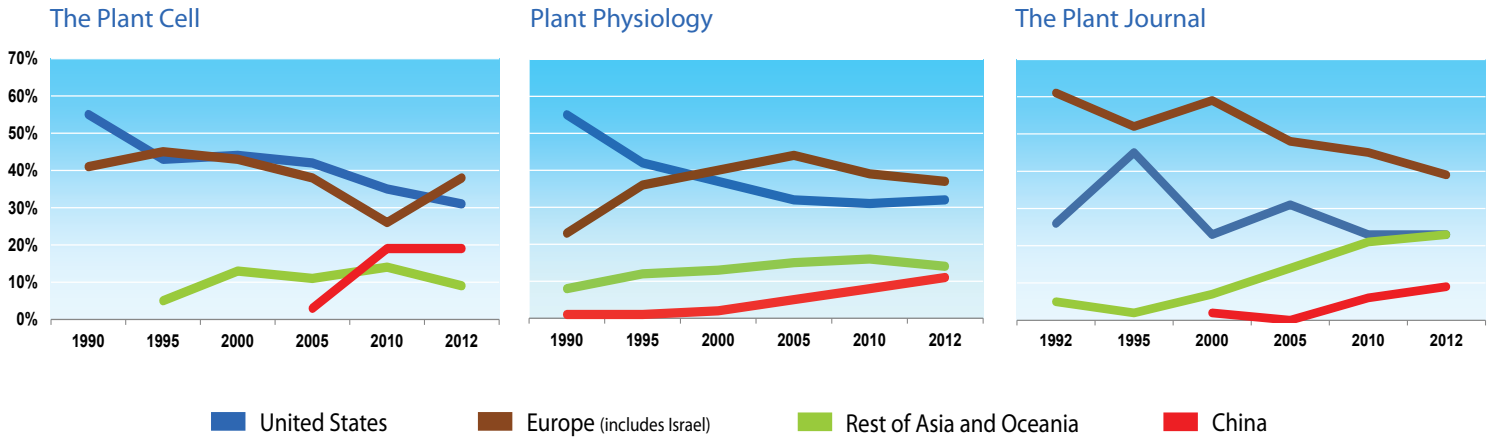


Figure 1. *Percentage of articles published by geographic location in three top plant science journals. Data were collected every five years from 1990 to 2010 and from 2012, except for* The Plant Journal, *which did not exist in 1990. Three issues from each year were included in the analysis, and the country of origin was determined by the institutional affiliation of the corresponding author.* ANALYSIS PERFORMED BY PATTI LOCKHART, ASPB MANAGING EDITOR.

PRESIDENT'S LETTER
continued from page 3

Gil Nam was recently charged to build a new plant research institute in South Korea. No major plant biology initiatives are planned for Japan, although according to my sources, plant researchers in Japan are holding their own—barely. As in other Asian countries with strong traditional agriculture, Taiwan had been actively supporting plant science for years. A 15-year National Science and Technology on Agricultural Biotechnology program (and its extension) was launched in the 1990s, significantly boosting funding for agricultural research in general. Unfortunately, the government recently decided not to renew this program after its successful conclusion. Efforts are now under way in the plant science community to raise government awareness on the impact of agriculture in the sustainable development of the region. Because Australia largely escaped the global financial crisis, it was surprising to learn that plant science funding in Australia is tight and there is no new money. Indeed, this year federal funding of the Australian Research Council and for early and mid-career fellowships was severely cut, with likely dire consequences for plant biology.

At the time of this writing (the new Lunar Year), ASPB's International Committee was not able to obtain any official announcements of plant research programs in China. But whether Chinese government decisions are transparent or not, it is evident that China is aggressively promoting and delivering plant science research. To illustrate this Chinese commitment, Figure 1 shows a breakdown of publications based on geography. The greatest percent of peer-reviewed research published in three top journals dedicated to plant biology comes from U.S. and European labs. However, the trend for European papers in the European-based *The Plant Journal* is steeply downward, and likewise, the trend for U.S. papers in ASPB's journals *The Plant Cell* and *Plant Physiology* is also steeply downward. The reason is obvious. Accompanying this *downward* U.S./European trend is a steep *upward* trend in Asian papers in these journals. Chinese authors are mainly publishing in *The Plant Cell* and *Plant Physiology,* whereas authors from elsewhere in Asia and in Oceania are predominantly publishing in *The Plant Journal*. China created the 1000 Talents program (http://www.1000plan.org), which opens up big platform science labs that include many western plant scientists, and Chinese graduate students and postdocs trained abroad are finding attractive permanent research positions back home. China is calling home its talent, and this is changing the landscape in global plant science research.

Increases in international commitments to plant science research help us all, and so I foresee a future in which the broadest range of partners is actively engaged. I hope that ASPB, with its fraternal societies around the globe, will fully participate in championing this exciting future of worldwide plant science. ■

1. https://s3-eu-west-1.amazonaws.com/sbwebsite/pdf/UK_Plant_Science-Current_status_and_future_challenges.pdf

Arabidopsis Conference 2014 Expands Career Development for Early Career Researchers and Under-Represented Minorities

BY JOANNA FRIESNER, Coordinator, North American Arabidopsis Steering Committee
DOMINIQUE BERGMANN, North American Arabidopsis Steering Committee, and Chair, NAASC Early Career Researcher Subcommittee
TERRI LONG, Co-Chair, NAASC Under-Represented Minority Subcommittee
SIOBHAN BRADY, North American Arabidopsis Steering Committee, Co-Chair, NAASC Under-Represented Minority Subcommittee

Arabidopsis thaliana has been at the forefront of basic plant science research for the past several decades and serves as a reference species for both research and international collaboration. Critically, paradigms established using Arabidopsis are applied to crop species, thus paving the way for rational improvements in a variety of agricultural traits. The success of this research field has been greatly facilitated by the openness and collegiality of the community fostered through multiple international forums including the International Conference on Arabidopsis Research (ICAR). ICAR, the annual main Arabidopsis meeting featuring a wide range of research topics, is hosted by volunteer members of the Arabidopsis community in various international locations.

In 2014, the North American Arabidopsis Steering Committee (NAASC) will host the 25th ICAR at the University of British Columbia in Vancouver, Canada. NAASC, composed of faculty members elected by the Arabidopsis community, has long recognized that the participation of scientists from diverse backgrounds is critical to scientific excellence. In the past 10 years, for example, North American ICARs have had, on average, nearly twice the number of female invited speakers (range: 24–50%) as typical international ICARs. NAASC has also made additional efforts to enrich diversity in the Arabidopsis community through applications of funding for early career faculty and scientists from backgrounds that are underrepresented in U.S. science. NAASC-secured funding supports early career researchers (ECRs) and U.S. Under-Represented Minorities (URMs) and faculty that teach at Historically Black Colleges and Universities (HBCUs), Minority Serving Institutions (MSIs), Hispanic Serving Institutions (HSIs), and Tribal Colleges and Universities (TCUs), collectively. As of January 2014, NAASC has provided full funding awards to 60 URMs/URM-related teaching faculty and partial ECR awards to 117 individuals to enable their participation in ICARs around the globe. Here, we would like to highlight our programs and new approaches to encourage participation and positively influence the academic careers of ECRs and URMs at the 2014 Arabidopsis meeting.

Meeting the Needs of ECRs and URMs in the Plant Sciences

While inclusion is the first step, a successful career in academia requires more than simply being present. NAASC continues to assess programmatic impact and implement new approaches to increase visibility of ECRs and URMs at the Arabidopsis meeting. For example, we intentionally structure North American programs to feature a significant number of scientists at earlier career stage. For ICAR 2014, earlier career invited speakers make up 45% of the concurrent session program. Many of these early career speakers will act as concurrent session chairs. Our reasoning for that approach was twofold: (1) since concurrent session chairs select the remaining speakers from submitted abstracts, junior-level chairs may have a slightly different view of what constitutes "interesting research," which may produce a novel program, and (2) this approach gives earlier career speakers a chance for exposure at a high-profile international meeting and may also facilitate new collaborations and dialogue between those chairs and conference participants.

Beyond selecting ECRs for invited speaker slots, NAASC engages ECRs from the broader community at ICARs through the development of conference programs that feature numerous speaking opportunities for attendees. The 2014 ICAR concurrent session program includes 60 longer and 30 shorter oral poster talks, all to be selected from submitted abstracts, and session chairs will be asked to give priority, when possible, to ECRs for abstract selection. Based on positive feedback collected via community surveys following ICAR 2011, NAASC elected to incorporate the new oral poster category within the 2014 conference program. These two-minute presentations (think "speed-dating" for scientists) will enable additional ECRs to gain public exposure through a brief introduction to their research, ideally to drum up audience interest followed by more in-depth discussions during later poster sessions. To specifically highlight graduate students, NAASC-organized ICARs have, since 2004, included an Emerging Scientist Luncheon featuring one graduate student from each

continued on page 6

ARABIDOPSIS CONFERENCE
continued from page 5

concurrent session, selected by the session chair on the basis of excellent research abstract. The informal networking event typically also includes invited speakers and NAASC members, and graduate students receive a certificate that can be included in their CV.

NAASC members have also sought funding from the U.S. National Science Foundation to fully support participation by minorities that are underrepresented in science in the United States, and by faculty that teach plant biology at U.S. MSIs (collectively, 'URMs'). Since 2004, we have fully funded attendance at ICARs for 60 URMs. At all NAASC-organized meetings, and several abroad, we have organized informal URM awardee networking luncheons that include NAASC members and representatives from U.S. funding agencies. The events allow awardees to meet researchers from other institutions and develop networks with each other, with faculty, and with funders. We began conducting online surveys of URM (and ECR) awardees in 2011 and have learned that the opportunities for awardees to attend ICARs, including networking events, have led to new scientific collaborations, publications, curriculum development, grant submission, and even future employment.

Arguably the most important information we receive from these annual surveys is insight into where our efforts are successful and where they fall short. Based on the responses we receive, we propose ways to change our practices to better suit the needs of those we are trying to engage in the Arabidopsis community. Combining survey data from both URMs and ECRs, we were able to identify key areas for improvement for ICAR 2014: (1) providing more opportunities to interact with researchers, (2) providing opportunities to learn of, and prepare for, future positions, and (3) providing information on funding and how to be successful in obtaining it. To increase participation by URMs and ECRs, we have initiated two new career-development programs for 2014 specifically to address key concerns of these groups. It has been shown that establishing cohorts of people with similar interests and concerns is one of the most effective ways of keeping people motivated, engaged, and able to weather difficult periods in their careers. By collecting participant information before the meeting, holding these workshops at the beginning of the meeting, and including informal social events throughout the meeting, participants will be able to explore the large ICAR meeting having already established cohort networks. The conference registration process allows attendees to indicate interest in joining the URM and ECR workshops. Organizers will then survey those interested to help tailor the programs to the needs of attendees.

Underrepresented Minorities Program for ICAR 2014

NAASC formed a Minority Affairs Committee (MAC) in the past year led by co-chairs Siobhan Brady (NAASC member, UC Davis) and Terri Long (community member, North Carolina State University). As in past years, NAASC will provide full funding awards to U.S. URMs through a competitive process (applications due April 7). The American Society of Biochemistry and Molecular Biology (ASBMB) undertook an initiative in 2011 to identify the perceived barriers encountered by faculty members from groups that are underrepresented in the sciences and by faculty members at MSIs. Relevant to the Arabidopsis community and researchers at all levels, these barriers included a lack of support networks for minority PIs, a leaky pipeline of minority talent, and a lack of URM-directed initiatives. Under guidance of the MAC at the American Society of Plant Biologists (ASPB) and based on recommendations from the ASBMB initiative, NAASC has decided to focus on the following objectives for a new, URM-focused workshop at ICAR 2014:

1. Identification of networking contacts from within the Arabidopsis community.
2. Development of a strong cohort and facilitation of communication among the cohort after ICAR.
3. Workshops dedicated to the experience of science from the perspective of three URM scientists including at the graduate, early career, and mid-career levels.
4. Opportunites for URMs to gain exposure to career options in science, funding opportunities, such essential skills as presenting themselves and their work well, and workshops from successful pre-tenure and established scientists.

Activities at ICAR 2014 will include informal networking meals and social events, research presentations and discussions, and interactions during the URM workshop. In addition, URM participants will join the ECR-specific workshop (described next) for a larger workshop session. Additionally, we will establish a Facebook page for all URM participants to continue their interactions after the meeting, and we will exchange the list of awardees with ASPB so URM scientists can be aware of other URM plant researchers. We also plan to cross-advertise this workshop on ASPB's Minority Affairs Committee webpage. Participation in the URM first-day program is not dependent on receiving URM funding, but to facilitate networking and to tailor the program to the interests of this year's participants, pre-registration by June 1 is required. During the registration process, participants may indicate their interest in this workshop and organizers will follow up to develop the program.

Early Career Researchers Program for ICAR 2014

In addition to ECR funding opportunities (http://arabidopsisconference2014.org/early-career) to attend the 2014 ICAR (applications due March 31), there will be a special ECR program partly in conjunction with the URM workshop on the first day of ICAR 2014. We recognize that "early career" is really two separate populations—scientists at the beginning of their training (ECR1-graduate students and young postdocs) and scientists making transitions into independent positions (ECR2-late postdocs, early faculty). At ICAR 2014, we will have an informal networking lunch followed by larger career

continued on page 12

Postcards from Portland

Willamette Valley Wines

BY CRISPIN TAYLOR
ASPB Executive Director

Day three of our sojourn in the Portland area saw us heading for one of its better known plant-associated attractions: the Willamette Valley and its many wineries (http://willamettewines.com/about-the-valley/regional-map).

We had reserved a car ahead of time, so it was just a short walk from the hotel to our ride for the day. After designating a driver (me), we set off for the 40-minute drive along Route 99W from Portland to our first stop: Joe Dobbes Wines in Dundee, Oregon.

In the tasting room at Joe Dobbes, we met a former chemistry major from our alma mater, Michigan State, who'd obviously found his life's calling a little farther west. Given that it was relatively early in the day and the tasting room action was slow, we leveraged our Spartan connection for an impromptu tour of the facilities. As it turned out, things were just being readied for the 2013 grape crop—mostly pinots noir at this particular winery.

Our next stop was the Erath Winery (http://www.erath.com), which was a short drive farther southwest along Route 99W and a sharp right turn into the hills above Dundee. Again, the tasting room was relatively quiet, and we had a long and pleasant chat with our hosts. In addition to highlighting the many worthy features of Erath's own wines, they were curious to hear about the other wineries we planned to visit. True to the generous nature of many who we met that day, when they heard that the Bella Vida winery (http://bellavida.com) was not on our list, they urged us to reconsider. "It's just across the road," they said, "and they have a really interesting approach to making wines that we think you'll enjoy."

They were right: Each year, Bella Vida provides the same estate-grown pinot noir grapes to three different vintners and invites each of them to create a wine that they feel brings out the grapes' best characteristics. Given that the vagaries of climate and *terroir* were not a factor, it was remarkable how different each of these wines tasted.

It was a slightly longer drive—and a few wrong turns—before we found our next winery: Remy Wines (http://www.remywines.com) in McMinnville. Nestled close to the railroad tracks, Remy Wines is actually housed in two small warehouse units—the tasting room in one and the wine-making equipment in the other. Owner Remy was more than a little distracted because the season's first pinot noir grapes had just arrived at her doorstep. It was truly a pleasure to watch Remy herself operating the forklift to load the grapes into the sorting machines. Remy's delight at the start of the new wine-making season was obvious when, a short while later, she excitedly offered the tasting room crowd a taste of the year's first pressings.

So it was with the sweet taste of freshly squeezed pinot grape juice in our mouths that we turned back on to the main road into Portland, joining the many others who'd spent the day perusing this most engaging and delicious region. ■

Child Care at Plant Biology 2014

ASPB is happy to announce that on-site child care will be provided at Plant Biology 2014. We have contracted with A+ Child Care to You to be the official child care provider for 2014.

A+ Child Care to You, established in 2007, is committed to providing high-quality and affordable on-site, event-based child care that promotes play, fitness, and education.

A+ Child Care to You works exclusively with individuals who pass our thorough screening process and have a passion to learn side-by-side with children, are dependable, and demonstrate professional work ethics. As part of our screening process, child care providers

- complete a background criminal check
- provide a minimum of three references related to working with children
- are 18 years of age and older
- have a state requirements card for handling food
- complete a face-to-face interview
- have up-to-date first aid/CPR training.

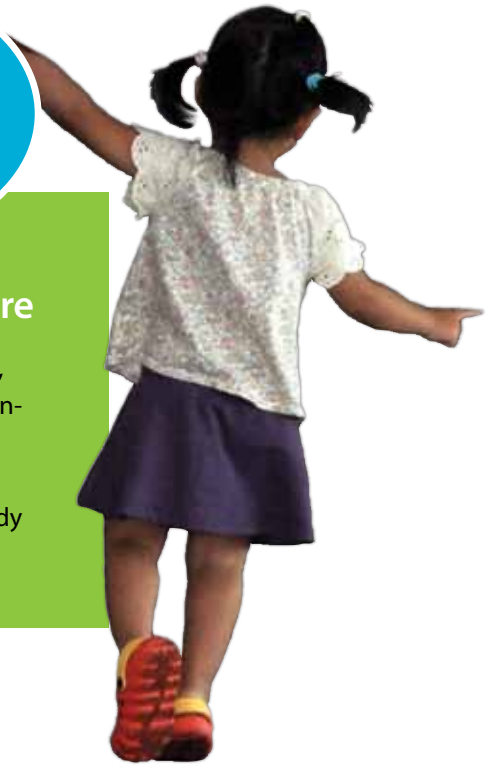
This year at Plant Biology 2014, there will be two rooms available, and children will be divided into age groups. Activities will be geared toward the needs of each age group and offer children the opportunity to play fun games, engage in physical activity, and learn new skills.

Let's have fun with

- coloring, water painting, drawing, or doodling
- crafting with glue to make hats, puppets, robots, space creatures, or animal habitats
- playing a variety of games such as Kids Cranium, Chutes and Ladders, Checkers, and Twister
- enjoying classic games like duck-duck-goose, pin the tail on the donkey, or musical chairs
- building play structures with Lego bricks, Polly Pockets, or Thomas trains
- listening to or reading stories that take us into an imaginary world
- and much more!

Children have the opportunity to enjoy a variety of wonderful art projects. Young artists are encouraged to describe their project, and we help them document their words through writing and digital photos. The children's special artwork will be shown to parents at the end of the event for families to take home. We may display artwork online only if approved by parents. ■

Please register for child care at http://my.aspb.org/2014childcare.



Special Highlight for 2014 Child Care

In addition to child care during the meeting sessions, we are planning a Kid's Science Party during the Opening Reception on Saturday, July 12, 6:30 p.m. to 8:30 p.m. Make sure to register your child for this exciting party, which will include science-related events, goody bags, and balloons.

LOOKING BACK
continued from page 1

Portland, Oregon. Those who were there may remember that when one of the speakers walked to the stage, a little voice proudly piped up: "That's my daddy!"

Now I am back to attending the Plant Biology meeting, and there is still more I enjoy:

The Minisymposia

I enjoy listening to cutting-edge research and "hot topics" in fields other than the one I work in. Since topics vary from year to year, it is never boring. Never mind that sometimes two interesting talks are scheduled at the same time or that the interest is so great that the rooms overflow—for a presenter, it is great to see all that interest!

Of course, I also love to present. As I prepared for my very first minisymposium talk as a postdoc, I received an e-mail requesting lettering in the slides large enough to be seen in the back of a room that held 350 people. I panicked—350 people! And yes, the room was packed. Two years ago, when I actually chaired a minisymposium, I found out that even full professors who are established scientists and experienced speakers are nervous before their presentations!

The Poster Sessions

They are huge! But they are a terrific opportunity for postdocs and students to present their data and get great feedback from fellow attendees. Every year, I have students, sometimes even undergraduates, present, and every year they are totally giddy and full of ideas after their poster sessions. They see that their research matters.

The Workshops

The variety of workshops is just amazing. I send my students to workshops on paper or grant writing, on teaching, or on job perspectives. I always bring my female students to the women in science luncheon, because those luncheons are inspiring and fun—and because they show that while it may not be easy, it is possible. The guys, though, tend to refuse my offer!

The Networking

It is surprisingly easy to meet people at Plant Biology meetings. Some are new acquaintances; some are old friends I haven't seen in years. Science is the glue that brings us back together. I introduce my students to these friends because it is good for their future to practice networking, and over dinner they realize that when we are not tense about deadlines, classes, or presentations, we can actually be fun!

The Parties

I remember dancing until they kicked us out when we were graduate students!

The Location

Portland, Oregon, was just voted best U.S. city (msn.com, 2/1/2014).

So Why Do I Keep Coming Back?

Plant Biology is the first meeting I ever attended, the one where I developed into a scientist, the one where I can always get candid feedback on my research, and the one where I made friends—some for a lifetime. Most important, it is a great opportunity to show my students that science is fun! ■

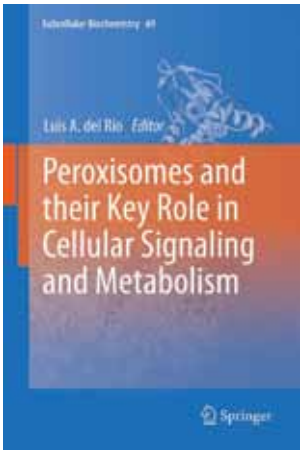
PHOTOS BY NICOLE BURKHART

From Around the Web

As anti–genetically modified organism (GMO) legislation pops up around the world, the tiny island of Hawaii, colloquially known as the Big Island, was ground zero for one of the latest local debates on the issue. A bill introduced in the Hawaii County Council in May 2013 called for a ban on the cultivation of all new GM crops and notably excluded GM papaya, which is important to the local economy. This local legislative initiative reached the U.S. national and world consciousness when the *New York Times* (NYT) ran an article in its January 4, 2013, issue by Amy Harmon (http://nyti.ms/1lswvAO). The article, "A Lonely Quest for Facts on Genetically Modified Crops," traces the efforts of Hawaii County Councilman Greggor Ilagan to cast an informed vote on the then-proposed ban. Featured in the article were ASPB members **Jon Suziki** of the U.S. Agricultural Research Service and **Pamela Ronald** of the University of California, Davis. Despite protests from the local scientific community, the ban passed and is currently being challenged in court by Monsanto and several other companies. Upon publication of the NYT article, ASPB contacted the councilman to offer its assistance.

Several weeks later and more than 7,000 miles away, the work of **Cathie Martin,** ASPB member and editor-in-chief of *The Plant Cell,* was featured by BBC News (http://bbc.in/1aPnIYo). Cathie, of the John Innes Centre in Norwich, UK, and her team developed a GM tomato that produces anthocyanin, an antioxidant also found in blueberries that is thought to have anticancer properties. Because of European Union restrictions on the cultivation of GM plants, Cathie has had to turn to Canada to produce her tomatoes. Working with an Ontario company, New Energy Farms, large-scale production is currently under way.

Finally, the *Seattle Times* profiled the work of ASPB Science Policy Committee member **Norman Lewis,** director of the Washington State University Institute of Biological Chemistry (http://bit.ly/1gocMyQ). Born out of the difficulty of extracting biofuels from woody plants, Norman's work looks to produce commercial quantities of specialty chemicals such as 2-phenylethanol, an aromatic alcohol found in roses and other fragrant plants, from GM poplar trees. The goal is to be able to extract useful chemicals and then use the waste material to generate biofuel. ■



ASPB Member Luis del Rio Authors New Peroxisomes Book

ASPB emeritus member Prof. Luis A. del Rio has published a new book, *Peroxisomes and Their Key Role in Cellular Signaling and Metabolism* (Springer, ISBN 978-94-007-6889-5). Containing 18 chapters written by different international specialists on these cell organelles, the book presents recent advances in the function and metabolism of peroxisomes from human, animal, fungal, and plant origin and their metabolic interconnection with other cell compartments, showing the central role played by peroxisomes as cell generators of different signaling molecules involved in distinct processes of high physiological importance. The book is co-dedicated to the memory of Prof. Harry Beevers, a distinguished ASPB member who discovered the β-oxidation system in plant peroxisomes (glyoxysomes) in 1969, seven years before its discovery in animal peroxisomes. This seminal discovery paved the way for our understanding of the metabolism and function of peroxisomes. ■

ASPB members share a common goal of promoting the growth, development, and outreach of plant biology as a pure and applied science. This column features some of the dedicated and innovative members of ASPB who believe that membership in our Society is crucial to the future of plant biology. If you are interested in contributing to this feature, please contact ASPB Membership at info@aspb.org.

Sunita Yadav

Professional Title: Senior Research Fellow
Member Since: November 2012
Place of Work or School: Indian Institute of Technology, Kharagpur, India
Research Area: Molecular biology and genetic engineering

What would you tell colleagues to encourage them to join ASPB?

ASPB is a great organization. It has brought together eminent and renowned plant biologists as well as undergraduates, graduates, postdocs, and other researchers linked to various organizations from around the globe. It is a unique society that has created a space for young scholars to appreciate, acknowledge, and share their novel concepts and findings, to excel, and to go beyond boundaries in the field of plant biology. The major reasons I would encourage someone to join ASPB include the following:

- ASPB organizes many conferences throughout the year to provide you with a great platform to both share your knowledge and aid in sharpening your approach to and thinking about plant science.
- It provides excellent sources of funding and fellowship to encourage women, young scholars, and students at various phases of their study.
- It helps you develop a sound network of researchers from all over the world.
- ASPB provides a source of career development via job postings to aid in finding a new job.

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

The next big thing in plant biology is to make the process of transformation in all the species of plants easy and specific, including specific integration of the gene in the genome of a plant, and to be aware of the site of integration before the infection of DNA in plants. This would definitely strengthen the research in plant biology in an absolute manner.

What advice would you give to a plant scientist just starting out?

My advice would be to think about what effect your research might have on human beings, plants, and climate.

Why has being a member of ASPB been important?

As a member of ASPB, my responsibility is to inform people about the important contributions the Society has made in the area of plant biology. It is a unique society, dealing with the various challenges in plant science. It is also my duty to encourage people to join the Society for great career development opportunities in plant biology.

Was someone instrumental in getting you to join ASPB?

No, I joined after reading about ASPB in *Plant Physiology* and *The Plant Cell.*

Have you enhanced your career using ASPB job postings or through networking at an ASPB function?

Yes, I have developed a good network with a number of people working in different universities across the globe over the past several months.

What are you reading these days?

I am reading publications related to abiotic stress and gene regulation.

What are your hobbies?

My hobbies include writing blogs (I just started a new blog to showcase my curiosity and ambitions about plant science at http://natureveil.blogspot.in), listening to music, and cooking.

What is your most treasured possession? Why?

From early childhood, I was very curious, especially about the things that surround us such as flowers and plants, birds and animals, and the stars in the sky at night, just to name a few. I consider my curious nature to be my most treasured possession.

What do you still have to learn?

Researchers learn throughout their lives and share their knowledge with students. I still have to learn the genetics, evolution, and mechanism of plants in depth in terms of practical experience.

How has being a member of ASPB helped you in your career?

I developed a network of young,

continued on page 12

MEMBERSHIP CORNER
continued from page 11

experienced researchers in plant biology and shared my queries and suggestions with them, which really helped me to answer many questions related to my research. This would not have been possible if I was not a member of ASPB.

Do you still read print journals?

Yes, I still read print journals! I generally read them at home after work or in the library.

Has there been an issue in plant biology where you thought ASPB should be involved or that led you to consider being active in the governance of ASPB?

No, as of now my research work is in progress. I have already benefited from ASPB so much, and that is quite enough reason for me to be active in the governance of ASPB.

What do you see as the most important role for scientific societies such as ASPB?

The most important contribution of a society such as ASPB is to appreciate the findings and the contribution of researchers and to help get sufficient funding for plant science research. Also, ASPB can help develop the interest in young students about plant biology. ASPB is working efficiently on all these fronts.

What do you think is the most important discovery in plant biology over the past year?

The most important discovery is the use of the TALE (transcription activator-like effector) and TALENs (transcription activator-like effector nucleases) tools in plant biology research.

What could ASPB do better?

ASPB is doing excellent job as a plant biology society, organizing and managing various programs at different level. One suggestion would be to organize ASPB members who are faculty members and researchers in various academic institutes as guest lecturers to increase awareness among young students about plant biology.

What is the most interesting thing you have learned this year?

I learned about the TALE and TALENs tools and their application in plant biology research.

In your opinion, what was the best article in an ASPB publication in the past year and why?

"The Perennial Ryegrass Genome Zipper: Targeted Use of Genome Resources for Comparative Grass Genomics," *Plant Physiology,* 2013, 161: 571–582. I am working on the stress physiology of plants and noticed the effect of polymorphism on the differential response of the gene. Perennial ryegrass is the ancestor of the grass family, and this source of information is very useful for the evolutionary study of the gene and how its adaptation during the course of cultivation may influence the genetic makeup with respect to other Poaceae members. ■

ARABIDOPSIS CONFERENCE
continued from page 6

sessions (joined by URM participants), and then small breakout sessions tailored to the needs of the ECR1 and ECR2 groups. Both ECR1s and ECR2s can benefit from programs that target essential skills like networking within the community, communicating science to the public, and time management, but the groups also have unique needs. For ECR1 members, we will focus on career options in science and how to present yourself and your work well (e.g., writing effective CVs, papers, and grants; giving great posters and talks). For the ECR2 group, we will have successful pre-tenure and established scientists tackle such issues as how to get an independent research position and thrive in it, what mentoring and management techniques are effective, how to establish collaborations and work with people whose skill sets differ from one's own, and how to find funding in this challenging time. Because the Arabidopsis community is international, funding opportunities will vary significantly. We will invite representatives from international funding agencies (e.g., NSF, DFG, USDA, AFGN, BBSRC, Genome Canada) to participate, as these groups often send representatives to ICAR. Participation in the ECR first-day program is not dependent on receiving ECR funding, but to facilitate networking and to tailor the program to the interests of this year's participants, pre-registration by June 1 is required. During the registration process, participants may indicate their interest in this workshop and organizers will follow up to develop the program.

Early career researchers and underrepresented minorities represent the future of Arabidopsis research. NAASC efforts to continually increase participation of these groups in the international Arabidopsis conferences help ensure the advancement and longevity of basic and applied plant biology. More information about the URM and ECR programs and funding opportunities for ICAR 2014 can be found at http://arabidopsisconference2014.org/.

ICAR 2014 Funding

URM—applications due April 7. http://arabidopsisconference2014.org/us-minorities.
ECR—applications due March 31. http://arabidopsisconference2014.org/early-career.

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.

Steve Kay

Professor and Dean, University of Southern California

BY SANDRA SMIESZEK
ASPB Student Ambassador, Royal Holloway, University of London

It is certainly my great pleasure to introduce Steve Kay, holder of the Anna H. Bing Dean's Chair and professor of biological sciences, leader, educator, and innovator. He is a member of the National Academy of Sciences and a fellow of the American Association for the Advancement of Science. This interview provides us not only with the story of his expansive career, but also shows how his career influenced research and education. Steve is a renowned expert on circadian rhythms. He spent two decades identifying the photoreceptors, genes, and complex networks that make these internal clocks tick. He transformed the field of molecular biology. His famous tricks include the blinking mustard plants and glowing fruit flies to explore the molecular genetic basis of circadian clocks in plants, flies, and mammals. His mantra as the 21st dean of USC Dornsife—educate, enrich, and empower—sums it all up.

What influences directed you to your specific area of research? Who influenced your scientific thinking early in your career, and how?

Steve Kay

I became interested in biology early in my childhood. It all began on the small island of Jersey, off the coast of Normandy. Many of my family members were fishermen, and I spent a lot of time on commercial boats. The oddities of marine life, coupled with teachers and my first microscope, predestined my career direction.

Certainly my supervisors pushed me to "think big." Trevor Griffiths, who was my PhD supervisor, introduced me to the world of plants. It was during my doctoral studies that I discovered that light regulated the expression of the gene that produced the enzyme for chlorophyll synthesis. These were the beginnings of the day/night cycle observations that set the scene. It was Trevor who advised me to pursue my research in the United States. That is when I started a postdoctoral fellowship at a lab of Nam-Hai Chua, who focused on light-dependent gene expression in plants. He certainly taught me how to approach more than one thing at a time. These were incredibly exciting times when we worked on the first vectors for transgenic plants.

What scientific breakthrough influenced your research directions, and why/how?

My "eureka" moment was definitely during my postdoctoral studies. Light signals change in gene expression patterns. I am thinking here particularly of chlorophyll a/b binding CAB gene. That is when we conducted the experiments around the clock. The discovery essentially showed how the circadian clock regulated CAB. It was 1985, and that was the first direct evidence for the role of circadian rhythm exerting its effect at a molecular level. That was astonishing.

What was the most difficult stage in your career?

I had several "science is really hard . . ." long periods of failure intermitted by splices of success. I can say here that cloning of the TOC1 gene took us quite some time—five years (published in *Science* in 1995). Of course, that was back in the day. It took many more years to elucidate what the gene does.

What recent developments in basic plant science are influencing policymaking bodies today?

I think it varies a lot by region. It seems more difficult to convince policy makers that funding research to gain knowledge in reference species is still valid and crucial. Overall, less than 1% of general funding goes to plant science versus around 30% in China and 20% Europe. That is entirely different from what it was and is supposed to be. I would like to highlight this and call for

continued on page 14

LUMINARIES
continued from page 13

appreciation of the critical role of robust funding for the basic sciences, which, if provided, will lay the foundation for improvements in health, agriculture, and the environment.

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

I would advise students to be concerned wide and go deep.

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

I look for passion, effort, intellectual capability, discipline, and horsepower.

"The challenge for biologists is to become comfortable with mathematical tools." Could you elaborate?

Of course. Beautiful examples of what can be done specifically in our domain come from Andrew Millar. Nowadays it is instrumental for biologists to become comfortable with mathematical tools. At the same time, we have to be comfortable with biology becoming a predictive science. Great emphasis should be placed on bottom-up approaches and painstakingly crafted models. Top-down approaches with the present capabilities should clearly be incorporated, but it is not one instead of the other. It seems the present mission of systems biology will be the fusion of both.

"I've watched agog as the word MOOC has proliferated and spiraled into the higher education buzzword of the year." Speaking of the new wave of educators, what is your stand on the evolution of Coursera?

It is fantastic, yet it will never be a replacement. As useful as it can be, it is superficial at the same moment. I have a direct example coming from John Hogenesch, who runs one of these classes (https://www.coursera.org/course/genomescience). The numbers were astonishing (10,000 people enrolled, 4,400 participated, 822 took the exam) compared to the numbers that come to class, which range in the 20s. Yet looking at the numbers, it seems these are professionals who participate. The opportunity is indescribable, and after all, who hasn't used Kahn Academy? It seems like the optimal refreshment.

With genomics monopolizing attention, what do you think is the next buzz domain that will take over in the years to come?

I think high-throughput sequencing in all shapes and sizes, together with posttranslational studies, will keep us busy in the upcoming years.

"Reductionism, as a paradigm, is expired, and complexity, as a field, is tired. Data-based mathematical models of complex systems are offering a fresh perspective, rapidly developing into a new discipline: network science." What can network science do for plant biology in reality?

That is the way to go, and I am all for these studies—as long as they complement previous research. Moreover, there is true potential in the study of the dynamics of biological systems, such as that done by Trey Ideker. This, coupled with the wealth of high-throughout data, is truly exciting.

Who should and will fund future molecular biology research, and what is the interaction between government funding/private and commercial/charitable donations?

That truly varies based on region and project, so it is difficult to elaborate.

Once speaking of the present stand on sequencing, you made a comment: "It's comparable to Darwin's theory of evolution." Do you agree now?

Certainly, it is a massive revelation. Nevertheless, it is complementary. It is the variation beyond nucleotide that constitutes lots of the present conundrums that one has to focus on.

On a light note, what is your favorite book?

Do Androids Dream of Electric Sheep? by Philip K. Dick. ■

Cathie Martin Named 2014 BBSRC Most Promising Innovator

Cathie Martin

ASPB member and Editor of *The Plant Cell* Cathie Martin has been named the BBSRC 2014 Most Promising Innovator in recognition of her work on the enhancement of bioactives in crops for comparative nutritional assays and nutritional improvement. Cathie's colleague at the John Innes Centre, Eugenio Butelli, shares this award with her. The award, one of the three BBSRC (Biotechnology and Biological Sciences Research Council) Innovator of the Year awards, recognizes scientists whose innovations reach beyond the lab to deliver social and economic benefits and reflect the breadth of the benefits delivered by BBSRC's investment in U.K. bioscience. More information about Innovator of the Year can be found at www.bbsrc.ac.uk/innovator.

Dr. Moehs Goes to Washington

BY CHARLES P. "MAX" MOEHS
Arcadia Biosciences

In 1962 when I was born, the concentration of carbon dioxide in the atmosphere stood at 316 parts per million (ppm). Now, nearly 52 years later, the carbon dioxide concentration in the atmosphere has reached 400 ppm. I can't see it, taste it, or feel it, but through the power of science I know it is there and still steadily rising. The evidence is unequivocal that this increase is due to the burning of fossil fuels by humans. It is strange to think that because of this vast, uncontrolled experiment that humans are conducting with the Earth's atmosphere, the world into which I was born, in a certain sense, no longer exists.

To raise awareness among U.S. politicians and policy makers about the issue of climate change and the impacts of unrestricted carbon dioxide emissions, 14 scientific societies have joined forces to hold an annual Climate Science Day on Capitol Hill in Washington, D.C. Now in its fourth year, the event saw about 40 scientists fanned out across Capitol Hill on January 29 to meet lawmakers and their staffs to discuss climate science and to offer themselves as resources about the science of climate change. This year, I had the privilege of representing ASPB on Climate Science Day.

Since this was my first time taking part in this event, I arrived with anticipation at the training session, held at the offices of the American Geophysical Union, on January 28—the day before our meetings on Capitol Hill. There I quickly met my partners for the following day's meetings: Peter Guttorp, professor of statistics at the University of Washington and member of the Nobel Prize–winning Intergovernmental Panel on Climate Change, who was participating in his third Climate Science Day; Tyrone Spady, science policy expert with ASPB in Washington; and Kaitlin Chell, also a local expert with ASPB. During the afternoon's training, the scientists introduced each other and separated into geographically based teams, heard descriptions from local experts about the process of meeting politicians and their staffs, and were treated to a lecture about climate change by Richard Alley of the Department of Geosciences at Penn State University. Richard's perspective was particularly valuable because of his engaging communication style and the knowledge he has gained from frequent appearances on Capitol Hill testifying about climate change before congressional hearings. During the lecture, he described atmospheric physics research done by the Air Force during the course of developing heat-seeking missile technology in the 1950s. He concluded that the science of climate change is as unequivocal as the science underpinning heat-seeking missile technology and that we cannot deny one without denying the other.

ASPB member Charles "Max" Moehs meets with Senator Maria Cantwell (WA) to discuss climate change.

The following day, Peter, Tyrone, Kaitlin, and I shuttled between the Senate and House side of the Capitol on a cold, sunny day. We focused on the Washington State delegation, since Peter and I both live in Seattle. We met with Senators Patty Murray and Maria Cantwell during their weekly constituent coffees, as well as with staff members of many of Washington State's congressional delegation from both the Democratic and Republican parties. These meetings were very useful for introducing ourselves and engaging these policy makers on an issue with which American society will ultimately have to grapple. At the end of the day, what stood out for me was the striking contrast between the urgency of Richard's presentation the preceding day and the relative lack of urgency on Capitol Hill, where climate change may be regarded as one among many issues that politicians face.

It is clear that many people have not yet grasped the reason for this urgency: delay now makes confronting climate change and carbon emissions that much harder in the future. This has been elegantly demonstrated by John Sterman of MIT in a series of papers highlighting the fact that many people have difficulty appreciating the concept of stocks and flows (Sterman, 2008; Sterman, 2011; Sterman and Sweeney, 2007). The amount (stock) of carbon dioxide in the atmosphere can be likened to the amount of water in a bathtub. The bathtub will keep filling and eventually overflow as long as the

continued on page 18

New Articles!

The Arabidopsis Book Posts New Content!

The American Society of Plant Biologists has published *The Arabidopsis Book* (TAB) as a free online compendium since 2002. ASPB is providing funds for the production of TAB as a public service.

Founded by Chris Somerville and Elliot Meyerowitz, TAB now has more than 100 articles online.

The current editorial board is working hard to continue TAB's ongoing expansion:

Keiko Torii *(editor-in-chief)*
University of Washington

Caren Chang
University of Maryland

Gitta Coaker
University of California, Davis

Luca Comai
University of California, Davis

Georg Jander
Boyce Thompson Institute

Dan Kliebenstein
University of California, Davis

Rob Last
Michigan State University

Ryan Lister
University of Western Australia

Rob McClung
Dartmouth College

Harvey Millar
University of Western Australia

Libo Shan
Texas A&M University

Doris Wagner
University of Pennsylvania

The board is overseeing all new content development as well as updates to existing articles to keep TAB the most comprehensive and current work on Arabidopsis.

PROTOCOL: Chromatin Immunoprecipitation on Arabidopsis Tissues
Nobutoshi Yamaguchi, Cara M. Winter, Miin-Feng Wu, Chang Seob Kwon, Dilusha A. William, and Doris Wagner
February 17, 2014. Edited by Keiko Torii.

Genetic and Epigenetic Mechanisms Underlying Vernalization
Dong-Hwan Kim and Sibum Sung
February 12, 2014. Edited by Doris Wagner.

Cellulose Synthesis and Its Regulation
Shundai Li, Logan Bashline, Lei Lei, and Ying Gu
January 13, 2014. Edited by Keiko Torii.

Cytokinins (update)
Joseph J. Kieber and G. Eric Schaller
January 13, 2014. Edited by Caren Chang.

Apoplastic Diffusion Barriers in Arabidopsis
Christiane Nawrath, Lukas Schreiber, Rochus Benni Franke, Niko Geldner, José J. Reina-Pinto, and Ljerka Kunst
December 27, 2013. Edited by Robert Last.

Abscisic Acid Synthesis and Response (update)
Ruth Finkelstein
November 1, 2013. Edited by Caren Chang.

As part of continuing initiatives to improve the quality and visibility of The Arabidopsis Book *and its content, PubMed is now indexing past and future articles.*

TAB is hosted in partnership with BioOne (www.bioone.org) in HTML and PDF formats.

Photos courtesy of The Arabidopsis Information Resource and the RIKEN Plant Science Center.

Policy Update

BY BRIDGET KRIEGER
Lewis-Burke Associates, LLC

Farm Bill Signed into Law

Congress finally reached agreement on a five-year Farm Bill after several years of attempting to do so, thereby reauthorizing a broad suite of programs supporting the nation's farmers, ranchers, and agricultural scientists. The bipartisan Farm Bill will result in a far-reaching reorganization of long-standing programs administered by USDA, including crop insurance, commodity programs, and nutrition assistance through the Supplemental Nutrition Assistance Program. The final bill reauthorizes significant investments in agricultural research, including the creation of a new Foundation for Food and Agriculture Research (FFAR) established with $200 million in mandatory funding. ASPB actively lobbied on behalf of its membership for relevant research programs, especially the creation of FFAR.

General Research Provisions

The USDA research and extension programs had strong bipartisan support. As such, the Farm Bill largely extends current programs. For example, the bill extends the authorization for intramural research through the ARS through fiscal year (FY) 2018. The bill also reauthorizes the National Institute of Food and Agriculture (NIFA) through FY2018 and extends the authorization for NIFA's extramural competitive grants program, the Agriculture and Food Research Initiative (AFRI), at the current $700 million annual level (the FY2014 funding bill funds AFRI at $316.4 million).

The House and Senate reached a compromise on a provision that would have required all institutions of higher education that are not land-grant institutions or designated non-land-grant colleges of agriculture to provide a 1:1 match for NIFA funds if that institution is not partnering with a USDA entity or a land-grant institution on the grant. After pushback from public institutions of higher education that were not designated as land-grant or non-land-grant institutions, the final bill includes one provision to partially work around the matching provision and another provision to clarify the process by which designation as a non-land-grant institution is achieved. First, USDA can grant a waiver to the matching funds requirement if a grant involves "research or extension activities that are consistent with the priorities established by the National Agricultural Research, Extension, Education, and Economics Advisory Board." Second, the bill requires USDA to "establish an ongoing process through which public colleges or universities may apply for designation as [a non-land-grant college of agriculture]," as several institutions had said the process was unclear to them.

In a major new initiative to boost agricultural research, the bill authorizes a new FFAR, which is established with $200 million in mandatory funding to remain available until expended. The Farm Bill stressed that FFAR should not duplicate current funding or research efforts and that it should not offset or allow a reduction in annual appropriations for agricultural research. The purpose of FFAR is to foster public–private partnerships to identify and prioritize the most pressing needs of the agricultural sector. Funding from FFAR must be matched 1:1 with non-federal funding.

The Farm Bill also reauthorized funding for the Extension Service and USDA education programs through FY2018. The bill continued mandatory funding as well as authorized additional appropriations, if Congress so chooses, for Specialty Crop Research, Organic Agriculture Research and Extension, and Beginning Farmer and Rancher Development.

The Farm Bill has no provisions affecting the current formula grant programs for land-grant institutions. Formula programs authorized under the Hatch Act and Smith-Lever Act have open-ended authorizations for appropriations at "such sums as may be necessary."

The bill does not address the indirect cost rate as the 2008 Farm Bill did. Thus, the indirect cost rate remains at the current level of 30% established in the FY2014 funding bill package. The 2008 Farm Bill increased the indirect cost rate from 19% to 22%.

FY2014 Appropriations Finalized

In mid-January, Congress passed the long-overdue appropriations bills for FY2014 to fund the entire federal government through September 30, 2014. Research and education programs important to the plant sciences received a needed boost as well.

The funding bill package adhered to the $1.012 trillion top-line spending level established by the Ryan-Murray budget agreement that Congress approved in December and includes some relief from sequestration for two years and support for new initiatives in the funding bills. NSF, NIH, and science and technology programs at the Department of Defense are among those receiving increases above FY2013 levels (post-sequestration). As evidenced by the agreement, research and development, and particularly basic research, remains a bipartisan priority for members of Congress despite constrained total spending levels.

NSF received funding above FY2013 levels for all accounts. The bill provided NSF with $7.172 billion overall, which is $287.8 million above FY2013, with an increase of $265.2 million to the Research and Related Activities (R&RA) account.

continued on page 18

POLICY UPDATE
continued from page 17

The USDA's research programs fared well with the Research, Education, and Economics account up $114 million (4.5%) to $2.64 billion. Within this amount, NIFA is funded at $1.277 billion, an increase of $74.6 million (6.2%) over the FY2013 enacted level. Within NIFA, AFRI is funded at $316.4 million, a significant increase of $25.9 million (8.9%). For ARS, the bill provided $1.122 billion, an increase of $50.5 million (4.7%) over the FY2013 enacted level.

The Department of Energy's (DOE) Office of Science research programs fared well compared to their FY2013 levels. The Office of Science would receive a 4% increase. The Biological and Environmental Research program within the Office of Science received level funding at $610.12 million, and Basic Energy Sciences received an increase of 1.4% at $1.712 billion. DOE would receive a total of $27.281 billion in FY2014, which would be an increase of less than 1% above the FY2013 pre-sequestration level. Many of the final FY2014 numbers reflect a compromise between the House and Senate proposed levels.

NIH received $29.9 billion, a $1 billion increase over the FY2013 post-sequester level. However, this amount is $714 million below the FY2013 pre-sequestration level of $30.6 billion.

New ARS Administrator Named

Dr. Chavonda Jacobs-Young was named the new administrator of ARS in late February. Prior to this appointment, Dr. Jacobs-Young was the ARS associate administrator for national programs. She holds a PhD in Wood and Paper Science from North Carolina State University. ■

DR. MOEHS
continued from page 15

water flowing in is greater than the water flowing out. Even if the drain is open, the level in the tub will stabilize only if the water flowing into the tub is the same as the water draining out. Similarly, carbon dioxide emissions have to be reduced to a level equivalent to the uptake of carbon dioxide by available carbon sinks just to stabilize carbon dioxide levels in the atmosphere. Merely reducing emissions somewhat, but still maintaining a level greater than the carbon sinks, guarantees a continuing increase in the amount of carbon dioxide in the atmosphere.

Because increased awareness of these facts is part of what is required for U.S. society and politicians to ultimately face the challenge of climate change, it is heartening to see the development of intuitive tools such as those developed by Climate Interactive (http://climateinteractive.org) to simulate possible carbon emissions trajectories and enable improved risk communication. Finally, Richard concluded his lecture to Climate Science Day participants by mentioning that he is now teaching a MOOC (massive open online course) on this topic. Given the enthusiasm and knowledge with which he approaches his topic, his students are in for an eye-opening experience! ■

References

Sterman, J. D. (2008). Risk communication on climate: Mental models and mass balance. *Science* **322**(5901): 532–533.

Sterman, J. D. (2011) Communicating climate change risks in a skeptical world. *Climatic Change* **108**(4):811–826.

Sterman, J. D., and L. B. Sweeney. (2007). Understanding public complacency about climate change: Adults' mental models of climate change violate conservation of matter. *Climatic Change* **80**(3–4):213–238.

Superstars of Public Engagement and Science Communication

BY KATIE ENGEN
ASPB Education Coordinator

At the December 2013 National Academy of Sciences event, Sustainable Infrastructures for Life Science Communication: A Workshop (http://nas-sites.org/publicinterfaces), in Washington, D.C., several superstars of public engagement shared their very clever and potentially sustainable science communication efforts (see companion article, "Start the Conversation: Communicate Your Science" on page 21 of this issue). Since it's not (yet) possible to clone these public engagement superstars, the life sciences communication network—and YOU—would do well to mine these rich experiences for ideas and inspiration that can be scaled up, transferred, and sustained.

Superstar #1
May Berenbaum

May Berenbaum (University of Illinois; http://tinyurl.com/d9et6ss) is an entomologist who focuses on insects and host plant interactions. May is a book author, denizen of peer-reviewed journals, and award-winning educator/communicator. She claims that over the years she has done a lot of making it up as she goes along. As it turns out, many of her choices now are integral to the emerging sciences of science education and communication. Weather conspired against May's travel plans, and so she called in to discuss a few PowerPoint slides. And yes, she read some of them. But she mostly used them as placeholders for her very engaging stories that enhanced her points about Sustainable Infrastructure (SI) and life sciences communication. Her favorite successes include

1. Insect Fear Film Festival (http://www.life.illinois.edu/entomology/egsa/ifff.html): With 30+ years and many worldwide copycats, this is a winner. May's husband is a film expert, so the right inputs (at the right price) helped build a firm foundation. May always picks the themes and films but now has grad student clubs run the campus-based festivals since they have funding to rent space, get t-shirts, and do PR. This teaches them valuable forms of engagement—with university officials, vendors, and festival participants.

   ASPB offers the PDF, "How to Host a Plant Biology Film Fest" (http://tinyurl.com/PlantFilms). Perhaps you can facilitate piloting a campus-based version.
2. The Bee Spotter crowdsourcing model (http://beespotter.mste.illinois.edu) was funded for only one year by an agency and then has been altruistically funded (via crowdsourcing) since 2008.

   For plants, Leafsnap (http://leafsnap.com) is a step in the right direction using this model of engagement.
3. The UI Pollinatarium (http://www.life.illinois.edu/pollinatarium) started small and has stayed small. But its impact is quite big. One local developer agreed to upgrade a lonely old building on campus. Now K–12, undergraduate, community college, and public visitors from six states and a handful of foreign countries have used this community pollinator education center. They have just one paid staff member; May donated some award funding to make this happen.

Superstar #2
Nalini Nadkarni

Nalini Nadkarni (University of Utah; http://tinyurl.com/n7l-g8yw) is known as the "queen of tree canopy research." But she does a whole lot more:

1. Treetop Barbie was an early failure. But the prototypes Mattel rejected serve as potent motivators, or examples of what not to do.
2. Plants are rooted in one place. So are inmates. In the Pacific Northwest, wild mosses were being overharvested. So Nalini partnered with a prison so the inmates could learn to grow sustainable moss. This grew to her bringing science classes to prisons (see TED Talk, http://tinyurl.com/Nalini-TED) so inmates could contribute to plant conservation research as they continued growing moss.
3. Nalini never rejects a speaking invitation to any citizen group, and she's never given the same talk twice, since she tailors to each audience. For example, faith-based groups love speakers who link their science and expertise to particular aspects of the faith. Nalini is happy to convey what she considers a synergistic spirituality of trees and science.
4. No, she's not cloned. She found time for her "day job" by spending her early career doing regular science. She worked part-time as a "shared space/spouse hire" for a while and used her extra time to develop public engagement activities. Soon they were woven into her career goals organically.
5. She reminds everyone that mentoring IS communicating. She recommends that you start there—and stay there if that's all you have time for at this point in your life.

Superstar #3
Craig McClain

Craig McClain (Nescent; http://mcclain.nescent.org) writes the Deep Sea News blog (http://deep-seanews.com). His goal is to build

continued on page 20

SUPERSTARS
continued from page 19

engaging content that attracts an audience with wide-ranging levels of interest and expertise when it comes to deep sea science. Craig also prefers to bypass any external pressures that may insist on a "proper" tone or type of information to share in a science-based blog. Risky? Maybe…but he thinks this is the best way to nurture authentic, sustainable participation, which will then lead to deeper understanding of the science at hand. And later, if the blog expands or shifts gears, followers will come along because they already trust and enjoy the platform. Craig offers Lessons from Creating an Online Outreach Empire (http://craigmcclain.com/?p=397). His lessons include the following:

1. A casual and sometimes irreverent tone or format is generally going to engage the public most effectively. Don't be frightened when scientists or administrators warn you to "serious up." Just be sure to have serious data (or similar expertise/input) to support whatever you're putting out there.
2. Be the "Nerd of Trust" in your local community. Make it easy for anyone to ask you anything about science (just don't be a pontificating know-it-all). Then expand your thoughts outward and online.
3. Use Pinterest, Tumblr, Facebook, and Vine. Invite the people where they already are congregating to join you in your area of the Internet.
4. Recognize "subtle snubs" and strategize or prioritize according to your specific career advancement concerns. For example, Craig is hired as a basic researcher and wonders if he gets snubbed for science grants because his blog is rather informal. He posits that his career arc may be hindered because reviewers and tenure boards don't know enough about science communication to see its validity to the research development and dissemination. He plans to help change that.

Superstar #4
Daniel Colon-Ramos

Daniel Colon-Ramos (Yale University; http://tinyurl.com/Colon-Ramos) grew up in a Puerto Rico that offered no science role models or community support for budding scientists. He even had to convince his family that his interests in science were valid. He talked them into it. Since then he has started Ciencia Puerto Rico (http://tinyurl.com/m3ca9g4), which models how collaborating scientists, educators, and citizens can promote the development of scientific research that is meaningful to local people while raising awareness about a region's science and its contribution to the progress of scientific knowledge on a global scale. Daniel says the group runs "on a shoestring" because its 6,000+ participants are very motivated to put Puerto Rico on the world's science map. Daniel recommends the following:

1. If your job title is "basic research," make sure you do that. Simultaneously, make an effort to show how your work in science communication helps train and retain graduate students. Daniel noted research showing that graduate student retention is significantly higher when department level communication is effective and addresses various cultural and demographic needs.
2. Daniel won the AAAS Public Engagement in Science Award, which specifies there must be a balance in basic research and public engagement in science. Awards such as this encourage scientists to prioritize public outreach.
3. Scientists collaborate with electron microscopy experts to get the work done. Find ways to collaborate with communication experts to get your work disseminated to wider audiences.

Superstar #5
Phil Needleman

Phil Needleman is a great storyteller—and he's worked quite successfully in academia, industry, medicine, and science centers. *Forbes* has reviewed Phil's expertise (http://tinyurl.com/Phil-Forbes). Here are some of Phil's bon mots and tips:

1. In God we trust. All others require data. Be *very* secretive with your data for as long as necessary. When you have confirmed, reproducible data, copyright its presentation and communicate it extensively and well.
2. Create a journal club for grad students. Incorporate it twice weekly into brown-bag seminars that meet three times a week (the third session should focus on research). Everyone presents (no matter what their level). Every other presentation must be on a journal article from outside the presenter's field.
3. Circulate one main goal to the whole group (lab, department, or research team). Link incentives (including funds) to clearly communicated data that supports how that goal is being met.
4. Practice external communications. Use or rent a theater and stage mock panels, press conferences, and so on. Seed the audience with "dumb" or provocative questions so interviewees practice thinking on their feet. Also have somebody practicing rapid-fire, backstage online research and feeding it to the interviewee in real time.
5. Deal with controversy directly. Set up a demonstration, interview, or tour that lets the curious or critical take a closer look alongside you.
6. Reduce your millions of pages of research to five really great PowerPoint slides.
7. Establish a firm and engaging answer to "so what?" when asked about your work.
8. Have a killer elevator speech. Then shorten or simplify it.
9. No jargon.
10. Never overpromise.
11. Tell stories, yet never forget that data always trumps anecdote. ■

Now go say what YOU need to say.

Start the Conversation

Communicate Your Science

BY KATIE ENGEN
ASPB Education Coordinator

In December 2013, the National Academy of Sciences hosted Sustainable Infrastructures for Life Science Communication: A Workshop (http://nas-sites.org/publicinterfaces) in Washington, D.C. A primary goal of the event was for life science researchers, their societies, and other stakeholders to determine core priorities for sustaining effective science communication among professional peers, in the media (in all its many forms), with funders or partners, and at various levels within the general public. Simply making life science community members aware of the value of effective communication was an initial goal. However, the main focus soon became shaping a Sustainable Infrastructure (SI) that can catalyze and consistently support effective communication that is engaging, sustainable, scalable, memorable to audiences, and practical to incorporate with other career priorities.

Say It Loud, Say It Proud

Successful SI will create networks among life scientists, communication scientists, informal education experts, and science communicators to explore challenging issues that may be unique to the life sciences. These networks would share data, experiences, tools, and insight to develop informed public engagement strategies. It's not a recipe, list, rank order, or matrix of current public engagement tools. It's a set of tools that once mastered will allow a scientist or educator to disseminate critical, interesting information from his or her particular milieu to a variety of audiences through various modalities. In short, SI for life science communication will be the mainframe or mother lode of standardized processes for communication.

It Almost Goes Without Saying…

Certain elements are necessary for any infrastructure to be successful and sustainable. Workshop attendees quickly recognized from the overview of 25+ years of unfulfilled attempts at effective life science communication that a newly invigorated SI in life sciences must include specifically allocated resources (time and money); incentives (promotion, tenure, "fame"); learning aptitudes (scientists' mastery of communication skills and tools); mentored practice time (teaching or mock interviews); event preparation (if you need heavy notes then maybe you're not ready); audience identification (defining who/how/why you want to reach); mastery of traditional and social media; evaluation and research; and, of course, enforcement or accountability. And while they all agreed to brainstorm outside of these very real constraints, it was agreed that some constraints served as helpful guidelines and motivators for clever solutions, not just as "deal breakers."

Chat with the Paparazzi

Workshop moderator David Duncan (http://www.davidewingduncan.com) is a novelist who also writes for *Nightline,* NPR, *National Geographic,* and more. He enthusiastically encourages scientists to contact him (or other writers) because professional journalists and science writers need scientists who are willing to talk openly and consistently with minimal jargon (or at least strong "translation" skills). David's many collaborations have taught him that:

1. Nonpartisan input matters. Bias cannot be eliminated, so be up front about what your science, world view, or political biases truly are.
2. Scientists and journalists can get science seen by new eyes. This can lead to fame and funding.
3. Even verbally astute scientists often shut down at showtime because being on air freaks them out. Practice with cameras first, then go live.
4. Researchers get cold feet about sharing iterative results, even if "iterative" is understood as a big factor by the journalist and intended audience. (Maybe the first pillar of SI should be defining and promoting the iterative nature of science.)
5. Public information officers, administration, and lab leaders may muzzle scientists. Some reasons to delay or stop communication are valid, some are tinged with a bit of paranoia, and some border on censorship. Workshop speaker Kathryn Foxhall (author and freelance science writer; http://tinyurl.com/Foxhall) warned how censorship can hinder scientific progress and even harm public health and safety. A summary of her rather serious points can be found at http://tinyurl.com/p96wgmu.

Data Speaks: What Is It Saying?

Diane Harley (UC Berkeley) studies public engagement at a rather granular level. She has discovered that values about publishing research are changing. Traditional peer review remains the gold standard, especially with regard to tenure, but online options are gaining value slowly, albeit not directly for tenure. Diane's results also show that faculty pursue public engagement activities to advance their careers, advance their field, and earn awards or other fame for themselves. She notes that early career faculty are very tentative about sharing any preliminary results or using nonstandard publication options for fear of career or reputation damage. And tenured faculty can remain dubious about some forms of communicating science often because they fear iterative information will get adopted as gospel truth in the wrong (public) venue. See more about Diane's

continued on page 22

2014 Outstanding Undergraduate Science Teaching Award

BY KATIE ENGEN, ASPB Education Coordinator
and SHOSHANA KRONFELD, ASPB Membership Manager

Do you know an OUTSTANDING undergraduate science teacher? Are you or a colleague getting impressive learning outcomes in the classroom or lab? Then nominate yourself or another for the Outstanding Undergraduate Science Teaching (OUST) award offered by the Society for College Science Teaching (SCST).

Award committee chair Tarren Shaw (University of Oklahoma) is quite familiar with ASPB's education efforts and has collaborated with former ASPB Education Committee chair Jane Ellis. Recently, Tarren suggested, "I don't think a plant biologist has won the OUST award in a while, and we'd like that to change!"

Nominations are being accepted now for the OUST award. Presented annually by SCST, the award recognizes the efforts and achievements of an outstanding science teacher based upon teaching, scholarship, and service.

The award includes a cash prize and support to attend the 2015 and 2016 SCST national conferences. Students or faculty can make nominations for this award, and self-nominations are encouraged.

See http://www.scst.org/grants/ousta or contact Tarren at tjshaw@ou.edu for more information. ■

START THE CONVERSATION
continued from page 21

studies at the Center for Studies in Higher Education site at http://cshe.berkeley.edu.

Dominique Brossard (University of Wisconsin–Madison) is a "dormant" plant biologist now studying science communication. Much of her work is available at the Science, Media & the Public site (http://scimep.wisc.edu). Dominique generously communicated some of her preliminary (and perhaps iterative) results from some recent research. She reported on several factors that seem to drive or impede successful, sustained life science communication. Specifically, frequent media contacts do not directly yield extrinsic rewards, such as funds or tenure. However, intrinsic rewards, such as community or campus status or enjoying the sharing of knowledge, will increase communication efforts. Dominique cautioned that all data is going to be very site/department/program specific because each entity offers its own unique supports and limitations for communication. She also noted that most of the present data may be outdated because of the social media tsunami that has occurred in public engagement since the early 2000s.

For more data, the NAS workshop organizers offer Suggested Readings and Viewings (a PDF) at http://tinyurl.com/NAS-SciComm.

Stop Talking

Sonny Ramaswamy (NIFA; http://tinyurl.com/m2ozgtt) is ready for everyone to stop talking and start building something concrete. He wants the right information getting to the right audiences. To illustrate why audience access is key, he recounted how residents of the North Carolina Research Triangle can cite college league sports stats ad nauseam. But can they tell you what a recent NC State breakthrough with pig poop (http://tinyurl.com/SciAmPigPoop) will do for their region and beyond? No! Why? Because even the engaging phrase *pig poop* is not getting put in front of the right audience. So to make a stink about public engagement in your community, consider Sonny's action items:

1. Cultivate popular media contacts to feature or profile scientists. *Science* magazine is not "popular" enough.
2. Invite communication experts in at the inception of research projects. They should help define how and why the iterative steps of the project can be communicated.
3. Follow the Cooperative Extension lead! It is designed to translate innovations to practical solutions using engagement and follow-up. It has been in place since the 1870s, but many of its procedures have been upgraded over the years. The farmers and other on-the-ground personnel are primed already to accept new, different communication tools (old: lantern slides; new: MOODLE). It offers evaluation models. And data exists for what works (for example):
   - Reframing hot issues keeps the focus on solutions (not world views or "winning").
   - Signal:noise ratio is major these days; audience focus or fine-tuning is needed.
   - Trust is imperative—experts who are local and available, can get buy-in, demonstrate integrity, mediate well, and have evidence are invaluable.

Cat Got Your Tongue?

Need some help getting started to say what you need to say? For inspiration and more specific ideas to start the conversation with your community or campus, see "Superstars of Public Engagement and Science Communication" on page 19 of this issue. ■

OFFICIAL PARTNER

USASEF: The Largest Celebration of STEM in the United States!

ASPB to Exhibit at Third USA Science & Engineering Festival Expo

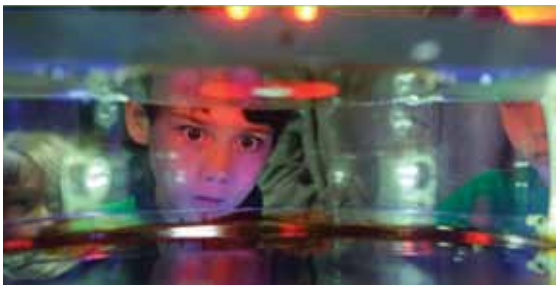
Walter E. Washington Convention Center
Washington, D.C.
April 26–27

What is the universe made of? Why did dinosaurs become extinct? What do magic tricks and hip-hop have to do with math? What will be the next medical breakthrough? What do fossils and rocks tell us about the Earth's secrets? What does baseball have to do with physics? *And why are plants so important to food, fuels, pharmaceuticals, and fibers?*

Find out at the third USA Science & Engineering Festival Expo! Explore hands-on exhibits from 750 of the world's leading professional scientific and engineering societies, universities, government agencies, high-tech corporations, and Science, Technology, Engineering, and Math (STEM) outreach and community organizations.

The free two-day expo is perfect for teens, children and their families, and anyone with a curious mind who is looking for a weekend of fun and discovery. Meet science celebrities like Mike Rowe, host of the Discovery Channel's Dirty Job series; Bill Nye the Science Guy; David Pogue, host of NOVA ScienceNow series on PBS; and Grammy Award–winning alternative music band They Might Be Giants—not to mention a host of plant biology experts and hands-on fun in the ASPB booth!

New this year: The festival is hosting the *U.S. News* STEM Solutions conference, bringing in 2,500 STEM professionals from across the country and several science teacher associations including thousands of teachers.



Come visit the ASPB booth: #6226

On April 24, middle and high school students will have a chance to view presentations from the most inspiring STEM professionals at X-STEM Extreme STEM Symposium, and the festival will feature teacher development workshops at the expo.

The expo is the pinnacle event of the third USA Science & Engineering Festival. For more information on all festival events and how you can get involved, visit http://www.usasciencefestival.org. ■

ASPB at 2014 AAAS Family Science Days in Chicago

BY BURKHARD SCHULZ
ASPB Education Committee Member, Purdue University

Once again the cold weather—the Chicago River was covered with floating ice sheets—was no match for the hot plant biology activities shared in the ASPB education and outreach booth during AAAS Family Science Days (http://www.aaas.org/go/fsd), held February 16–17 in Chicago, Illinois. Along with our regular inquiry-oriented resources designed to eradicate plant blindness and engage youngsters in plant biology, ASPB offered a few new options.

"I could grow into a plant scientist!"

Visitors were invited to complete a large interactive graph by placing a smiley face sticker to show which trait or skill of a plant biologist they think is the best or their favorite. Just thinking about these traits helped youngsters "try on" the idea of being a plant biologist and perhaps set a few school or career goals, too. More than 400 children participated in this activity, with "I am curious" placing a strong first. And curious they were!

Budding interests!

My Life as a Plant Photo Op

Sally Sunflower and Charlie Cactus from the coloring and activity book *My Life as a Plant* (http://www.aspb.org/coloring-book) were emblazoned on two "kid-sized" banners with openings where the character faces would have been. Kids walked behind the floor banners and poked their faces through for a fun photo op. Many families used this activity to take a memento home from the ASPB booth. Sally's banner also listed plant parts and added the terms *sun, air,* and *plant power* to convey some key ideas of plant biology. Charlie's banner boasted that plants are, make, and do hot stuff! Volunteers helped kids ham it up as well as try out the plant biology interactions or materials offered elsewhere in the booth.

Mini Garden Cups

Hands down, the most requested activity was the planting of sunflower seeds in a take-home mini-pot necklace. This was a great opportunity for the kids to get their hands "dirty" as they shoveled the soil into mini-pots and planted and watered the seeds. At the end of the day, the exhibit hall was crowded with children who proudly sported their ASPB sunflower necklaces. Many of them promised to keep on watering their plants at home and take good care of them.

Lieselotte Altstatt working with Benjamin Choi.

Ache Gana (far right) and Lieselotte Allstatt (middle) working with Amaris Scurlock (far left).

My Life as a Plant Coloring and Activity Book

Again, this great book found a lot of friends at the AAAS Family Days. Many parents were impressed that ASPB has already translated the book into eight languages with more to come.

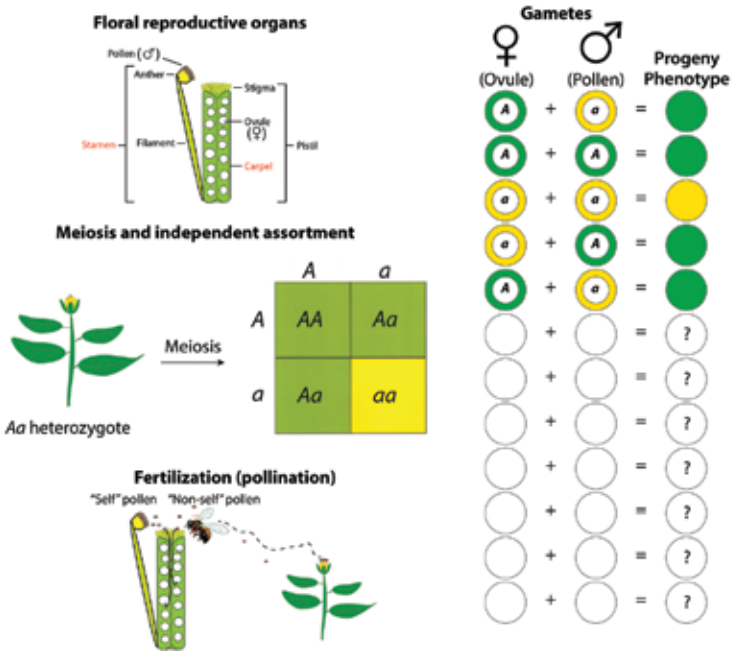
The Mating Game

Based on the already very successful *Brassica rapa* Fast Plants from the University of Wisconsin (http://www.FPsc.wisc.edu), Scott Woody developed a great board game (The Mating Game), which playfully demonstrates how gametes with dominant and recessive alleles are assorted during pollination and what the effect of these alleles is in the phenotypes of the progeny generations. Examples of dominant and recessive gene mutations were displayed in *B. rapa* Fast Plant sc populations at our booth.

Judy Callis helping the Hill sisters plant seeds.

Many educators and teachers appreciated not only the game itself as handouts, but also that seeds of segregating Fast Plant populations were given out to play with at home and in biology class at school. ■

Play the Mating Game



Thank you, volunteers!

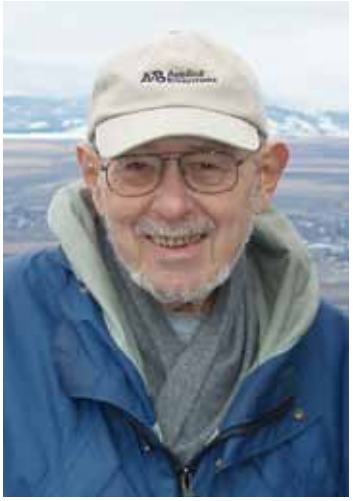
I, Burkhard Schulz (Purdue University), was happy to lead the team of energetic volunteers and help infuse this annual booth with new perspectives. Scott Woody (University of Wisconsin–Madison) adjusted outreach activities he normally offers to science educators and other adults to fully engage this audience of youngsters. Louise Anderson (University of Illinois–Chicago) ably shared her particular perspectives on cool plant science content. The University of Chicago was well represented by active input from Jean Greenberg and two of her postdocs, Jiyoung Lee and Andrew Manning. Local educator Anne Stickley Michel took advantage of this plant biology "immersion experience" while sharing her enthusiasm with visitors. Devi Potluri, J. Ache Gana, and their respective students, Ashvi Patel and JaNae Williams (undergraduates) and Denise Medrano (graduate), brought well-received expertise from Chicago State University. Our former ASPB secretary Judy Callis (UC Davis) took time from her busy AAAS main conference schedule to share her particular skills and savvy in the ASPB booth. ASPB's Crispin Taylor also stepped away from his formal AAAS meeting itinerary to once again engage with both the visitors and the team of ASPB member-volunteers in the booth. Our youngest volunteer was Lieselotte Altstatt, who showed that a six-year-old first-grader from Lafayette's Edgelea Elementary School can easily engage her peers at the mini garden cup planting station.

Frank A. Loewus

(1919–2014)

A Life Well Spent and Well Remembered

BY NORMAN G. LEWIS
Corresponding Fellow, Royal Society of Edinburgh, Washington State University



Frank A. Loewus

Professor Emeritus Frank A. Loewus, largely renowned worldwide for his and fellow scientist wife Mary's discoveries in the *myo*-inositol signaling and ascorbic acid (vitamin C) biosynthetic pathways, passed away peacefully in late January in Pullman, Washington. Some 94 years young, Frank had a good life and a genuine thirst for scientific knowledge. Frank was blessed not only with a very productive scientific career, caring family, and lifelong scientific friendships, but also with good health and a keenness and sharpness in mental agility that belied his years.

I thus enthusiastically and graciously invite the reader to join in celebrating Frank's life, with all of its richness and variety of experience. I must also underscore that my own modest contribution to this celebration of his life is made resplendent with a few short vignettes and recollections from previous coworkers, contemporaries, friends, and admirers. In this regard, both he and his beloved spouse/fellow researcher and partner, Mary, made highly significant scientific contributions spanning from the early 1950s to the late 1990s. As the late Nobel Prize winner Sir Derek H. R. Barton reflected years back, scientists must be judged not only by their contributions, but also in the context of the technologies and dogmas in place at the time these contributions were made. Frank and Mary are a wonderful example of the wisdom of such a philosophical outlook, and the scientific contributions they made began at a time when equipment and technologies, and indeed our understanding of many biological processes, were all in their infancy. Let me try to do justice to these contributions and revive happy memories.

Scientific Contributions

These were initially prominently made on the then-unknown stereochemistry of hydride transfer reactions in enzymatic reactions using the cofactors NAD/NADH (then called DPN/DPNH) in the early 1950s and involved a star-studded research team that Frank was part of. Then followed an independent career at various institutions, where his scientific interests led him to vitamin C (ascorbic acid) and *myo*-inositol, respectively. Indeed, his work at various institutions serves to remind one that the important part of a life's scientific contribution is that of the discoveries and progress made, as it is those that are most remembered—rather than the home institution(s) where the work was done. Let's look again at each main area and celebrate Frank's successes.

The Discovery and Functions of NAD/NADH (DPN/DPNH) and the University of Chicago Years

Following his doctoral work at the University of Minnesota (see below), Frank joined the brilliant team at the University of Chicago that was led by Birgit Vennesland and Frank Westheimer (who later went on to further prominence at Harvard University). He was there from 1952 to 1955. Other outstanding team members at the time included Eric Conn, Harvey Fisher, and Paul Talalay, with the latter a highly gifted young MD/biochemist. The late plant scientist Helen Stafford was another contemporary. Thus began heady days in enzymology; this experience helped sculpt Frank's future scientific direction and the outlook and rigor that would be the signature hallmark of his scientific pursuits and career.

As part of the joint Vennesland/Westheimer team, Frank was intrigued by their discovery of an enzymatic hydrogen transfer from NAD (then called DPN), and he was tasked with investigating the stereospecificity of hydrogen transfer from beef heart lactic dehydrogenase (LDH; Fisher et al., 1953), thus building on the earlier seminal work on alcohol dehydrogenase (ADH) by the other team members. Next up was whether the stereospecificity of hydrogen (hydride) transfer also applied to the substrates, and this was established to be the case (Streitwieser, 1953). Paul Talalay, a contemporary at the time, today fondly recalls a seminal moment in these studies: "When a steroid dehydrogenase that I discovered appeared not to transfer the alcohol dehydrogenase "hydrogen" directly, we showed that it used the diastereomeric hydrogen. This was the first demonstration that NADH could use both diastereomers" (Talalay et al., 1955).

Thus emerged what we now take for granted, namely discovery of this beautiful stereochemical control over oxidative/reductive processes (actually hydride addition and abstraction with NAD/NADH and their

continued on page 28

FRANK LOEWUS
continued from page 27

substrates) in Nature's resplendent armory. Brilliant discoveries indeed that stood the test of time! (For additional context, Paul Talalay went on to worldwide renown at Johns Hopkins University and continues to this day with a vibrant program in developing our understanding of dietary plant substances conferring cancer protection.) Importantly, these three years at Chicago thus began to develop Frank's skills at working independently and in identifying the new and productive opportunities that beckoned.

Vitamin C (Ascorbic Acid) and *myo*-Inositol

These studies spanned mainly the time frame from 1955 onwards, with lengthy sojourns at the USDA Western Regional Research Lab, Albany, California (1955–1964), the Department of Biology at SUNY Buffalo (1965–1975), summer stints at Woods Hole (Massachusetts) Marine Biological Labs (1970–1974), and the Institute of Biological Chemistry (IBC) at Washington State University (1975–1990, and thereafter as professor emeritus).

Vitamin C, myo-Inositol, and Frank A. Loewus

(as contributed by Fred Stevens, Oregon State University)

"Frank first developed an abiding interest in ascorbic acid (vitamin C) biosynthesis when he was investigating oxidative processes in stored fruit at the USDA Western Regional Research Laboratory. While a pathway for the biosynthesis of ascorbic acid in animals had been proposed and supported with experimental data by the early 1960s, the situation in plants appeared to be much more complicated. Frank's first surprise finding was that ripening strawberries, when fed D-[^{14}C]-glucose via cut stems, produced ascorbic acid *without* inversion of the carbon chain positions, thus differing from what had been demonstrated and reported in rats. This finding suggested that the pathways for ascorbic acid biosynthesis proceeded differently in strawberries and rats, a finding that those in the mammalian field dismissed at the time, as Frank often reminded Norman Lewis in private conversation. Nevertheless, undeterred, Frank next hypothesized that *myo*-inositol served the role of its biosynthetic precursor in plants, as *myo*-inositol is readily oxidized in plants to produce D-glucuronic acid, a now known intermediate in both plant and animal pathways. He then demonstrated that *myo*-inositol is produced in two steps from glucose-6-phosphate via 5-ketoglucose-6-phosphate and D-*myo*-inose-1-phosphate.

A younger Frank (date unknown).

The biosynthetic formation of *myo*-inositol-1-phosphate involves an oxidation at position 5 of glucose-6-phosphate, followed by aldol condensation between carbon 6 and the aldehyde carbon 1 and reduction of the keto functionality. His research group isolated the responsible enzyme, *myo*-inositol-1-phosphate synthase, from pollen of *Lilium longiflorum* and characterized its properties. Phosphatase-mediated removal of the phosphate group and subsequent oxidative ring cleavage between carbon atoms 5 and 6 yielded D-glucuronic acid. This pathway thus satisfactorily explains the metabolic labeling pattern in ascorbic acid formed from D-glucose in his earlier strawberry feeding experiments. Now, 50 years or so later, four distinct plant pathways for the biosynthesis of vitamin C are known: the 'Loewus' *myo*-inositol pathway, the mannose/galactose route (Smirnoff-Wheeler pathway), the gulose shunt, and the galacturonate pathway.

In his pursuit to elucidate the biosynthetic formation of ascorbic acid, Dr. Loewus made a number of other seminal discoveries. When he fed radiolabeled *myo*-inositol to leaf or fruit, he found the bulk of the label in hemicellulose and pectin of the cell wall, demonstrating the importance of *myo*-inositol as a versatile biosynthetic intermediate. At SUNY Buffalo, his research group, which by then included his wife, Mary, discovered that the enzymatic cleavage of ascorbic acid between carbons 4 and 5 or between carbons 2 and 3 to form L-(+)-tartaric acid depends not only on the plant species, but also on the stage of development. Since Dr. Loewus's early observations, it has now been well established that ascorbic acid is a major biosynthetic source of tartaric acid (and oxalic acid) in plants.

Frank Loewus's long chain of discoveries in the vitamin C field thus started with research on oxidative processes in stored fruit. While vitamin C plays many important roles, not only as a cofactor for several hydroxylating enzymes but also in maintaining proper cellular redox balance, Dr. Loewus's example of tartaric acid suggests that ascorbic acid may play a prominent but poorly recognized role as a biosynthetic precursor or building block for a host of phytochemicals. A 2009 survey of the literature published in *Phytochemistry* describes 33 phytochemicals derived from ascorbic acid, which may only represent the metaphorical tip of the iceberg."

Scientific Service to the Community

Frank also worked tirelessly in support of the scientific community. Among other responsibilities, he was president of the Phytochemical Society of North America (PSNA) in 1975 and later successfully took on the organization of the first joint annual meeting of the American Society of Plant Physiologists (ASPP; now ASPB) and PSNA, held August 4–7, 1980. While the meeting was a rewarding endeavor overall, it was not without some headache. Frank often remembered it from the perspective of some nearby colleagues not providing the level of help he felt had been needed! A further complication was that on May 18 of that year, Mt. St. Helens had erupted and, during the meeting, a further small eruption led to a sprinkling of ash in Pullman—enough, Frank re-

called, for everyone to take home a sample. Frank, though, took all these things in stride, and the meeting was a great success.

Recognition

During his professional career, Frank received accolades from his peers, including the Charles Reid Barnes Life Membership award from ASPP in 1993 and the 2007 PSNA Phytochemistry Pioneer Award. He later provided a most informative summary of his scientific career and personal development in the February 2008 issue of the *PSNA News,* an article well worth reading. Frank and Mary's legacy is also kept very much alive with the Frank and Mary Loewus travel awards given annually for deserving PSNA students.

A Very Private Man

Frank was a very private man, but solid and reliable in all he did. His word was his bond. He came into this world in Duluth, Minnesota, on October 22, 1919, with his mother passing away when he was only 2, and then his father when he was 17. Growing up as a youngster in the abundant woodland and shorelines surrounding Lake Superior, he was drawn initially to pre-forestry, which ultimately culminated in a BSc in forestry in 1942 from the University of Minnesota. This experience and training whetted his appetite for a graduate program in biochemistry, which was thwarted at the time due to World War II.

The World War II Years

Following receipt of his BSc degree, Frank enlisted in the Army Air Corps, serving as a first lieutenant in the Pacific Theater, which took him across the South Pacific, through the Philippines, and ultimately to Japan. During his tour of duty in Japan, which lasted until 1946, he served as an intelligence officer and by that time had seen firsthand the destruction and human loss that accompanied this terrible conflict. Indeed, Frank would occasionally reflect on the horrors he had witnessed and the level of destruction he encountered on landing in Japan. Nevertheless, he left Japan with enormous respect and admiration for the Japanese nation and later made lifelong friendships with Japanese scientific colleagues that continued until his passing. For individuals like me, who never directly experienced the horrors of warfare, we salute those whose sacrifices have enabled us to pursue our own scientific passions today.

Mary and Frank in St. Louis, Missouri, 2007.

Post-War Education, the GI Bill, and a Happy Marriage

After military duty overseas, and initially leaning toward an industrial career, a chance visit to his old alma mater resulted in Frank immediately beginning graduate school in the Department of Biochemistry at the University of Minnesota under the tutelage of Professor David Briggs. Frank then became a recipient of funding through the GI bill and completed his MSc in 1950 and his PhD in 1952 on the chemistry of amylose retrogradation. While in graduate school, he met his beloved wife, Mary; they were married on December 26, 1947, and this happy union continued until his passing. She also hailed from Duluth! Their marriage marked the beginning of their own lifelong personal and professional interactions as a research team.

Frank and Mary have three children, Rivkah, David, and Daniel, and six grandchildren of whom they are very proud. Interestingly, one of Frank's sons, David, went on to complete his PhD degree at Harvard with Frank Westheimer, who had previously been the coleader of the University of Chicago team with Birgit Vennesland that father Frank had been part of earlier.

A Keen Sense of Humor

Frank had a very well-developed sense of humor, and regrettably some of his best jokes cannot be repeated here. To whet the appetite of those who did not know Frank, the first professional interaction I remember was during an interview for the position I have held since 1990 (director, Institute of Biological Chemistry). Many faculty told me that Frank had some difficulties with the dean. When I inquired about this, the only quiet, straight-faced clarification I received from Frank was: "Difficulty with the dean? Which dean do you have in mind? I have been here since 1975, and I have had problems with all of them!"

Frank Loewus at Home

Many of my own recollections of Frank also stem from him being our next door neighbor from the early 1990s until he and Mary moved to Bishop Place Senior Living apartments many years later. My main sightings and recollections of Frank at home as a neighbor were as an avid gardener. He spent seemingly endless hours in his backyard, growing among many other things wonderful tomatoes and geraniums, which he would generously share with us. As he became somewhat physically frailer in his still youthful 80s, his exercise regime in his front yard seemed to be mainly restricted to using—with what appeared to require increasing amounts of physical overexertion—what may have been the only hand-pushed lawn mower in this college town. There were quite a few instances when

continued on page 30

FRANK LOEWUS
continued from page 29

either his mower and/or roto-tiller would get the upper hand. But any offer of help was quickly—but politely and unmistakably—rebuffed.

In Memoriam

In the days following the sad news of Frank's passing, we were heartened to hear from previous collaborators and colleagues of Frank and Mary expressing their condolences, including Bruce Baldi (previous graduate student), Wendy Boss (North Carolina State University), Daneel Ferreira (University of Mississippi), Heinz G. Floss (professor emeritus, University of Washington), Jack Preiss (Michigan State University), Ralph Quatrano (Washington University), Kazumi Saito (professor emeritus, Kyoto University), Nick Smirnoff (University of Exeter), Fred Stevens (Oregon State University), Paul Talalay (Johns Hopkins University), and Mechthild Tegeder (WSU, and widow of the late Vince Franceschi, another collaborator who Frank immensely enjoyed working with), as well as George Wagner (University of Kentucky), who began his successful professorial career as a dishwasher in Frank's lab. George still remembers Frank coming into the lab at 3:00 a.m. to check how his work was progressing, and I assume to establish whether he was actually really there! In our own laboratory, we also have a strong connection with the Loewus lab, since when Frank retired, his previous technician, Diana Bedgar, began working with us and has continued to do so to this very day. Diana still misses the Woods Hole days and visiting Frank there during the summer. It's hard to know, though, if her nostalgia also derives from missing fresh lobster and crab! Nonetheless, Diana was very well trained, I am pleased to report! All these folks remember Frank and Mary with sincere fondness and as rigorous scientists and great people. Furthermore, the WSU community share greatly in our loss, as Frank was highly regarded and respected by all of the IBC faculty, staff, students, and visiting scientists.

As I close this celebration, it is worthwhile reflecting on this wonderful scientist and person. Frank had quietly endured much through life, but remained captivated with the science that he had been eager to pursue until the very end. One of his very last literature contributions was with Pushpa Murthy (Michigan Technological University) on an overview on inositol metabolism, of which he was very proud.

We also remember Frank's 90th birthday celebration in our conference room: the 90 candles that I had insisted we put on (and light) his birthday cake quickly resembled the output of a flame thrower, but all turned out fine. Frank leaned over the burning mass and quickly blew out this blazing monument in honor of our proud nonagenarian, without need for the fire department.

Sadly, at the galley proof stage of this obituary, we learned that Mary W. Loewus passed away on March 12, 2014, at the age of 91. Frank and Mary are survived by their children, their families, and their grandchildren.

Respectfully submitted on behalf of all contributors. ■

References

Fisher, H. F., Conn, E. E., Vennesland, B., Westheimer, F. H. (1953). The enzymatic transfer of hydrogen: I. The reaction catalyzed by alcohol dehydrogenase. *Journal of Biological Chemistry* **202:**687–697.

Streitwieser, A. (1953). Stereochemistry of the primary carbon. I. Optically active *n*-butanol-1-d^1. *Journal of the American Chemical Society* **75(20):**5014–5018.

Talalay, P., Loewus, F. A., Vennesland, B. (1955). The enzymatic transfer of hydrogen: IV. The reaction catalyzed by a β-hydroxysteroid dehydrogenase. *Journal of Biological Chemistry* **212:**801–810.

Opti-Sciences Inc.
8 Winn Avenue
Hudson, NH 03051
www.optisci.com 603-883-4400

"Game Changing" Research

Why is White Light Better?

q_M - is the fluorescence change caused primarily by chloroplast migration. Chloroplast migration is a light avoidance mechanism that occurs at high actinic light levels, found in nature.

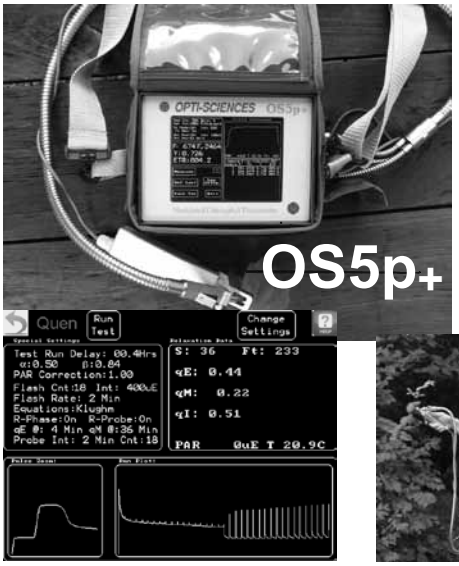
q_M *represents about 30% of fluorescence non-photochemical quenching or NPQ.*

q_M only occurs under intense **white light** and under **intense blue light. Intense red light has little affect**. Furthermore, q_M causes leaf absorptance to change.
The i*FL* measures leaf absorptance. (See Above)

q_M can affect reliable measurements of Y(II), ETR, J, NPQ, g_M, C_C, A/Ci curves at high light levels, A/Q curves and A/C_C curves at high light levels.

Reference:

(Cazzaniga S, Osto L.D., Kong S-G., Wada M., Bassi R., (2013) "Interaction between avoidance of photon absorption excess energy dissipation and zeaxanthin synthesis against photooxidative stress in Arabidopsis", The Plant Journal, Volume 76, Issue 4, pages 568–579, November 2013 DOI: 10.1111/tpj.12314)



Opti-Sciences uses a ***stable white light actinic light*** *source* with an intense blue spectrum in the **i*FL***, the **OS1p**, and the **OS5p+** chlorophyll fluorometers.

The OS5p+ measures **q_E**, **q_M**, **q_I**, q_T, & q_Z.

Includes:

The Loriaux 2013 F_M' correction protocol
Kramer lake model quenching protocol
Hendrickson lake model quenching protocol
Puddle model quenching protocol
Strasser OJIP protocol
Vredenberg OJIP quenching protocol
Rapid light curves with curve fitting
F_V/F_M & F_V/F_O, Y(II), ETR

ASPB News
American Society of Plant Biologists
15501 Monona Drive
Rockville, MD 20855-2768 USA

PERIODICALS
POSTAGE PAID
AT ROCKVILLE MD
AND ADDITIONAL
MAILING OFFICES

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.

ASPB News (ISSN 1535-5489; Online ISSN 1544-9149) is published bimonthly by the American Society of Plant Biologists, 15501 Monona Drive, Rockville, MD 20855-2768 USA, telephone 301-251-0560, fax 301-279-2996. Members' dues include a subscription price of $2 per year to *ASPB News*. Subscription price to nonmembers is $30 per year. Periodicals postage paid at Rockville, MD, and at additional mailing offices. Postmaster: Please send address changes to *ASPB News*, 15501 Monona Drive, Rockville, MD 20855-2768 USA.