ASPB News

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Inside This Issue

Sally Assmann Assumes Presidency October 1

Sarah M. (Sally) Assmann, Penn State University, is ASPB's new president. She succeeds Rob McClung, Dartmouth University, who became immediate past president on October 1. The Society's new president-elect is Tuan-hua David Ho, Washington University in St. Louis.

Sally Assmann

Sally currently is the Waller Professor of Biology at Penn State University. She received her BA in biology from Williams College in 1980 and her PhD in biology from Stanford University in 1985. After a postdoctorate at UC–Riverside with Rob Leonard, she joined the Organismic and Evolutionary Biology Department at Harvard University as an assistant professor in 1987 and continued there as an associate professor. In 1993, she moved to the Biology Department at Penn State.

During her PhD research with Eduardo Zeiger on stomatal responses to light, Sally developed a fascination with cellular signaling, an emphasis that is retained in her laboratory to this day. Her group takes a multilevel approach to guard cell biology and draws on methods ranging from single-cell electrophysiology and ionic imaging; to molecular genetic, genomic, and proteomics approaches; to whole plant physiology. Recently, Sally has begun collaborating with systems biologists to construct predictive models of guard cell signaling. In 2006, she was one of a team of scientists awarded an NSF Arabidopsis 2010 grant to elucidate the membrane interactome. The project's aim—to define the protein–protein interaction network of several thousand membrane proteins and soluble signaling proteins—should provide a wealth of information to the plant science community.

Another major research focus of Sally's group is on roles of heterotrimeric G-proteins in plant plasticity and plant stress tolerance. She has demonstrated that these key signaling proteins regulate a diversity of ion transport, hormonal, and developmental processes and is extending this research from the model plant Arabidopsis to the oilseed crop canola.

Sally teaches introductory plant physiology to freshmen and a laboratory course on cell biology techniques to beginning graduate students. Her professional activities include grant review panels for NSF, DOE, and USDA; in 2004, she was program manager for the USDA Developmental Processes in Crop Species panel. She has served in an editorial capacity for a number of journals: subject editor for *Plant, Cell, & Environment* from 1997 to 2000; editorial board member of *Plant and Cell Physiology* from 1998 to 2001; and monitoring editor for *Plant Physiology* from 1994 to 1997. She has been a coeditor for *The Plant Cell* since 1998. Other ASPB service includes membership on the Publications Committee from 2000 to 2005, current membership on the board of directors of the Education Foundation, and co-organizer of the "Biology of Transpiration" meeting held in 2006. Sally's K–12 outreach activities include teaching special programs on plant biology to elementary school classes and production of "Roots of Discovery," a 30-minute science education video. Her most extensive outreach effort has been development of a week-long summer science camp on plant biology for 4th

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The *ASPB News* is delivered online as well as in print. Members will be alerted by e-mail when a new issue is posted. The *ASPB News* welcomes member feedback. Contact the editor at nancyw@aspb.org.

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President's Letter

Turn! Turn! Turn!

Timing is everything (says the circadian biologist). Pete Seeger wrote the peace anthem (*Turn! Turn! Turn!*) that expresses this concept most poetically. The Byrds made it number 1 (1), and Judy Collins rendered one of the most beautiful covers (2). One year ago, in my first letter as president, I spoke of transitions. As I write my final letter as president, my thoughts have returned to that theme. Pliny the Elder, Roman scholar and scientist (c. 23–79 AD), wrote, "From the end spring new beginnings." ASPB now makes the transition to new leadership, with Sally Assmann assuming the presidency. I want to take this opportunity to thank Rick Amasino, who has provided energetic, thoughtful, and effective leadership in his three years in the presidency. I also welcome Tuan-hua David Ho, our president-elect. I look forward to working with him as well as continuing to work with Sally. I also want to acknowledge the folks who participate on our many committees. They do an excellent job, and it is a real privilege to work with them.

As I re-created my search for the perfect quotation about transitions, I was reminded of a second and perhaps more pertinent quote: "Those who cannot remember the past are condemned to repeat it" (3). However, as I re-trod my path, I did come across a number of other quotations from Pliny the Elder that retain surprising relevance, given that 2,000 years have passed since he wrote. In my letters this past year, I have focused on the current issues I call the three Fs: food, fuel, and funding. Rick Amasino also emphasized education, and it turns out that Pliny the Elder had important things to say about each of these.

Driven by the need to provide food and (bio)fuel, one of our major goals as plant scientists is to increase plant productivity. The challenges of meeting this goal are exacerbated by the diversion of arable land from agriculture and also by the degradation of our environment and climate through human activities. I was surprised to see that Pliny the Elder had said, "With man, most of his misfortunes are occasioned by man" (4). Apparently some things never change.

As I write, a political campaign is playing out in the United States of America. Current and future energy supplies are at the forefront of this campaign, and Pliny the Elder addressed one of the more simplistic responses to sustaining energy supplies: "Everything is soothed by oil" (5). Of the windfall profits being enjoyed by the giant oil companies, he said, "The best plan is, as the common proverb has it, to profit by the folly of others" (6). I find it impossible to endorse this business plan, however profitable, and I was pleased to read that an earlier Roman writer, Publilius Syrus, cautioned, "Never find your delight in another's misfortune" (7).

If the solution to energy supplies were as simple as those who spout slogans would have us believe, new policies would be implemented and we would move on. Any solution is complex and, although drilling for more oil may be part of the solution, drilling alone is insufficient. Moreover, we should all recall Publilius Syrus's 301st maxim: "There are some remedies worse than the disease" (8). Burning fossil fuels and transferring CO_2 into the atmosphere contributes significantly to another problem—global warming.

Many of those who profit from the status quo frequently resort to claims of uncertainty about global warming to justify deferring or avoiding altogether solutions that might be painful or might reduce short-term profits. Pliny the Elder, as a scientist, recognized that "The only certainty is that nothing is certain" (9). Indeed, scientists and other thoughtful individuals are frequently at a handicap in debating complex issues with zealots who profess certitude where none is justified. Education is critical to allow people to evaluate available evidence, to recognize when further evidence is required, and to understand that uncertainty is not an excuse for inaction. Where, as in the case of global warming, the preponderance of evidence indicates that change is occurring and that anthropogenic activities are contributing substantially, action is urgent as the risks are compounded by procrastination. The time to develop crops and agronomic practices better able to respond to global warming is now. Again, Pliny the Elder had an appropriate comment: "It is a maxim universally agreed upon in agriculture, that nothing must be done too late; and again, that everything must be done at its proper season; while there is a third precept which reminds us that opportunities lost can never be regained" (10). Now is the time to invest in basic and applied plant biology.

Persuading taxpayers to invest in plant biology requires that we educate both the taxpayers and their elected leaders to better understand both the challenges presented to and the opportunities afforded by plant science. One of the most critical goals is to persuade young people and their parents that a career in plant biology is challenging, relevant, and fulfilling. ASPB devotes considerable time, energy, and money to education goals through the Education Committee and the Education Foundation. Looking across the globe, there are many examples of obstructions to education, whether to the teaching of specific subjects, such as evolution, or to the teaching of specific populations, such as women. Publilius Syrus was fully in tune with ASPB's educational goals when he wrote, "It is only the ignorant who despise education" (11).

Turning to my own attempts to educate, I compared publication rates in Ara-

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bidopsis and Drosophila in my previous letter, "A Model Citizen." The analysis included data for maize taken from the Maize Genetics and Genomics Database (12). However, since that figure was published, I have learned that MaizeGDB stopped curating maize publications. Therefore, that figure seriously underestimates the maize literature. (See the letter from MaizeGDB and the Maize Genetics Executive Committee posted at http://www.aspb.org/newsletter/septoct08/maize.pdf.) Similarly, I have been advised that the rice data also provide an underestimate. A revised figure omitting the maize and rice data has been posted at http://www.aspb.org/newsletter/julaug08/01pljul08.cfm. Publilius Syrus recognized the need to revise: "It is a bad plan that admits of no modification" (13).

Most issues facing plant biology today are global in scope. ASPB has long recognized the importance of internationalism in science, but this year has marked a new stage in our commitment to international science. Our annual meeting, Plant Biology 2008, was held jointly with the Sociedad Mexicana de Bioquímica Rama: Bioquímica y Biología Molecular de Plantas in Mérida, Mexico. Mérida, like Honolulu, lies noticeably south of the Tropic of Cancer, making this our second annual meeting in the tropics (don't forget our third, next year when we return to Honolulu). Travel to Mérida was an agricultural pilgrimage, as Mexico is the center of diversity for maize and peppers, and the Yucatan itself is the home of the habañero and also the likely site of the introduction of the tomato to Europeans. Of course, there were many more lessons and much excellent science. I would like to extend many, many thanks to Danny Schnell, our secretary, who, together with the Program Committee and with the notable help of our past secretary, Nick Carpita, and the invaluable contributions of our newly elected corresponding member, Federico Sánchez, put together an excellent program. The Mérida meeting was the first ASPB meeting held in Mexico; we have met in Canada before (1997 in Vancouver), and we will return to Canada with the 2010 meeting in Montréal, from July 30 to August 5. It is not too early to mark your calendars!

Plant Biology 2008 represented a new model for ASPB, as it was coupled with the Pan American Congress on Plants and BioEnergy. Nick Carpita and Steve Long put together a fascinating program for the BioEnergy meeting. The combination of policy discussions and scientific presentations was a really enjoyable mix. Many thanks to Nick and Steve for recognizing a real need and bringing the meeting to fruition. Of course, many, many thanks go to Jean Rosenberg, director of meetings, marketing, and membership, and "meeting diva" Wendy Sahli, ASPB's manager of meetings, marketing, and web services, and to the rest of the ASPB and local staff who made both meetings flow so smoothly.

I want to take the opportunity afforded by this last letter to thank the ASPB staff. We could not ask for a better group of people. Their energy, creativity, and dedication make so much possible. Working closely with Crispin Taylor, the Society's executive director, has always been a pleasure, and his collaboration made this year enjoyable and, I hope, productive. I particularly wish to single out Diane McCauley and thank her for her patience and understanding as I blew through deadline after deadline and for her talent and professionalism in making the newsletter happen.

In particular, I thank all of you, our members. The Society is strong because of its membership. I am especially gratified that so many of you volunteer to serve the Society on committees and in other capacities. It has been a tremendous honor to serve as president of ASPB. Of course, Pliny the Elder had it right, and this transition does not mark simply an end but also the beginning of a year as past president. I look forward to the coming year and to subsequent opportunities to contribute to ASPB.

Rob McClung
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Acknowledgments

I thank Sally Assmann (Penn State University) and Mary Lou Guerinot (Dartmouth College) for their comments and discussion. I also thank Mary (Polacco) Schaeffer, Patrick Schnable, Anne Sylvester, and Yukiko Yamazaki for pointing out the flaw in the maize and rice publication analysis.

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Tuan-hua David Ho Elected to Lead ASPB in 2009–2010

Tuan-hua David Ho becomes president-elect October 1 and is slated to become ASPB president next October for the 2009–2010 term.


Tuan-hua David Ho

David Ho, professor at Washington University in St. Louis, obtained his PhD in biochemistry from the DOE Plant Research Laboratory at Michigan State University in 1976. After two years as a Jane Coffin Childs postdoctoral fellow in the Department of Biology at the Massachusetts Institute of Technology, he took a position as assistant professor in the Department of Plant Biology, University of Illinois at Urbana–Champaign. In 1984, he moved to Washington University, where he is currently a professor in the Department of Biology. During the past four years, he also served as the director of the Institute of Plant and Microbial Biology, Academia Sinica, Taipei.

David's research concentrates on the hormonal regulation of seed germination and on plant responses to environmental stresses. His early work contributed to the understanding of the physiological role of cereal aleurone layers during seedling growth. Several key hydrolytic enzymes involved in this process have been studied, purified, and cloned in his laboratory. In recent years, his work has been centered on hormonal regulation of gene expression and programmed cell death and the role of stress-induced proteins. His group played a major role in defining the *cis*-acting promoter sequences necessary and sufficient for GA and ABA regulated gene transcription. His work also addresses the role of protein kinases and phosphatases, transcription factors, and other components in signal transduction pathways mediating the antagonism between GA and ABA. More recently, he has become interested in biofuel-related problems, especially microbial enzymes capable of hydrolyzing lignocellulosic materials.

David has been elected a fellow of AAAS (American Association for the Advancement of Science; 2004), a member of TWAS (Academy for the Developing World; 2004), and a member of Academia Sinica (Taipei; 2002). He was also recognized as an ISI most-cited researcher in Animal and Plant Sciences in 2003, the Burris Distinguished Lecturer at South Dakota State University in 1993, and a UNESCO Professor at Peking University in 1994. He served as director of the Plant Biology Program at Washington University from 1987 to 1989. He was an editor of the *Journal of Plant Growth Regulation* from 1989 to 2001 and a member of the editorial board for *Developmental Genetics* from 1984 to 1990. He has served on various government research panels, including the NSF Developmental Biology Program (1993–1994), USDA–NRI Genetic Mechanism Program (1981–1983), Stress Biology Program (1985–1986), and Special Grant Program (1994). He was manager of the USDA Plant Responses to the Environment Program in 1993.

David joined ASPB in 1973. He served on the Program Committee from 1994 to 1997 and as chair of the Corresponding Membership Committee from 2001 to 2003. He is currently a member of the International Committee. He was the Society's representative to AAAS from 1992 to 1994 in the sections of Biological Sciences and Agriculture, Food, and Renewable Resources. From 1982 to 1993, he was on the editorial board of *Plant Physiology* and was a monitoring editor from 1995 to 2001.

As a long-time member of ASPB, David has been interested in promoting the role of our Society in the international arena. In addition to emphasizing outreach, education, academic publication, and public affairs, he also would like to see ASPB play a major role in bridging academic and industrial interests.

Sally Assmann
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through 8th graders, which used the popular Harry Potter series to engage over 150 children in the subject of "herbology."

Sally writes, "During my past year as ASPB president-elect, I have been struck by how extremely dedicated and generous both ASPB members and ASPB headquarters staff are in committing their time, energies, and insights to ASPB and its initiatives. Many members read and publish in our stellar journals, *The Plant Cell* and *Plant Physiology,* and 27% of current members have enjoyed the outstanding science and camaraderie of one or more ASPB meetings. Yet ASPB does so much more, ranging from lobbying Capitol Hill for crucial support of plant biology and agriculture, to providing free copies of the much-lauded ASPB-published textbook, *Biochemistry and Molecular Biology of Plants,* to scientists and educators in lesser developed countries. In the coming year I look forward to more opportunities to contribute to ASPB's wide-ranging endeavors. Society initiatives I'll be engaged in include working with the ever-vigilant Public Affairs Committee and associated ASPB staff to provide an accurate portrayal of science and our scientific endeavors to the general public, funding agencies, and Congress; partnering with our Minority Affairs, Women's, and Membership Committees to further improve the diversity of our membership and leadership; promoting increased education and outreach efforts to the international plant sciences community; and, in the truly global community of the Internet, serving on the advisory board for an ASPB-sponsored YouTube plant biology video contest. This contest is just one of several innovative projects to receive GAP award funding from the ASPB Education Foundation (http://www.aspb.org/education/foundation/gap.cfm). You, your children, and your students will all be eligible to submit videos—see page 34 for more details.

Kathy Osteryoung Elected to Executive Committee

Katherine W. Osteryoung joins the ASPB Executive Committee as an elected member on October 1.

Kathy earned a BA degree in biological sciences from the University of California, Santa Barbara, and in 1990 she earned a PhD in plant physiology from the University of California, Davis.


Kathy Osteryoung

Kathy was a postdoctoral research associate from 1990 to 1993 and an NIH postdoctoral fellow from 1993 to 1995 in the Department of Biochemistry at the University of Arizona. From 1996 to 2000, she was assistant professor in the Department of Biochemistry and Department of Biology at the University of Nevada, Reno. In 2000, she moved to Michigan State University, where she was associate professor until 2006 and is currently professor in the Department of Plant Biology.

Kathy's research interests include the composition, structural organization, biochemical dynamics, evolution, and regulation of the chloroplast division machinery in plant cells. She also has investigated cyanobacterial cell division as an evolutionary model for plastid division and dynamics.

Her professional activities include a stint from 2004 to 2006 as evaluator, Faculty of 1000, and service on the editorial committee of *Annual Review of Plant Biology* from 2006 to the present. She was also a member of the peer-review grant panels of USDA's National Research Initiative Competitive Grants Program for Plant Growth and Development and of NSF's Integrative Plant Biology program. In addition, she has been a mentor to 24 undergraduate research students.

Kathy has served ASPB in a number of capacities. From 2005 to the present, she has been a monitoring editor for *Plant Physiology*. She was a member of the Charles Reid Barnes Life Membership Award Committee from 2005 to 2007, and from 2007 to 2008, she was chair of that committee.

Addressing Ethical Standards: Mentor Involvement in Research Misconduct

Between 2004 and 2005, the *ASPB News* published a handful of articles addressing the most common types of ethical misconduct in publishing (http://www.aspb.org/newsletter/ethicalstandards.cfm). An interesting new study, published in July in the journal *Science and Engineering Ethics* (http://www.springerlink.com/content/70w5wu2142w6151g/?p=3aeb5f3fe93c4cd6952337857f55e3c2&pi=4) and discussed in an article in the August 29 issue of the *Chronicle of Higher Education* (CHE; http://chronicle.com/daily/2008/08/4405n.htm), investigates the extent to which mentors are involved in promoting responsible research in cases of research misconduct. The authors reviewed the U.S. Public Health Service misconduct files of the Office of Research Integrity. They explored the role of the mentor in these cases on such behaviors as review of source data and teaching of research standards. They found that nearly three-quarters of the mentors had never examined the trainees' lab results, and two-thirds never taught the trainees standards for properly keeping lab notebooks. They concluded that many mentors were poorly prepared to educate trainees about ethics. Further, as noted in the CHE article, many scientists were in fact poor role models because they themselves engaged in possibly unethical research practices.

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Below we have published an extract from the CHE article. It is reprinted courtesy of *The Chronicle of Higher Education,* copyright 2008.

The *ASPB News* welcomes ideas for its occasional column "Addressing Ethical Standards," in which we address scientific (mis)conduct in publishing. Our format is simple: We provide the reader with a brief introduction to the topic, then reprint (by permission) a few paragraphs from a previously published article by an authoritative source, with a link to the full article. You can read all prior columns at http://www.aspb.org/newsletter/ethicalstandards.cfm.

Send your ideas to column editors Rob McClung and Nancy Winchester at **nancyw@aspb.org.**

Scientists Who Cheated Had Mentors Who Failed to Supervise Them

By Jeffrey Brainard

When young scientists fake results, their mentors—senior researchers who are supposed to train them—have neglected their supervisory responsibilities. A new study of scientific trainees caught cooking their data found that in three-quarters of the cases, their mentors had never examined the trainees' laboratory results. And two-thirds of the

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From Plants to Planets

AAAS/ASPB Mass Media Fellow Reports In

Julie Thole is the fifth AAAS/ASPB Mass Media Science & Engineering Fellow

Julie Thole

Only a week after defending my PhD thesis, I said goodbye to my husband, my dog, and our comfortable St. Louis home. Ready or not, I was off to Washington, D.C., for a crash course in journalism at the headquarters of the American Association for the Advancement of Science (AAAS). There were 15 of us in the AAAS Mass Media Fellowship program, ranging from fresh BS graduates in math to fresh PhD recipients in biology, and we had varied journalism backgrounds. Having no journalism experience myself, taking the AAAS version of Journalism 101 was essential before I was sent off to New York City, where I would be working at *Discover* magazine for 10 weeks.

After a splendid evening sleeping on the floor of Reagan Airport (thank you, airline industry!), I finally arrived in the Big Apple. Once I settled into my apartment in Queens and got acquainted with the city, I headed to the office of *Discover* in downtown Manhattan, excited to learn everything I could about science writing.

In my first week at *Discover*, I read through the past two years of issues to get a feeling for the style of the magazine. My first real assignment from my editor was to help with the next special issue of the magazine—"Think about how we would put together an issue about the universe." What?! I'm used to a little more . . . direction.

While I thought about how to accomplish such a gargantuan task, I also was put to work researching exoplanets. These are planets around stars other than our sun—as of a few weeks ago, 307 exoplanets had been discovered. I learned about how these planets are identified and about the scientists who find them, and I discovered that most of these exoplanets are very large and very hot.

The special issue, called "The Whole Universe Catalog," slowly came together, with a lot of work on my part. We decided to organize the issue by "zip code," starting close to home with the Earth and our solar system and going outward to explore other solar systems, stars, and ultimately the entire cosmos. The stories in special issues are mostly repurposed features from past issues; I read through eight years of *Discover*'s astronomy features and made a list of my favorite articles, and the editor used my list to choose most of the stories for the issue.

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ASPB Participates in FESPB Congress in Tampere, Finland

ASPB traveled to Finland to showcase its premier plant biology journals, *Plant Physiology* and *The Plant Cell,* and some of its many other important activities at the 16th Congress and Exhibition of the Federation of European Societies of Plant Biology (FESPB), held in Tampere from August 17 to 22. More than 1,200 delegates gathered over six days, and ASPB was there for all of it. We first joined our European colleagues at the FESPB meeting in 2006 in Lyon, France, and plans are already under way to again participate in this important event in 2010, when FESPB will convene in Valencia, Spain.

We believe that our attendance at the meeting was especially timely this year, as the Society has its first-ever European editor in chief, Cathie Martin of the John Innes Centre in Norwich, England. Cathie was our special guest at the stand, and many delegates dropped by over the course of the conference to chat with her.

The ASPB exhibit also highlighted the Education Committee's work (see related story on page 40) and various membership activities. The committee was represented by Mary Williams, a former chair, who is on sabbatical in Glasgow from Harvey Mudd College. Nancy Winchester, director of publications, represented the journals along with Cathie Martin, and Jean Rosenberg, director of meetings, marketing, and membership, represented the important work ASPB does in support of its members and the profession worldwide.

In preparation for the meeting, Cathie Martin and Don Ort, editor in chief of *Plant Physiology,* compiled a special collection of articles from *The Plant Cell* and *Plant Physiology*. *Insights in Plant Biology* includes five recent papers from each journal that the editors believe reflect the latest and most important work in fields especially relevant to the Tampere Congress. If you would like to receive a copy, please contact jean@aspb.org.

ASPB's presence was welcomed by our European colleagues, and the meeting afforded the Society a great opportunity to discuss ways to build relationships with plant biologists in Europe and around the world. We look forward to seeing everyone again in Valencia in 2010!

Online *Arabidopsis Book* Posts New Content; More Chapters in Production

The Arabidopsis Book (TAB), ASPB's free online compendium (http://www.aspb.org/publications/arabidopsis), has posted nine new chapters online since late May:

Gehring, M., and Henikoff, S. DNA Methylation and Demethylation in Arabidopsis. May 23, 2008.

Millar, A.H., Small, I.D., Day, D.A., and Whelan, J. Mitochondrial Biogenesis and Function in Arabidopsis (update). July 9, 2008.

Robert, S., Raikhel, N.V., and Hicks, G.R. Powerful Partners: Arabidopsis and Chemical Genomics. July 10, 2008.

Schaller, G.E., Kieber, J.J., and Shiu, S.-H. Two-Component Signaling Elements and Histidyl-Aspartyl Phosphorelays (update). July 14, 2008.

Sakamoto, W., Miyagishima, S.-Y., and Jarvis, P. Chloroplast Biogenesis: Control of Plastid Development, Protein Import, Division and Inheritance. July 22, 2008.

Baud, S., Dubreucq, B., Miquel, M., Rochat, C., and Lepiniec, L. Storage Reserve Accumulation in Arabidopsis: Metabolic and Developmental Control of Seed Filling. July 24, 2008.

Sun, Tai-ping. Gibberellin Metabolism, Perception, and Signaling Pathways in Arabidopsis. September 24, 2008.

Bassham, D.C., Brandizzi, F., Otegui, M.S., and Sanderfoot, A.A. The Secretory System of Arabidopsis (update). September 30, 2008.

Micali, C., Göllner, K., Humphry, M., Consonni, C., and Panstruga, R. The Powdery Mildew Disease of Arabidopsis: A Paradigm for the Interaction Between Plants and Biotrophic Fungi. October 2, 2008.

Three more chapters are due to be posted online this fall:

Ramon, M., Rolland, F., and Sheen, J. Sugar Sensing and Signaling.

Lu, Y. and Last, R. Web-Based Arabidopsis Functional and Structural Genomics Resources.

Kwak, J.M., Mäser, P., and Schroeder, J. I. The Clickable Guard Cell, Version II: Interactive Model of Guard Cell Signal Transduction Mechanisms and Pathways.

Founded by Chris Somerville and Elliot Meyerowitz, TAB has been bringing readers the latest Arabidopsis content free on the Internet since 2002. ASPB funds the production of TAB as a public service. All chapters are hosted in partnership with BioOne (www.bioone.org) in HTML and PDF format. The current editorial board is chaired by Rob Last, Michigan State University.

Do you use *The Arabidopsis Book* in your classroom?

Let us know how you use TAB, what about it you find valuable, and what you'd like to see improved.

E-mail nancyw@aspb.org

Future ASPB Meetings

Plant Biology 2009
Honolulu, Hawaii
July 18–22, 2009

Plant Biology 2010
Montreal, Canada
July 30–August 5, 2010

Joint Annual Meeting of the American Society of Plant Biologists and the Canadian Society of Plant Physiologists/Société Canadienne de Physiologie Végétale

For more information go to http://www.aspb.org/meetings/

PHOTO COURTESY OF THE HAWAII TOURISM AUTHORITY.

ASPB Member Strauss Named Oregon State University Distinguished Professor

ASPB member Steve Strauss, a professor of forest science in the College of Forestry, Oregon State University (OSU), was recognized with the university's highest academic honor, the title of "Distinguished Professor," on May 22, 2008.


Steve Strauss

Steve is internationally known for his impacts in research, outreach, and teaching, and his scholarship spans the molecular to the ecological, and technical to policy levels. He has made major contributions to analysis of the social, ecological, and policy aspects of biotechnology.

"Steve's potential as a scientist was recognized early in his career at OSU when he received a prestigious NSF Young Investigator Presidential Award in 1989," notes Forest Science Department Head Tom Adams. "He has certainly not disappointed us! Today Steve is recognized worldwide in the field of forest genetics as a pioneer of the application of molecular genetics to understanding the biology of forest trees. In particular, he has used the tools of genetic engineering and genomics to help unravel the genetic control of flowering, stem form, and pest resistance in poplar species."

Strauss has become well known at OSU because of the biotechnology outreach program that he has directed since 2004, which brings high-profile speakers to campus to address the diversity of social and scientific issues surrounding use of biotechnologies. He was a Leopold Leadership Fellow in 2005–2006; the program trains leading environmental scientists in outreach and communication skills. He has been quoted in dozens of major news articles, including in the *New York Times, USA Today, The Oregonian, The Economist,* and *Science.*

Baulcombe Wins the Lasker

University of Cambridge plant scientist David Baulcombe, formerly of the Sainsbury Laboratory in Norwich, UK, has won the 2008 Albert Lasker Basic Medical Sciences Award for his work on RNA-mediated silencing of gene activity in plants. Baulcombe shares his award with Gary B. Ruvkun and Victor Ambros, both of whom discovered similar modes of gene regulation in *Caenorhabditis elegans*.

A comprehensive description of the 2008 award to Baulcombe, Ruvkun, and Ambros is available on the Lasker Foundation website at http://www.laskerfoundation.org/awards/2008_b_description.htm. This page also includes links to a celebratory essay (http://www.laskerfoundation.org/awards/2008_b_description.htm) written for the October issue of *Nature Medicine,* in which Baulcombe uses case histories of basic biological discoveries made in plants to argue that carrying out research in plant model systems is equally valuable as investigating yeast, worms, and other animals. He points out, however, that in addition to helping scientists address basic questions in biology, research in plants may "help with the small problem of harvesting the sun and feeding the world."


David Baulcombe
PHOTO COURTESY OF THE LASKER FOUNDATION.

Those interested in teaching the basics of how RNA interference impacts gene expression may appreciate the video short from Nova that is available at http://www.pbs.org/wgbh/nova/sciencenow/3210/02.html.

Addressing Ethical Standards
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supervisors never taught the trainees standards for properly keeping lab notebooks.

"There was a troublingly high incidence of missing data or of no lab books at all (even in the laboratories of renowned scientists)," wrote the authors of the study, <http://www. springerlink.com/content/70w5wu2142w6151g/?p=3aeb5f3fe93c4cd69523 37857f55e3c2&pi=4>, which appears in the September issue of the journal *Science and Engineering Ethics*.

The findings suggest that principal investigators and laboratory leaders should more frequently spot-check trainees' work as well as instruct them about laboratory procedures and ethics, the authors said. But the mentors need help from their institutions to do so…

Read this article in its entirety by visiting http://chronicle.com/daily/2008/08/4405n.htm. A subscription to the Chronicle of Higher Education *is required to access this article.*

AAAS/ASPB Mass Media Fellow
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I also helped out with photo research, digging around on the Internet for the newest and coolest images of outer space. And after all of my research on exoplanets, I was assigned to write a short article, basically a Top 10 list of the weirdest and most interesting exoplanets. For this story, I did phone interviews with some of the most famous "planet hunters," which was undoubtedly the most fun I had all summer.

Being a part of putting together this issue, from conception to (almost) completion, was by far the most rewarding experience of the summer. I can't wait to actually hold the magazine in my hand and have concrete evidence of my hard work.

In the end, I didn't get to write as much as I hoped. But I guess if you compare the number of stories in a monthly magazine to a month's worth of articles in a daily newspaper, it's not surprising. Most of my time was spent helping editors with research and doing fact checking, which was still helpful in learning about science writing.

I feel lucky to have been so involved in the special issue. Before this summer, I had no idea how much work went into putting together a magazine—the coordination is truly an art. When I started in June, the majority of issues were planned until February of next year! I will never look at a magazine the same way again.

All in all, the summer was a truly rewarding experience. It was also kind of like a long vacation with really expensive rent. When I wasn't working, I was exploring New York—I went to just about every art museum and yarn store in the city and saw some great concerts. I had always thought New York was a great place to visit but that I could never live there. Now I can verify that!

I am now back home in St. Louis, easing myself into a postdoc position at the Danforth Plant Science Center, where I am actually looking forward to some bench work. I will keep my eyes open for opportunities to write about science, and I hope to eventually find a job communicating the importance of science to the general public. Regardless of what the future holds, I know that my 10 weeks as a science journalist have at least made me a better scientist.

Julie Thole
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CALL FOR APPLICATIONS

American Philosophical Society Research Programs

All information and forms for all of the Society's programs can be downloaded from our website, http://www.amphilsoc.org. Click on the "Fellowships and Research Grants" tab at the top of the homepage.

Information About All Programs

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

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

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

Contact information
Questions concerning the FRANKLIN, LEWIS AND CLARK, programs should be directed to Linda Musumeci, Research Administrator, at LMusumeci@amphilsoc.org or 215-440-3429.

Brief Information About Individual Programs

Franklin Research Grants

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

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

Award
From $1,000 to $6,000.

Deadlines
October 1, December 1; notification in February and April.

Lewis and Clark Fund for Exploration and Field Research

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

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

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

Deadline
February 15; notification in May.

Information updated July 2008.

Reflections on Relevance

by Mary E. Musgrave
Professor and Head, Department of Plant Science, University of Connecticut; mary.musgrave@uconn.edu


Mary Musgrave

The first time I thought seriously about what makes science relevant came during my days as a graduate student studying the physiological significance of cyanide-resistant respiration in plants. My major adviser in the Botany Department at Duke University, then assistant professor Jim Siedow, had given me a grant proposal to read. I thought that the paragraphs at the beginning of his proposal to NIH, giving background on the linkage between cyanide-resistant respiration and disease, "didn't fit in," because it was the first time I had considered that studying plant mitochondria could have medical applications. Over the intervening years, I saw the relevance of this basic research on plants to combating human disease; Jim used his extramural funding from NIH to make many fundamental research discoveries and move through the ranks as a powerful and effective advocate for science.

In my own first faculty position, at Louisiana State University, I had the title of plant stress physiologist. In Louisiana, it was easy to discover the most relevant environmental problem—soil waterlogging—and the most severely affected crop—winter wheat. The Louisiana Small Grains Research and Promotion Board funded work that promised to identify wheat varieties that best stood up to waterlogging, and this gave me an opportunity to study physiological traits that confer waterlogging tolerance. Since waterlogging affects 12% of agricultural soils in the United States as a whole and a much higher percentage in Louisiana, the relevance of my work was becoming increasingly clear to me.

Nevertheless, this relevance was suddenly challenged by an unfortunate national discourse that arose surrounding "plant stress" at that time (which other stress physiologists in ASPB no doubt recall). Former President Clinton chose to ridicule investigators studying plant stress, charging that scientists should have better things to do with their time and the nation's money than fretting over the emotions of vegetables. The fallout was immediate. Almost overnight, I became an "environmental plant physiologist," and my popular graduate course, Plant Stress Physiology, followed suit with the new name of Environmental Plant Physiology.

In the 1990s, I realized that what I had learned about waterlogging could be put to use in solving a persistent problem facing NASA. Plants had been grown in "microgravity" ($<10^{-3}$ g) in freely falling orbital spacecraft since the 1960s. However, by the late 1980s, the problems with getting plants to reproduce in space had led researchers to conclude that there might be some step in flowering and seed production that was absolutely dependent on gravity. Waterlogging research had given me the perspective that the problems faced by plants growing in microgravity were likely caused by zero-g-related environmental conditions rather than by any direct biological requirement for gravity. Microgravity, famous for scenes of astronauts playing with floating globs of water, also gives us the ultimate in undrained rootzones.

At the time, NASA had two research programs that sponsored plant research: the Space Biology Program and the CELSS (Controlled Ecological Life Support System) Program. The former was dominated by scientists who wanted to use the microgravity environment to perform basic research on gravitropism, while the latter was a group of scientists pushing the limits of yield in hydroponic culture by manipulating light, carbon dioxide, and nutrients, with the long-term goal of being able to sustain human food and atmosphere regeneration needs away from Earth.

Program managers in both groups were convinced that a project investigating the reasons behind reproductive failure by plants in microgravity fell solidly in the other program's camp. However, when I proposed to team up with plant anatomist Shirley Tucker to tackle this problem, the work qualified as "Space Biology." My lab soon had the opportunity to study early reproductive development in Arabidopsis during a series of experiments on the U.S. Space Shuttle. Our findings that the microgravity environment was functionally waterlogging the rootzone due to lack of drainage and starving the plants for carbon dioxide due to ineffective gas exchange lay the basis for redesigns of plant growth hardware and cultural practices, so that during the late 1990s and early 2000s, reproduction became a routine success for plants growing in space. The relevance of terrestrial research to extraterrestrial systems was immediate and obvious.

Because of the success of this initial work with Arabidopsis on the space shuttle, NASA soon gave my group a new opportunity. In 1995, for purposes of foreign policy, it was decided that a Ukrainian was going to fly on the U.S. Space Shuttle. This edict was given to NASA, along with the task of selecting a project that would make best use of the astronaut/cosmonaut's time in space. NASA managers had to decide whether a space welding demonstration or experiments in plant space biology would have greater relevance.

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The decision tipped in the favor of plant space biology when we showed that the experiments could intercalate with education and outreach by engaging the public in the scientific process. Discarding Arabidopsis in favor of the more charismatic Wisconsin Fast Plant (*Brassica rapa* L., cv. "Astroplants"), we partnered with Paul Williams, who developed "Teachers and Students Investigating Plants in Space," a middle and high school hands-on curriculum that adapted our flight experiment to the classroom. More than 200,000 students in the United States joined 20,000 students working with the Ukrainian version of the curriculum. The scope of the project and intensity of the media coverage during the real-time participation by students gave us scientists celebrity status. It was a public relations coup for NASA.

Years passed, and new opportunities came for experiments in space. My experience with a national-scale outreach project earned me the position of associate dean in the College of Natural Sciences and Mathematics at the University of Massachusetts–Amherst. After four years in this role, I found myself missing the relevance of my background as a plant scientist to my daily work.

It was while I was interviewing for the Plant Science Department head position at the University of Connecticut that I had a mishap at the Dairy Bar. During one of the dental visits that followed, I happened to notice that the *Highlights for Children* I was reading had run an article about my research, "Farming in Space." Knowing that *Highlights* has a readership of about 4 million, I strangely felt that I had arrived.

Surely of all scientists, plant scientists have the greatest opportunity to devote their lives to relevant pursuits. From our antecedents in agronomy, horticulture, and forestry, we inherit the scientific stewardship of the world's food supply, its atmosphere regeneration, and its nutrient and water cycling. The green revolution, biofuels, phytoremediation, nutriceuticals, sustainability, seeds . . . our list of key words goes on and on.

For my group, hooked on space biology, thoughts now turn away from weightless plants to those that will grow in habitats on the moon or Mars. The relevance test continues: I am in Washington, D.C., taking a cab to the National Academies building, and the driver's eyes narrow back at me in the rearview mirror. "Are you some kind of scientist?" As I explain my work, he nods in slow understanding and grudging respect. I realize anew that it is a privilege to be a scientist. Much of a scientist's satisfaction comes from the simple joy of discovery, but it is just as important that what we do matters to the rest of the world—that we are, in a word, *relevant.*

The Bioethics Imperative XXXVI

The close of TBI

"Mokita": The truth we all know and **agree** not to talk about. *Papua New Guinea*


Dina Mandoli

After some consideration, I have decided to close "The Bioethics Imperative." After seven years of bimonthly columns, I feel that I have covered the major topics that I set out to do, and more! In this column you, the readers, and I have explored topics as diverse as authorship, sexual harassment, Federal Effort Certification, and conflict of interest. A full list of the topics covered and links to the columns themselves can be found at http://www.aspb.org/newsletter/bioethics.cfm. ASPB formulated its own code of ethics to address the Society's expectations for scientific conduct in publishing and our procedures for handling allegations of misconduct for authors, editors and reviewers, and the publisher and staff while TBI has been running (http://aspb.org/publications/ethics.cfm).

Ethics, defined as "the study of morality's effect on conduct" and "code of morality"(1), is really a branch of philosophy that dates back at least to the Greeks. The word comes via Latin *ethica* from the Ancient Greek ήθική [φιλοσοφία] "moral philosophy," from the adjective ήθος [ēthos] "custom, habit" (2). Wikipedia (2) has both theoretical and applied listings (bioethics is under "Applied"). Core issues listed are justice, value, right, duty, virtue, equality, freedom, trust, free will, consent, and moral responsibility. Key thinkers range from Confucius and Socrates, to Hume and Kierkegaard, to whom I assume are the more modern thinkers, Nozick and Rawls.

And in the news, daily ethics cases abound. For example, both vice presidential candidates have been scrutinized: Governor Sarah Palin for the firing of a top law enforcement official in her administration (3) and Senator Joe Biden, whose son was a partner at a Washington law firm that has lobbied the senator's office (4). As of this writing, a quick Google search for "ethics cases" comes up with 785,000 listings. There are 2,390,000 hits for "ethics institutes" in areas ranging from business and medicine to public affairs. Clearly, one can spend a lifetime studying and debating ethics.

It has been said that as soon as there are at least two people in a room, there's politics. I would add that as soon as there are two people in a room, there's ethics. The genesis of ethical ground—both high and low—is the dynamics between those people and the events that they experience. Indeed, the ethics issues often emerge because no two people experience the same situation in the same way; they bring to it their "now" in the form of their own five senses, their past, their expertise, their desires, and their emotions. In the meeting of just two people then, there are complex landscapes on which ethical issues can roam and multiply. Add a friend or colleague and things can really get going! Set the stage in a public forum like a classroom and … well, you see what I mean.

Lasting messages of this column are really just twofold: Be aware of your resources, and be proactive. The primary resources in place for us all are local, including colleagues, departmental chairs, ombudsmen, and deans. In this mix, one might include publications like newspapers and departmental newsletters that can often set a story in a context that is meaningful to the wider audience. Don't scoff! There is more than one way to squelch the rumor mill. Secondary resources are those of the state including government, legal professionals, and professional societies such as ASPB. And then there are federal resources, to which we all might have to turn when dealing with ethics in the scientific community, the land of reviewing grants and manuscripts. On this broader scale, NSF, DOE, NASA, NIH, NOAA, Sea-Grant, and other federal agencies that have ethics committees, ombudsmen, and offices of the inspector general serve us all.

For me, being proactive now means examining your own position and the position of others, such as colleagues or students, around you. Over the years that I have been writing this column, I have seen or heard of many, many cases in which ethical problems have arisen that could easily have been avoided if the parties involved had been proactive in clarifying, questioning, and carefully considering all the possible angles of a situation at the onset. The watchwords are *leave no stone unturned* and *act positively, quietly, and openly* at the first hint of a sticky situation.

Personally, I have learned a lot from my work on this column. I have interacted with great people during these seven years as "a columnist." Thanks are due to many, including, in no particular order,

- my mentors who showed me ethics, both good and bad, by their actions and example
- ASPB Executive Committees who have made an ongoing commitment to ethics in our Society
- the ASPB membership for critically reading TBI and contributing ideas for these columns
- teachers who have used and taught with TBI over the years
- the NSF Office of the Inspector General, especially Jim Kroll
- students in my lab and in the labs of others who have willingly acted as guinea pigs during these past seven years
- administration, staff, and faculty at the University of Washington who have contributed to the columns with their time and their expertise
- and, of course, Nancy Winchester and

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Diane McCauley, the dedicated ASPB staff who have helped TBI be published over the years. They have been most professional and courteous in all my dealings with them.

So adieu! May you be ethical and lucky in all your professional dealings.

Dina Mandoli

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Membership Corner

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.

Name: Ashley Spence

Title: Graduate Student Research Assistant

Place of Work or School: University of Illinois at Urbana–Champaign

Research Area: The unique cold tolerance of *Miscanthus x giganteus* and its use as a biofuel feedstock

Member since: Fall 2007

1. **Why has being a member of ASPB been important to you?**
   Most recently, my membership in ASPB allowed me to attend the Pan American Congress on Plants and BioEnergy in Mérida, Mexico. This was an amazing opportunity to meet scientists from around the globe who are conducting research in similar areas. I think this has been so important in changing my perspective on my own research and determining how I fit into the scientific community.
2. **Was someone instrumental in getting you to join ASPB?**
   A fellow lab member, as well as my adviser, Dr. Steve Long, were both avid supporters of the importance of joining ASPB.
3. **What would you tell colleagues to encourage them to join?**
   I would emphasize the importance of being part of a prestigious organization where you can share your research and learn about that of others. Communication and community are necessary and useful.
4. **Have you enhanced your career using ASPB job postings or through networking at an ASPB function?**
   At the conference in Mexico, I was able to network with quite a few scientists whom I would never have met otherwise.
5. **Do you read print journals? If so, where do you usually read them?**
   Our lab has subscriptions to quite a few journals that we keep in a common area where people can sit and browse.
6. **What do you think is the next "big thing" in plant biology?**
   I think the next big thing will be another "green revolution," so to speak. We are getting close to directly altering the photosynthetic capacity of plants so that they can reach maximum quantum efficiency. For plant biologists, this is exciting, but I think globally this would mean extremely productive food crops.
7. **What person, living or deceased, do you most admire?**
   I admire my dad the most. He is a successful engineer and always gives me great advice and a more logical perception of life at times. "It's not the end of the world!" he would say.
8. **What are you reading these days?**
   Besides journal articles? Well, I'm the type of person who likes to reread (many times over) books that she loves, so right now I'm rereading *The Awakening*.
9. **What are your hobbies?**
   I enjoy playing soccer, exercising, and being outdoors in general. I don't get the chance much in Illinois, since it's so flat, but I love to hike.
10. **What is your most treasured possession?**
    My multipoo, named Noel. He is infinitely adorable and amusing.
11. **What do you still have left to learn?**
    Probably more than I'm aware.

NSF Research Up at Least 15% in Appropriations Committees' Fiscal Year 2009 Recommendations

Bond, Mikulski Champion Plant Genome Research Program

The Senate Appropriations Committee has approved a recommended increase of 16% over the current year level for NSF Research and Related Activities. The Research and Related Activities account receives $5.59 billion, an increase of $773 million. This amount equals the president's budget request.

Overall, the Senate Appropriations Committee increased recommended funding $789 million, or 13%, to $6.85 billion for NSF, which equals the president's budget request.

Language supporting the Plant Genome Research Program has been a legislative priority for ASPB this year. Senator Kit Bond (R-Mo.) worked with Chair Barbara Mikulski (D-Md.) in adding needed language to the Committee Report, which states, "Plant Genome Research Program—The Committee recommends $101,220,000 for the Plant Genome Research Program. The Committee remains a strong supporter of this important program due to its potential impact on improving economically significant crops. The Committee also recognizes its vast potential in combating hunger in poor countries."

Senator Bond has championed the Plant Genome Research Program since 1997, when he initiated the program. Senator Mikulski has worked closely with Senator Bond each year in support of the program. Their actions helped bring plant science to a new advanced era of research.

Senator Barbara Mikulski

Senator Christopher Bond

For Education and Human Resources, the Senate Appropriations Committee recommendation would provide $790 million. The recommendation is $65 million above the fiscal year 2008 enacted level and the same as the budget request.

The House Appropriations Subcommittee on Commerce, Justice, Science and Related Agencies recommended an increase of $723 million, or 15%, for NSF Research and Related Activities. Overall, NSF would receive an increase of $789 million, or 13%, over the current fiscal year. NSF Education and Human Resources would increase $50 million, or 6.3%, above the agency's requested level of $790 million. This represents an increase of $115 million, or 16%, over the current year.

The appropriations bills are not likely to be enacted separately. A continuing resolution is expected to be passed to cover federal expenses until after a new president takes office, but there is still much significance to the recommendations in the appropriations bills and reports. A combined appropriations bill may be assembled after a new president is sworn into office.

NRI, ARS Receive Increases in Appropriations Recommendations

The Senate Appropriations Committee approved on July 17 its recommendations for agricultural research. For the National Research Initiative (NRI), which is now being called the Agriculture and Food Research Initiative (AFRI) by the Senate Committee, a recommendation of $200 million was approved. This compares to $202 million recommended by the House Appropriations Subcommittee on Agriculture, which is using the NRI name. The House Subcommittee increase for the NRI represents a 5.8% increase over the current year; current year funding is $191 million.

Hatch Act funding is at $206 million in the Senate Committee recommendation. The House Subcommittee recommended $213 million. Current year funding is $196 million.

For the Agricultural Research Service (ARS), the Senate Committee recommended $1.13 billion for salaries and expenses. This compares to current year funding of $1.12 billion. House Committee recommendations for ARS were not yet released as this issue went to press.

ASPB President Rob McClung submitted testimony in support of increases for the NRI and ARS to both the House and Senate Appropriations Committees. We circulated an Alert with ASPB Campus Contacts. ASPB member Tim Nelson and ASPB staff conducted constituent visits at the office of the House Appropriations Subcommittee on Agriculture Chair, Rosa DeLauro (D-Conn.), and other offices in the Connecticut delegation. Tim is a constituent of DeLauro.

Boost for Science in Appropriations for DOE

The Senate Appropriations Committee and House Appropriations Subcommittee on Energy and Water Development have both recommended substantial increases for the Office of Science within the Department of Energy.

The Senate Appropriations Committee recommended $4.64 billion for the Office of Science, compared to current year funding of $4.02 billion. The House Subcommittee recommended $4.86 billion for science, $140 million above the president's request and an increase of $844 million over the fiscal year 2008 enacted level.

For Biological and Environmental Research, the Senate Committee recommended $599 million—$30 million more than the budget request. Within this amount, the Committee recommended $424 million for biological research.

For Basic Energy Sciences, the Senate Committee recommended $1.42 billion. Of these funds, $145 million is for construction activities as requested in the budget. The remaining $1.27 billion is for research. The House Appropriations Committee has not yet reported out its bill, so we don't know its recommendations. However, the House Appropriations Subcommittee on Energy and Water Development released some of its recommendations, reported above, and the full committee generally accepts the subcommittee's recommendations.

DOE, USDA Plant Feedstock Genomics Awards to ASPB Members Support Needed Basic Research in Biomass Genomics Leading to Cellulosic Fuels

The U.S. Department of Energy's (DOE's) Office of Science, Office of Biological and Environmental Research, and the National Research Initiative of the USDA Cooperative State Research, Education, and Extension Service have jointly selected 10 projects for awards totaling $10 million for biobased fuel research. These awards continue a commitment begun in 2006 to conduct fundamental research in biomass genomics that will establish a scientific foundation to facilitate and accelerate the use of cellulosic plant material for bioenergy and biofuels. The awards were announced by USDA Research, Education and Economics Undersecretary Gale Buchanan and DOE Undersecretary for Science Raymond Orbach.

"USDA is committed to fostering a sustainable domestic biofuels industry at home in rural America," Buchanan said. "These grants will broaden the sources of energy from many crops as well as improve the efficiency and options among renewable fuels."

Orbach commented, "Cellulosic biofuels offer one of the best near- to mid-term alternatives we have on the energy production side to reduce reliance on imported oil and cut greenhouse gas emissions while continuing to meet the nation's transportation energy needs. Developing cost-effective means of producing cellulosic biofuels on a national scale poses major scientific challenges—these grants will help in developing the type of transformational breakthroughs needed in basic science to make this happen."

A 2005 report by DOE and USDA—"Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply"—found that there is enough renewable biomass in the nation to displace more than one-third of the transportation fuels (primarily gasoline from imported oil). Considering that one of every four barrels of oil used in the world is burned in the United States, primarily by cars and trucks, renewable biomass-derived fuels represent a huge contribution to the nation's future energy security.

In 2008, DOE will provide $8.8 million in funding over three years, while USDA will award $2 million over three years. The following sections provide information on each grant award.

Development of Genomic and Genetic Tools for Foxtail Millet, and Use of These Tools in the Improvement of Biomass Production for Bioenergy Crops

- University of Georgia, $1,295,000
- Principal Investigator: ASPB member Jeff Bennetzen
- Co-Principal Investigators: Katrien Devos, Andrew Doust, ASPB member Janice Zale (University of Tennessee)

This project will generate a variety of genomic and genetic tools for foxtail millet, including single nucleotide polymorphisms, bacterial artificial chromosome libraries, optimized foxtail millet transformation technology, and a high-density quantitative trait focus and genetic map of foxtail millet for significant biomass traits. These resources will complement the DOE Joint Genome Institute whole genome sequencing of foxtail millet, enhancing its value as a functional

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Herrera-Estrella Receives ASPB Leadership in Science Public Service Award

Luis Herrera-Estrella received the ASPB Leadership in Science Public Service Award for outstanding contributions to science and society at the ASPB annual meeting in Mérida. He also was the featured speaker in the Perspectives of Science Leaders program.

Herrera-Estrella has made important contributions to the field of plant molecular biology, especially in the study of gene regulation and the development of gene transfer methods. While still working as a PhD student, he published the first report showing the successful transfer and expression of a bacterial gene in plant cells. He also pioneered the development of dominant selectable markers and the use of reporter genes for plant systems, which later became two of the most important tools in the development of gene transfer systems for economically important crops.

ASPB President Rob McClung (right) presents Luis Herrera-Estrella with the 2008 ASPB Leadership in Science Public Service Award.

Herrera-Estrella has been awarded several national prizes, among them the award in biology from the Mexican Academy of Sciences and the National Art and Science award from the Mexican government. He has also been honored with international awards such as the Minuro and Ethel Tsutsui Distinguished Graduate Research Award of the New York Academy of Sciences and the Javed Husain prize for young scientists from UNESCO. In 2003, Herrera-Estrella was elected a foreign member of the U.S. National Academy of Sciences, and he is currently director of the National Laboratory of Genomics for Biodiversity in Mexico.

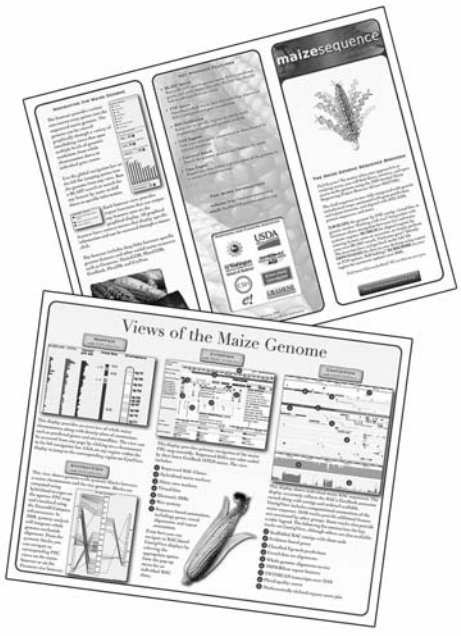
ASPB Exhibits Maize Genome Research at CNSF Congressional Exhibition

For the 14th straight year, ASPB sponsored a booth on maize genome research at the 14th Annual Coalition for National Science Funding (CNSF) exhibition and reception held on June 25, 2008. There was a large turnout for the event; the more than 400 attendees included seven members of Congress.

Sandra W. Clifton, PhD, prepared a poster and brochure on her NSF-sponsored research for the ASPB booth. Clifton is research assistant professor in genetics and assistant director, Genome Sequencing Center, Washington University School of Medicine.

The brochure, *Views of the Maize Genome*, gives multiple views of the maize genome.

ASPB was joined by many other institutions—primarily science societies and universities—that exhibited. The exhibition and reception offered the opportunity for scientists throughout the nation to talk with congressional staff and members of Congress about their research projects sponsored by the NSF.



Plant Feedstock Genomics Awards
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genomic model for second-generation bioenergy crops such as switchgrass.

Identifying Genes Controlling Ferulate Cross-Link Formation in Grass Cell Walls

- Pennsylvania State University, $587,191
- Principal Investigator: Marcia Maria de Oliveira Buanafina
- Co-Principal Investigators: ASPB member David Braun, Doug Archibald

This project will investigate the regulation of ferulic acid cross-linking in the cell walls of *Brachypodium distachyon* and generate a saturated ethylmethane sulfonate mutant population for forward genetic studies in this model bioenergy crop.

Computational Resources for Biofuel Feedstock Species

- Michigan State University, $540,000
- Principal Investigator: ASPB member C. Robin Buell
- Co-Principal Investigator: Kevin Childs

This project will provide computational tools and resources for data mining of genome sequence, genome annotation, and large-scale functional genomic datasets available for biofuel feedstock species. Such species include candidates within the Poaceae, Pinaceae, and Salicaceae families, for which a diversity of genome sequence resources currently exist, ranging from whole genome sequences to modest expressed sequence tag transcriptome datasets.

Translational Genomics for the Improvement of Switchgrass

- Purdue University, $1,200,000
- Principal Investigator: ASPB member Nick Carpita
- Co-Principal Investigator: ASPB member Maureen McCann

This project will study the cell walls of grass species, performing bioinformatics analyses on cell wall biosynthetic genes in maize and annotation of switchgrass orthologs. The project will also generate mutants in selected candidate cell wall–related genes, with direct analysis of saccharification of maize and switchgrass cell wall mutants.

Identification of Genes That Regulate Phosphate Acquisition and Plant Performance During Arbuscular Mycorrhizal Symbiosis in *Medicago truncatula* and *Brachypodium distachyon*

- Boyce Thompson Institute for Plant Research, $882,000
- Principal Investigator: ASPB member Maria Harrison
- Co-Principal Investigator: ASPB member Matthew Hudson

This project will identify genes controlling arbuscular mycorrhizal symbiosis, as well as key factors regulating gene function and the acquisition of key nutrients such as phosphate. The results will provide mechanistic and molecular-level understanding of plant–fungal partnerships in natural ecosystems and their role in maintaining a terrestrial soil environment for sustainable biofuel production.

Systems-Level Engineering of Plant Cell Wall Biosynthesis to Improve Biofuel Feedstock Quality

- University of Massachusetts, $1,200,000
- Principal Investigator: ASPB member Samuel Hazen
- Co-Principal Investigators: Todd Mockler, ASPB member Steve Kay

This project will identify and characterize cell wall biosynthetic regulatory genomic binding sites using reverse and forward genetic approaches with candidate transcription factors in Brachypodium and Arabidopsis, two model plant systems. The results will contribute to our understanding of key tissue-specific and developmental regulators of plant cell wall biosynthesis in monocot and dicot bioenergy crops.

Identification of Genes That Control Biomass Production Using Rice

- Colorado State University, $1,500,000
- Principal Investigator: ASPB member Jan Leach
- Co-Principal Investigators: ASPB member Dan Bush, John McKay, Hei Leung

This project will provide an integrated breeding and genomics platform to identify biomass traits in rice for translation to second-generation bioenergy grasses such as switchgrass and Miscanthus.

Genomics of Wood Formation and Cellulosic Biomass Traits in Sunflower

- University of Georgia, $1,200,000
- Principal Investigator: Steven Knapp
- Co-Principal Investigators: ASPB member Jeff Dean, ASPB member Joe Nairn, Laura Marek, Mark Davis

This project will develop genomic resources for woody biomass trait identification in hybrid sunflower, a species that is extremely drought tolerant. This fundamental knowledge will complement the existing body of work on this species with respect to oilseed production.

A Universal Genome Array and Transcriptome Atlas for *Brachypodium distachyon*

- Oregon State University, $1,200,000
- Principal Investigator: Todd Mockler
- Co-Principal Investigator: ASPB member Todd Michael

This project will develop an Affymetrix genome tiling array, based on the DOE Joint Genome Institute sequence of *Brachypodium distachyon*, and make the array available for broad community use. The investigators will use the array to generate an expression atlas representing major developmental stages or stress responses in Brachypodium, a model species for polyploid, perennial grasses with complex genomes, such as wheat and switchgrass.

Epigenomics of Development in Populus

- Oregon State University, $1,200,000
- Principal Investigator: ASPB member Steven Strauss
- Co-Principal Investigators: Todd Mockler, Michael Freitag

The project will study the role of chromatin modification (epigenetics) in the regulation of development and dormancy induction in poplar and other woody species. The investigators will characterize changes in DNA methylation patterns on specific tissues during dormancy induction and poplar development.

ASPB Members Ort, Betzelberger Discuss with Voice of America the Effects of Greenhouse Gases on Crop Growth

What effects will higher carbon dioxide and ozone levels have on crop yields and world food supplies? ASPB members Don Ort of the USDA Agricultural Research Service and the University of Illinois and Amy Betzelberger, also of the University of Illinois, responded to this question in a Voice of America interview on July 10.

Don Ort

Amy Betzelberger

Voice of America reported that carbon dioxide gas is released from the tubes that surround the corn plants Ort and Betzelberger study. Inside this ring, carbon dioxide wafts over the crop at a level environmental scientists predict to occur in the general environment in 2050.

Studies have shown that elevated carbon dioxide, attributed to global warming, helps plants grow larger. "What we didn't know is that it also makes the plants more delicious to herbivorous insects, which might be a problem in the future if there are more bugs eating our crops," Betzelberger said to Voice of America.

There is also the issue of elevated ozone, which, when it was released in the rings, appeared to lower soybean yields by 20%, Voice of America reported.

Ort commented, "We began seeing even five and six years ago that world grain reserves were at dangerously low levels. . . . [We] wondered, If there is a bad year globally in production, how is that going to affect world food supplies? We're beginning to see that play out," he said.

The full Voice of America report is available at http://www.waterconserve.org/shared/reader/welcome.aspx?linkid=102690&keybold=food%20corn%20prices%20climate.

Sayre Leads BioCassava Plus with Funding from Gates Foundation

ASPB member Richard Sayre and his colleagues have determined how to fortify the cassava plant, a staple root crop in many developing countries, with enough vitamins, minerals, and protein to provide poor and malnourished people with a day's worth of nutrition in a single meal.

The researchers have further engineered the cassava plant so it can resist the crop's most damaging viral threats and are refining methods to reduce cyanogens, substances that yield poisonous cyanide if they are not properly removed from the food before consumption. The reduction of cyanogens also can shorten the time it takes to process the plant into food, which typically requires three to six days to complete. Studies also are under way to extend the plant's shelf life so it can be stored or shipped.

The international team of scientists hopes to translate the greenhouse research into a product that can be field tested in at least two African nations by 2010. Funded by $12.1 million in grants from the Bill & Melinda Gates Foundation, the group of researchers is led by Sayre, director of the ERAC Institute for Renewable Fuels at the Donald Danforth Plant Science Center in St. Louis.

Sayre presented an update on the BioCassava Plus project June 30 at Plant Biology 2008 in Mérida, Mexico.

"This is the most ambitious plant genetic engineering project ever attempted," Sayre said. "Some biofortification strategies have the objective of providing only a third of the daily adult nutrition requirements, since consumers typically get the rest of their nutritional requirements from other foods in their diet. But global food prices have recently gone sky high, meaning that many of the poorest people are now eating just one meal a day, primarily their staple food.

Richard Sayre (holding cassava plant)

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Sayre
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"So what we're working on has become even more important in the past year than it was when we started, not just in regions where people are malnourished, but also across developing countries, where food has gotten so expensive that people can't afford the diverse diet that they're used to."

Cassava (*Manihot esculenta*) is the primary source of calories for an estimated 800 million people worldwide, including 250 million people in sub-Saharan Africa, the current focus of the Gates-funded project. But the plentiful crop has several drawbacks. It is composed almost entirely of carbohydrates, so it does not provide complete nutrition. The roots can be banked in the ground for up to three years, providing food security, but the plant must undergo time-consuming processing immediately after harvest to remove compounds that generate cyanide. Unprocessed roots also deteriorate within 48 hours after harvest, limiting the food's shelf life. And a plant disease caused by the geminivirus reduces yields by 30% to 50% in many areas in sub-Saharan Africa, a major blow to farm productivity.

Sayre and colleagues from multiple institutions set out to tackle virtually all of cassava's problems to make the plant more nutritious and to increase the crop's revenue-producing potential for farmers. Sayre reported that the research team has been able to address each of the plant's deficiencies in individual transgenic plants. The next step will be to combine some or all of the bioengineered traits into a single, farmer-preferred cultivar, with the goal of eventually developing cassava varieties that carry all of the improvements developed by the researchers.

"We've begun field trials in Puerto Rico to make sure the plants perform as well outside as they do in greenhouses, and we hope to start field trials in the target countries of Nigeria and Kenya by 2009," Sayre said.

The labs in the project have used a variety of techniques to improve on the model cassava plant used for the research. They used genes that facilitate mineral transport to produce a cassava root that accumulates more iron and zinc from the soil. To fortify the plants with a form of vitamin E and beta carotene (also called "provitamin A" because it converts to vitamin A in the body), the scientists introduced genes into the plant that increase terpenoid and carotenoid production, the precursors for provitamin A and vitamin E. They achieved a 30-fold increase in provitamin A, which is critical for human vision, bone and skin health, metabolism, and immune function.

Adding protein to the cassava plant has posed a challenge, Sayre said. The scientists discovered that most of the nitrogen required to make the amino acids used for protein synthesis in roots is derived from the cyanogens that also cause cyanide toxicity. So their strategy for increasing protein levels in roots focuses on accelerating the conversion of cyanide-containing compounds into protein rather than completely eliminating cyanogen production, which would hinder the efforts to increase protein production, Sayre explained. To further address the cyanide problem, the scientists have also developed a way to accelerate the processing methods required to remove cyanide—a days-long combination of peeling, soaking, and drying the roots before they are eaten.

To strengthen the cassava plant's resistance to viruses, the scientists introduced a protein and small RNA molecules that interfere with the virus's ability to reproduce.

Prolonging cassava's shelf life has involved the development of a hybrid species that crosses two related plants native to Texas and Brazil. The strategy, still in development, will combine the properties of these plants and additional genes that function as antioxidants, slowing the rotting process that has been traced to the production of free radicals that damage and kill cells in newly harvested cassava roots.

The first cassava product the team plans to develop for investigations in the field will likely include the virus resistance, elevated protein, elevated beta carotene (provitamin A), and elevated minerals (iron and zinc), Sayre said. "These traits have been working the best in the greenhouse, and the virus resistance is critical to success in the field," he said. "The thinking behind starting with these four traits is driven by science and by the impact they can have."

The BioCassava Plus project was launched with a $7.5 million grant from the Gates Foundation and recently received an additional $4.6 million in supplemental funding from the foundation to accelerate the application of this research in Africa by African scientists. The supplemental funding will support the training of African scientists so they can produce the transgenic plants in African institutions for use on African farms.

"It will not only be an improved staple crop eaten as a main source of nutrition, but we're also looking at the transformation of cassava from a staple crop to an income-generating crop," Sayre said. "That lifts people out of poverty and allows families to send kids to school and build infrastructure in their villages, so this is an important way to cross cultural barriers. There are many different cultures and languages in Africa, but higher crop yield, productivity, longer shelf life, and making money are things that everyone understands."

The BioCassava Plus research team includes Claude Fauquet, Nigel Taylor, Dan Shachtman, Ed Cahoon, and Paul Anderson of the Donald Danforth Plant Science Center; Willi Gruissem and Peng Zhang of the Swiss Federal Institute of Technology in Zurich; John Beeching of the University of Bath in England; John Fellman of Washington State University; Martin Fregene and Hernan Ceballos of the International Center for Tropical Agriculture in Colombia; Ivan Ingelbrecht, Alfred Dixon, and Bussie Maziya-Dixon of IITA–Nigeria (an African research organization); Caroline Herron of IITA–Kenya; Simon Gichuki of the Kenya Agricultural Research Institute; Ada Mbanaso of the National Root Crops Research Institute in Nigeria; Dimuth Siritunga of the University of Puerto Rico; Mark Manary of Washington University; and independent consultant Jeff Stein. Mary Ann Abiado and Kristen Mosier of Ohio State University provide administrative oversight.

ASPB Member Peng and Colleagues Find a Key to Rice Nutrition in Chromatin

Researcher Zhaohua Peng and colleagues at Mississippi State University and the Ohio State University have determined that chromatin plays an essential role in the control of endosperm sizes and grain quality. The results obtained in this study are applicable not only to rice, but to other cereal crops as well in improving grain yield and nutritional quality.

Zhaohua Peng

The endosperm portion of grain is an important component in determining the nutrient content for most cereal crops, as it provides nutrition, such as starch, oils, and protein, to growing plants. This makes endosperm an important source of nutrition in the human diet as well.

Rice is the primary food for more than 3 billion people around the world. Peng's research, funded by USDA's Cooperative State Research, Education, and Extension Service (CSREES), may allow scientists to improve the nutritional value of rice, affecting the health of more than 70 million of the world's poorest people in developing countries.

Chromatin structures store genetic information and control gene expression in cells. In chromatin, a piece of DNA wraps around a group of basic proteins called histones to form a structure similar to the coil of a telephone cord. When proteins interact with the chromatin, it adjusts the tightness of the DNA and histone interaction. Genes positioned in loosely packaged chromatin regions are usually active, and genes within the tightly package chromatin regions are often silenced.

The scientists used proteomics, which examines proteins in a large scale, to gain new insight into the chromatin structure and function in rice. They identified a total of 344 unique proteins associated with chromatin and found a large number of histone variants in rice.

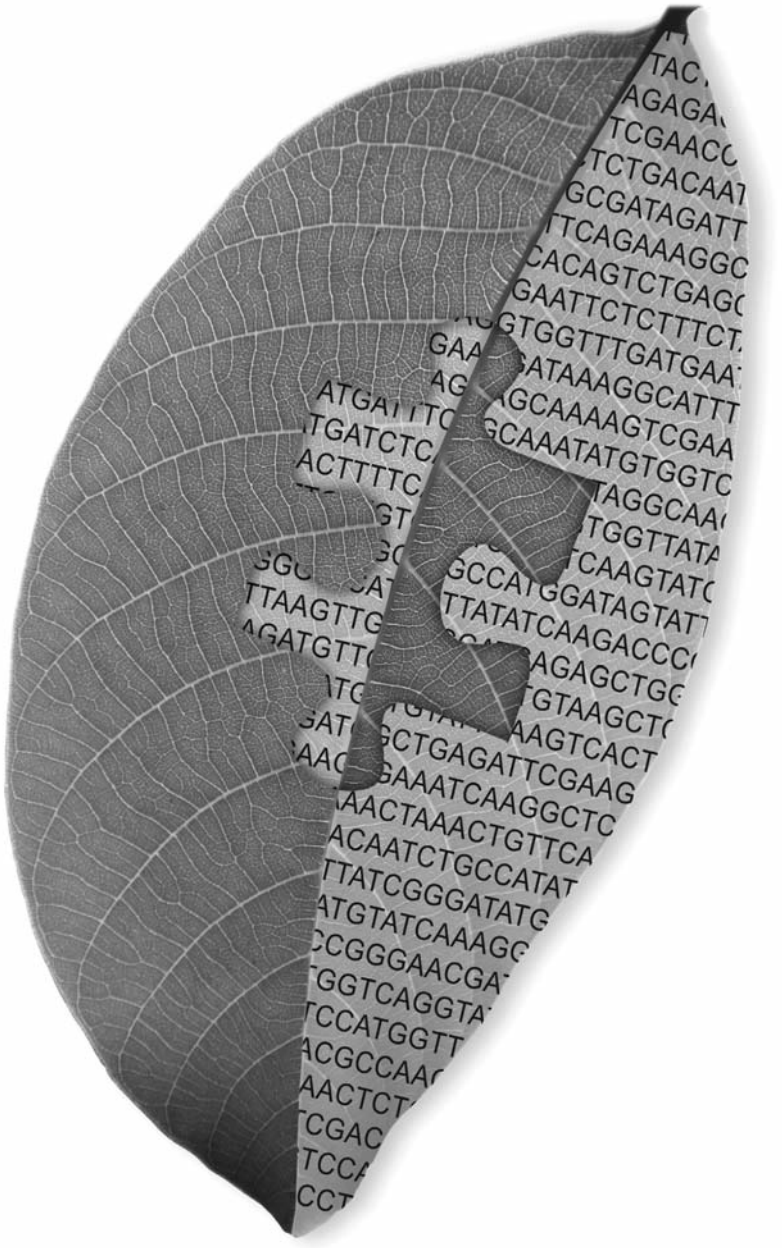
The researchers also determined that chromatin modification genes control the endosperm sizes and grain quality in rice. These findings suggest that manipulating chromatin modification genes may be an effective approach for improving crop yield and quality. Future studies may also clarify how genes are expressed and how these genes control plant functions.

CSREES funded this research project through the National Research Initiative Plant Genome program. Ed Kaleikau is national program leader.

CORRECTION

Nina Fedoroff's name was misspelled in the article "The Pan American Congress on Plants and BioEnergy—Biofuels Now and for the Future" in the July/August 2008 issue of the *ASPB News,* p. 8. We regret the error.

Do You Know Your Leaf Inside and Out?



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Plant Biology 2008

ASPB Education Booth: *Muchas Ideas en Mérida*

The ASPB Education Booth in Mérida featured an array of exciting programs sponsored by both the ASPB Education Foundation and the ASPB Education Committee. Thanks to the hard work of booth organizer Chad Jordan (North Carolina State), the booth proved yet again to be a popular part of the annual meeting exhibit hall space and served as a forum for exchanging ideas and information on new educational initiatives.

The booth highlighted interactive displays from the two winners of the highly competitive 2008 ASPB Education Booth Competition. Debra Burhans (Canisius College) presented her work, entitled "The Dynamic Gene: An Interactive Resource," which was carried out in collaboration with the Dolan DNA Learning Center at Cold Spring Harbor Laboratory. Visitors at the display had the opportunity to partially annotate a small portion of the rice genome on site and received information about incorporating annotation activities into the classroom using the Dynamic Gene.

Burkhard Schulz and Michael van Oosten (Purdue University) showcased their competition-winning efforts to incorporate "Video Podcasts as a Teaching Tool in Plant Physiology Laboratory Courses." The multimedia presentation included a wealth of information on how student-developed instructional podcasts can be incorporated as effective teaching tools in lab courses with students from diverse educational backgrounds and lab experiences. It also included a dynamic example from their extensive podcast library demonstrating procedures for plant pigment extraction.

Booth visitors had an opportunity to review the variety of projects sponsored since 2004 by the ASPB Education Foundation's Grant Awards Program (GAP). GAP catalyzes plant science education and outreach projects created by ASPB members. Winning projects have the potential to make positive impacts in local, regional, and global understanding of plant biology. Booth visitors viewed a DVD highlighting interesting features of GAP projects. This DVD montage, prepared by GAP winner Roger Hangarter (Indiana University), also aired at the entrance to the exhibit hall and in various session rooms.

Specific GAP programs were on display in the booth. For example, GAP veteran Peggy Lemaux's (University of California, Berkeley) GENEie Juice Bar, an affordable method for

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Jane Ellis demonstrates the use of a video microscope for hands-on exploration of plant materials. The Carson ePIX Digital Microscope shown here is available online for about $60.

Erin Dolan explains the 12 Principles of Plant Biology to a visitor.

ASPB Education Booth
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doing DNA extractions, demonstrated great ideas for easy and effective lab work. Information about three GAP-sponsored Plant Science Radio programs, sample program CDs, and details for how to access broadcasts were available. The booth even invited interested parties to submit accurate and entertaining plant biology videos to new GAP winner Dan Cosgrove's (Penn State) Competition for New Plant Biology Videos on YouTube.

The Education Committee had a very active presence at the booth and displayed numerous educational tools and resources for meeting attendees. ASPB Education Committee member Larry Griffing (Texas A&M) provided information on initiatives and ways for plant biologists to become involved the Planting Science program, which is supported in part by the ASPB Education Foundation.

Committee members Chad Jordan, Erin Dolan (Virginia Tech), and John Cushman (University of Nevada) joined Education Committee Chair Jane Ellis (Presbyterian College) to explain the displays and myriad classroom-ready ideas. Particularly popular was the 12 Principles of Plant Biology flyer and accompanying bookmarks, each featuring one of the 12 Principles. The 12 Principles materials were codeveloped with the ASPB Education Foundation. Other resources for teaching how plants are a part of everyday life included "How Many Plants Are in a Fast Food Hamburger?" and the newly developed "Genes in Your Jeans" and "Plants in Your Pants: Indigo" worksheets, among others.

Visitors also learned how simple it is to study plant matter in things like money, fabric, and the local flora by using a microscope connected to a laptop. This interactive display drove home that plant science is everywhere and is easy to access. Finally, booth visitors were invited to assemble and take away 5× microscope necklaces, which were useful for looking up close at some of the fascinating plants of Mexico.

Larry Griffing talks with booth visitor Jane Shen-Miller about Planting Science initiatives and helps assemble 5× microscope necklaces.

Chad Jordan demonstrates simple microscopy teaching ideas to Steve Bernacki (left) and Rich Tuttle (right), both from North Carolina State.

Plant Biology 2008
Education Workshop

A diverse crowd of about 30 scientists, educators, and evaluators attended the Education Committee–sponsored workshop at the annual meeting. The Education Workshop theme for 2008 was "Education Evaluation," including what it is, why to do it, and how to get started. Workshop participants from Mexico to Germany to Texas shared details about their education programs involving students and teachers from kindergarten through graduate school.

For example, Cristina Reynaga-Peña and her colleagues in the genetic engineering department at Cinvestav in Mexico described their program for engaging elementary-age students in on-campus science camps to build their enthusiasm and interest in science and expand their awareness of education and career opportunities in science. Indeed, the first take-home message for how to design an evaluation plan is to start with the education program's goals. Participants spent time learning about example goals from the programs of Nancy Moreno at Baylor College of Medicine and Erin Dolan at Virginia Tech, and then they worked in small groups to articulate goals for their own programs.

Goals are then used to define measurable or otherwise documentable objectives. For example, Moreno described one of her group's programs, which was designed to develop local teacher leaders who then go on to enhance science teaching and learning across their schools. At first glance, the goal of "creating leaders" seems difficult to measure. Yet Moreno and her colleagues considered the behaviors exhibited by teacher leaders (e.g., teaching other teachers, serving on committees, volunteering "above and beyond") and the ways others recognize leaders (e.g., by electing them to leadership positions, giving them awards). They then designed their evaluation data collection and analysis to capture changes that could result from teachers' participation in the program.

Nancy Moreno (left) and Erin Dolan.

Again, after discussing several examples from Moreno's and Dolan's programs, participants generated measurable objectives that aligned with their goals and also considered strategies for collecting the data.

Moreno and Dolan explained the different aspects of evaluation, including formative evaluation, which is conducted to inform further development and revision of a program, and summative evaluation, which is conducted to document the program's impact. Even though these types of evaluation are often discussed separately, the same data collection methods and even the same data can be used for both. For example, if a program aims to change students' knowledge about plant biology, including plant structure and function, a multiple-choice assessment can be in a pretest–posttest design to document knowledge changes from before to after program participation. If students show gains in knowledge about plant structure but not about plant reproduction, these results can be used to document the impact of the program on students' learning and to change the program to improve teaching of plant reproduction.

As the workshop progressed, participants discussed the challenge of documenting the impact of educational interventions (e.g., new lessons, units, programs) without the luxury of control groups. For the most part, classrooms are not appropriate venues for experimental studies that involve groups of students serving as the control group. Students rarely, if ever, are assigned randomly to classrooms, and many schools will not allow their students to participate in program evaluations or research unless they benefit directly from the program being studied. In addition, experimental studies are time consuming and costly and may not be necessary to answer informative questions about an education program's benefits, challenges, or impacts. Participants were encouraged to consult their institutional review boards, schools of education, local school districts, and others involved in studying science teaching and learning to take advantage of existing expertise about education evaluation and research.

When the session ended, participants were better prepared to manage the challenges of education evaluation in science teaching and learning. For more information about the session, including copies of the handouts, contact Erin Dolan, Education Committee member and workshop copresenter, at edolan@vt.edu.

Plant Biology 2008

Posters Packed with Plant Science Education Possibilities

The ASPB poster session on Education and Outreach at Plant Biology 2008 in Mérida showcased 13 different posters exploring various ways to reach out, engage, and train the next generation of young scientists in plant biology.

Children and teachers in rural Mexico have very little access to scientific materials, limiting students' ability to become actively engaged in performing hands-on experiments in the classroom. However, with a grant from the Consejo de Ciencia y Tecnología del Estado de Guanajuato (CONCYTEG), Cristina Reynaga-Peña from the Cinvestav, Irapuato, and María Leonor Valderrama from the Department of Public Health at the Universidad de Guadalajara have been improving student access to plant science by bringing an innovative array of materials directly to students in rural areas.

For the past six years, this dynamic team has presented a series of one-week workshops to students in grades 3 to 6 and junior high. In these workshops, students, including some who are blind, conduct a series of fun and highly stimulating experiments, including microscopic examination and/or modeling of plant cells and anatomical structures, transpiration and oxygen production, seed germination, separation of plant pigments by paper chromatography, and DNA extractions. Their goal is to change, little by little, the state of plant science education in Mexico by allowing students to become active participants in the lab. They are also in the process of deploying video versions of their workshops on DVDs to more than 1,500 schools in rural areas of the state of Guanajuato to compensate for deficiencies in the education system and to reach a greater number of students.

Ann Kleinschmidt, associate professor of biology at Allegheny College in Meadville, Penn., presented a poster on the use of the

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Burkhard Schulz presents the innovative use of video podcasts with his "Pigment Podcast" at the ASPB Education Booth.

María Leonor Valderrama (left) and Cristina Reynaga-Peña present their poster on exploring stimulating ways to generate children's interest in science through plant biology workshops in Guanajuato, Mexico.

Plant Biology 2008

Education and Outreach Minisymposium

On Saturday afternoon, June 28, a very successful Education and Outreach Minisymposium was held in the Salón Mérida of the Siglo XXI Convention Center. The first speaker, Adán Colón-Carmona, from the Department of Biology at the University of Massachusetts–Boston, discussed "An Inquiry-Based Plant Genomics Course and Workshop: Phenotype to Gene and Back Again." He described a two-step, year-long project that engaged high school teachers and undergraduate plant biology students in research using Arabidopsis to increase interest and excitement in biotechnology and genomics.

This project, "Arabidopsis 2010," included an intensive one-week summer workshop for area biology teachers with a follow-up program during the year and a semester's self-directed research experience for undergraduates in a plant science course. At the end of the course, students and teachers presented their research in a symposium. Colón-Carmona summarized the activities, experiences, and an evaluation of this exciting project.

"Video PodCasts as a Teaching Tool in Plant Physiology Laboratory Courses" was presented by the second speaker, Burkhard Schulz, from the Horticulture and Landscape Architecture Department, Purdue University. Schulz, Michael van Oosten, Diana Nucera, and Steven Holladay developed a set of video podcast archives composed and produced by students to demonstrate a variety of plant physiology laboratory procedures and techniques. Schulz discussed the process and obstacles involved in the production of the podcasts, along with student and faculty evaluations. Session attendees enjoyed viewing a sample podcast, and after the presentation, Schulz gave away CDs containing a number of these podcasts for use in plant physiology labs.

Our third speaker, Nancy Moreno, professor of allied health sciences and senior associate director, Center for Educational Outreach, Baylor College of Medicine, presented "Web-Based Biology Teaching Resources." Moreno demonstrated *BioEd Online*, Baylor College of Medicine's award-winning website, which offers up-to-date biology content, news, and professional development resources appropriate for educators of all levels, including undergraduate instructors. Among the many features of this outstanding website are peer-reviewed annotated PowerPoint slides, videos to focus students' attention, streaming video content, how-to laboratory presentations, inquiry-based lessons, and science education outreach resources. She also described a problem-based undergraduate course on genetics and genomics that will be launched in fall 2008. These can be found at www.bioedonline.org and at the new companion site, K8 Science (www.k8science.org).

Adán Colón-Carmona

Burkhard Schulz

Nancy Moreno

Christopher A. Cullis

Christopher A. Cullis, Department of Biology, Case Western Reserve University, presented "Lost Crops of Africa—Involving Undergraduates in Their Rediscovery and Development." Cullis developed a laboratory course to engage undergraduates in real-world biology with useful, applied plant genomics and biotechnology. This course was designed to develop DNA markers for underutilized crops in Africa while also providing students with an international experience. Cullis stated that bambara nut, banana, cassava, cowpea, and marama bean were originally chosen, but marama bean (*Tylosema esculentum*) has been selected as the focus crop for the next few years. One important component of the course involved live web video links between students and faculty in Cleveland, Pretoria, and Windhoek. Cullis noted that the students received this course enthusiastically and evaluated it positively.

Jane Ellis, presider of the minisymposium, noted that the speakers presented a unique variety of outstanding educational outreach programs and that attendees received them well.

Posters
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plant peroxidase gene superfamily from *Arabidopsis thaliana* as the focus of a semester-long research project for a molecular biology class taken during the sophomore or junior year. Working from mRNA and expressed sequence tag (EST) data from *Brassica rapa* (FastPlants), undergraduate students clone and sequence full-length cDNAs and analyze steady-state mRNA content in different tissues of *Brassica rapa* using real-time polymerase chain reaction. The course culminates in the students writing a primary literature–style paper from their research efforts and analyzing sequences using databases such as GenBank and PeroxiBase, a class III peroxidase-specific database.

Several posters were featured as part of the annual ASPB Education Booth Competition this year, including the video podcasts display by Burkhard Schulz and his colleagues from Purdue University. This group developed a set of student-produced video podcasts that quickly oriented students of a plant physiology laboratory course to new methodologies for a specific laboratory exercise. More information about using video as an educational tool can be found at http://www.hort.purdue.edu/hort/academics/HortMedia/hortmedia.html.

Debra Burhams, director of the bioinformatics program at Canisius College in Buffalo, N.Y., presented "The Dynamic Gene," an educational resource for plant bioinformatics targeting high schoolers, undergraduates, and teachers. This NSF-funded resource provides animated tutorials with step-by-step instructions on how to analyze gene models using Apollo, research software originally developed to annotate the Drosophila genome. More information about these program materials can be found at the Dynamic Gene website (http://dynamicgene. cshl.edu).

Ann Kleinschmidt presents her poster on the use of the plant peroxidase gene superfamily as part of a semester-long research project in a molecular biology class at Allegheny College.

Debra Burhams demonstrates the capabilities of the "The Dynamic Gene" educational resource to two interested researchers.

2008 GAP Winners

Plant Science Fills Classrooms, Exhibit Halls, the Web, and the Airwaves

ASPB's Education Foundation supports programs to promote the understanding of key plant science concepts to students and the general public in a wide variety of settings. The ASPB Grant Awards Program (GAP) is one such opportunity. Through GAP, the Foundation awards grants to ASPB members who have developed high-quality plant biology education and widely appealing outreach activities. Of the 15 applicants for GAP 2008, seven were awarded funds. The Foundation Board was pleased that such a competitive pool of applicants yielded a 47 percent funding rate.

Rodrigo Gutiérrez

This year's winning projects will provide motivating learning everywhere, from inside the classroom and exhibit hall to across the airwaves and Internet. Each grant winner brings a distinct and important expertise to the Society's education offerings.

GAP in Classrooms and Exhibit Centers

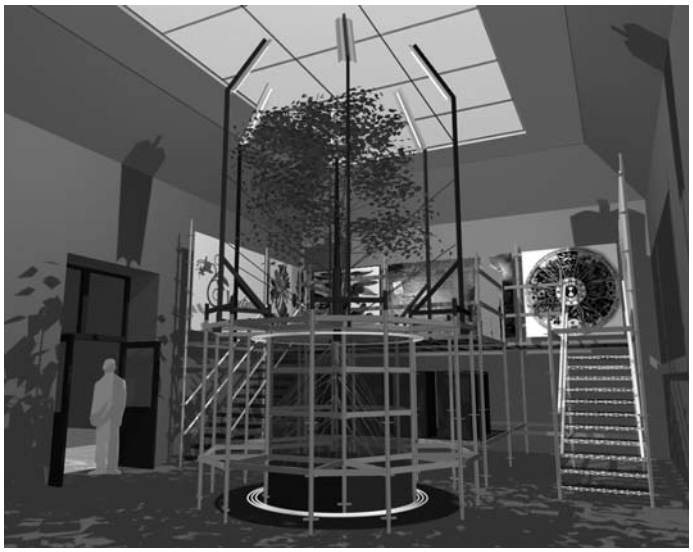
Rodrigo Gutiérrez
Pontificia Universidad Católica, Chile

The Foundation is especially pleased to announce the first international GAP winner, Rodrigo Gutiérrez of Pontificia Universidad Católica in Chile.

The objective of his project is to establish the permanent, interactive exhibit "Vegetalista: From Genesis to Genes" at the Science and Technology Museum in Santiago, Chile. The exhibit will teach about plant biology and the importance of plants for ecosystems and humans.

Gutiérrez explained, "Agriculture is one of the main and fastest growing economic sectors in Chile. The Chilean government has identified biotechnology as a means to innovate in the agricultural sector. Innovation requires building intellectual capital via formal and informal science education programs, as well as addressing important economic, ethical, and social issues related to technological advances (e.g., the controversy over genetically modified organisms). Museums are one mechanism scientists can use to educate, communicate with, and engage the public.

"In Chile," he continued, "opportunities for public outreach and communication on science issues are few, scientific literacy is low, and public debates are scarce, yet polarizing opinions about biotechnology are already present in the media. Our proposal seeks to bridge the gap between science and society in Chile and specifically to raise awareness of the role of plants in our everyday life."



Hydroponic tree with visible water circulation system.

The multidisciplinary team has designed sensorial experiences relating to different topics and concepts in plant biology, from molecules and the ecosystem to biotechnological applications. For school group visits, our proposal includes planned academic activities. Teacher training is included as part of the visit.

The museum exhibit will have five sections. "Plants Depend on Light, Water, and Soil" will feature a large hydroponic tree and visible water circulation system. "Plant Anatomy and Physiology" will display a variety of images to convey cell biology, development, and anatomical processes. A closer look at diversity and ecology will be the focus of "Phenotype, Biodiversity, and Ecosystems." Photosynthesis and autotrophy will be highlighted in "Molecular Biology of Plants." In "Plant Biology," visitors will discover genotype and phenotype elasticity and adaptation through genetically modified plants in various environments.

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Gap Winners
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There will be a free website related to each section of the physical exhibit, as well as an interactive game. The game will lead users through an inquiry-based learning process that includes observation, analysis, synthesis, and research skills. The game lets visitors view a virtual plant's growth as it faces adverse conditions. Gamers must virtually experiment with internal (genetic modification) and/or external variables to enable their plant to survive. The outcome of a visitor's intervention will be associated with a plant image, and points will be awarded based on the virtual plant's survival.

Peggy Lemaux
University of California, Berkeley

Lemaux's winning project "DNA for Dinner? Genes, Genomes, Genetics: Building a 4-H STEM Curriculum" expands on educational resources Lemaux has already developed with prior funding from the ASPB Education Foundation and other sources. Lemaux will use the 2008 GAP funds to create complementary curricula and related materials for four earlier projects: "Foods: Past, Present, and Future"; "Genes, Genomics, and Diversity"; companion baseball-style cards; and a GENE-ie Juice Bar. Each project builds on the theme that DNA and genes are a natural part of our lives. With their colorful and tactile messages, these earlier projects have successfully conveyed important plant science concepts at a very wide variety of outreach events.

Lemaux reported, "Recently, increasing numbers of teachers and educators have borrowed the displays for classroom use. While they are useful for these situations, developing activities to accompany the displays will maximize their educational impact. In addition to an existing network of users, a new outlet for our educational resources became available through a 4-H Science Education and Technology (SET) program. This effort currently reaches nearly 6 million youths in urban, suburban, and rural communities. A new SET initiative plans to involve another 1 million young people over the next five years, 100,000 of them in California."

Peggy Lemaux

By combining the SET initiatives with her 2008 GAP project, Lemaux will be updating and expanding a curriculum called "Biotechnology and Foods" that she and others developed for 4-H in 1994. Her team will modify existing activities and create a new one about genomics to develop the new "DNA for Dinner?" program. Activities developed for the curriculum will be complementary to the displays and juice bar. The curriculum and coordinated activities will use the rubric developed for 4-H SET. Such compliance and coordination will ensure wide-scale dissemination through the national 4-H SET curriculum repository.

The new biotechnology curriculum will expand and update the topics addressed in the original curriculum (http://ucbiotech.org/edu/edu_aids/whifbiotech.pdf), which include genetic diversity, genetic codes and genomes, DNA and chromosomes, building blocks of an organism, genetic engineering, and risks and benefits. New exercises will be added to the hands-on activities, word game, background information, suggestions for volunteer leaders, discussion suggestions, and questions to ask 4-H'ers that lead them to find more information.

The "DNA for Dinner?" SET curriculum will be pilot-tested with county-based 4-H audiences to measure content using pre- and postassessment tools. After the curriculum is finalized, the Berkeley group will conduct a student outcome assessment to measure impact. For parent volunteers to be comfortable with the topic areas, volunteer training sessions will be made available through professional development opportunities offered by the SET initiative. This training will increase the content knowledge and confidence of the 4-H volunteers who will be responsible for bringing the SET projects and activities to 4-H youths.

In addition to Lemaux's existing teacher network and the 4-H SET avenue for dissemination, David Gilchrist and Barbara Soots at the Partnership for Plant Genomics Education (PPGE) at the University of California, Davis, will become involved. This veteran program has a culturally diverse network of teachers and students in the greater Sacramento Valley region. Their successful teacher training sessions have reached 1,900 teachers on both a national and regional scale; these teachers will use Lemaux's educational resources in future workshops. The PPGE network of teacher collaborators will provide teacher feedback and test Lemaux's displays and teaching modules.

Lemaux's team will also make the curriculum available through the University of California Biotechnology Workgroup website (http://ucbiotech.org, Resources section), where the displays and juice bar are currently available for loan, and through the PPGE website (http://ppge.ucdavis.edu).

Jeffrey Coker, *Elon University*
Jane Ellis, *Presbyterian College*
Mary Williams, *Harvey Mudd College*


Jeffrey Coker


Jane Ellis


Mary Williams

Coker, Ellis, and Williams have been developing "Twelve Activities to Accompany the 12 Principles of Plant Biology." ASPB defined the 12 Principles as a springboard for plant science education at the K–12 levels. These principles serve as guidelines for curriculum developers and teachers to ensure that students gain a thorough understanding of plant biology.

Coker stated, "We have received numerous requests from teachers and organizations for well-constructed ('foolproof'), hands-on, active-learning opportunities with plants that coordinate with these principles." To continue responding to these requests, Coker, Ellis, and Williams will use their GAP 2008 award to further develop the components of this project, which was started with funding from GAP 2007.

The trio will complete the final stages of assessment for the first six of these plant science activities. Then they will use GAP 2008 funding to develop and distribute the last six activities. Field testing will take place through the Elon Academy at Elon University and the CHAMPS program at Presbyterian College. The Elon Academy is a one-month program for talented students (grades 8–12) from underprivileged backgrounds. CHAMPS (Communities Helping, Assisting, Motivating, Promising Students) is a summer program for sixth graders at Presbyterian College. Along with their own assessment process, the team will incorporate feedback about the project from experts in the fields of education and plant biology.

The team will disseminate the project to several thousand new people around the country every year. They will present their activities at teacher workshops in various school systems and will prepare PDF files of the activities to be archived on the ASPB website for easy access. The team also will incorporate the 12 activities into exhibit booths or sessions at the conferences of the National Association of Biology Teachers and the National Science Teachers Association (NSTA), as well as at public science events like the Family Science Days of the American Association for the Advancement of Sciences. When the 12 activities are fully developed, the trio will present them to the Council of State Science Supervisors at the NSTA conference with the goal of disseminating the project through this influential network of science education outreach.

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CHAMPS teacher and student.


Principle 3
Seeds of Change: Evolution


Principle 9
Mean & Green: Defense


Principle 10
Plant Plumbing


Elon Academy students.

Jennifer Moon

Gap Winners
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GAP Online and Across the Airwaves

Jennifer Moon
University of Texas at Austin

In 2006, Jen Moon launched greenseedling.com to fulfill the need for a comprehensive plant news site geared toward people with an interest in plants.

Moon explained, "As public awareness of biofuels, genetically modified foods, and medicinal plants gained momentum, we wanted to provide a friendly resource for finding and understanding the latest plant news. Since then, greenseedling.com has provided weekly plant news stories, resources, and links to science media on the web."

Greenseedling.com has two goals. First, it seeks to provide current information about recent developments in plant science, including basic research and advances in medicine, agriculture, and alternative fuels. The second goal is to motivate students to develop science writing skills by using student-submitted summaries of recent discoveries or other resources. This exposure will encourage students to consider careers in plant science.

The website offers information in four categories. In "Plant News," plant science news summaries are posted with links to both mainstream media coverage and published research abstracts, if available. In addition to news stories, "Plant News" provides links to other plant science blogs and RSS feeds displaying plant news stories from *ScienceNow* and *Science Daily—Botany*. "Science Podcasts and Media" provides links and brief descriptions of available science podcasts. Also included are brief descriptions of new books that may be of interest to the public and links to general science magazine websites and plant science journals. "Teaching Resources" provides activities, information about museum exhibits, links to educational websites, and references to information about teaching plant biology. "Fun Stuff" is a light-hearted take on plant biology and general science. It contains links to stunning photos, quizzes, tips, and more.

Beyond standard public relations efforts (e.g., ads, school contacts), Moon will increase the visibility of and access to greenseedling.com through a *web ring*, a collection of plant science websites linked together to develop an interrelated online community. Web rings are different from a list of links, as each site in the ring agrees to be linked to the other sites in the ring.

Greenseedling.com

Daniel Cosgrove

Penn State University

"A Competition for New Plant Biology Videos on YouTube" is just what it sounds like: Dan Cosgrove will use his 2008 GAP funds to sponsor an open competition for the best new plant biology videos published on YouTube (www.youtube.com).

Cosgrove reported, "As anyone with teenagers will attest, YouTube has tremendous outreach and vitality and attracts a

wide and international audience, notably a young audience. Its impact as a teaching aide is also growing as more informational videos appear on this site. A simple video clip that I put on YouTube as an experiment six months ago has gotten thousands of views and positive feedback, with no advertising whatsoever. I use several YouTube videos in teaching plant physiology at Penn State, and this seems to be a growing practice by other educators. Currently, there are some useful videos on YouTube related to plant biology, but there are also a lot of less-accomplished offerings. With some catalytic action from this project, this ratio could improve, and the popularity of YouTube could be leveraged to inform a huge audience about plant biology."

Through this competition, Cosgrove aims to

- encourage budding filmakers and other creative individuals to produce informative and entertaining videos on topics of interest to the ASPB Education Foundation
- increase the availability and range of short videos for use by educators
- increase exposure of the public, particularly younger members of society, to plant biology
- establish a simple webpage with links to recommended videos.

In September 2008, Cosgrove will launch a simple website to provide information about the contest and to accept applications from contestants. The site will also give some guidance about effective videomaking, the rules of the contest, and pointers on how to get video content reviewed for informational correctness. The website will provide links to contest winners and other meritorious videos. This contest link will be available in various locations, including www.aspb.org/education. Until Cosgrove's site launches, interested parties can e-mail him at dcosgrove@psu.edu. Write "plant videos" in the subject line.

Potential video categories under consideration include lecture type presentations of plant biology topics; time lapse, high speed, video microscopy and related techniques to illustrate and elucidate plant-based phenomena; biographies and interviews of plant scientists or others important to the field; animations, storybook-style videos, and other creative formats; "try it yourself" videos illustrating experiments and demonstrations of plant biology concepts that can be repeated at home or in a simple school laboratory without advanced equipment; and wildcard entries that don't fit the above categories. Categories such as professional versus amateur, short (less than a few minutes) versus long (10 minutes maximum), and other criteria may also be stipulated. Frivolous entries will be eliminated immediately.

A small panel will judge the videos by category. The panel is anticipated to include one or more plant biology professionals (ASPB and Botanical Society members), K–12 educators, and students. The panel will assess each submission for informational correctness (an absolute requirement) and video qualities that contribute to effectiveness.

Videographers can earn cash prizes for first and second place or honorable mention certificates. Recognition will also be given for aspects such as most innovative, most entertaining, best sound track, and other attractive features. Videos with the highest number of YouTube viewers and the highest ranking by YouTube viewers could also receive recognition on the Plant Videos website. A steering committee will finalize the details of the rewards and incentives system.

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Dan Cosgrove

Beth Judy

Gap Winners
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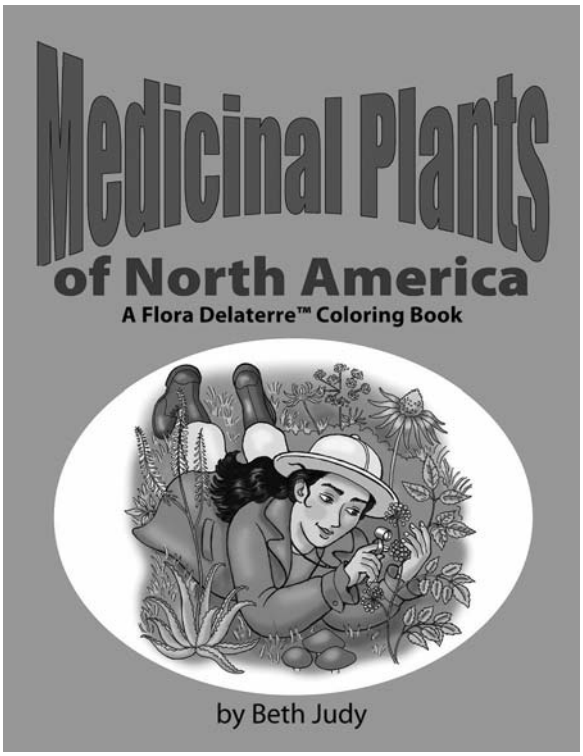
Beth Judy
Montana Public Radio

In fall 2006, the ASPB Education Foundation granted Montana Public Radio (MTPR) and radio producer Beth Judy funds to produce and distribute "The Plant Detective," a 90-second radio show about medicinal plants. The show delivers accurate and interesting science-based information about phytomedicinals, spicing up accessibility and appeal with a humorous fictional gumshoe/narrator, Flora Delaterre. Focusing on one plant per show, "The Plant Detective" teaches listeners about the inner workings of plants, phytomedicinal interactions with the human body, and the value of plants to humans. The show does not promote any one system of medicine, and overall it maintains a science-based focus on the plants and what credible research reveals about them.



Thanks to the ASPB Education Foundation's earlier funding, "The Plant Detective" broadcast grew in one year from one to 107 stations nationwide and in Canada and the Philippines, far exceeding the original goal of 60 stations (see the carriage list on the opposite page). The producers estimate that more than 26 million listeners now have weekly access to "The Plant Detective." Judy will use the funds from GAP 2008 to expand the show's reach by creating podcasts and RSS feeds for it.

Judy explained, "This additional way of distributing the program will allow us to reach new audiences, especially younger ones. It also bypasses radio stations that aren't playing the show yet, giving individuals anywhere direct access to the show and its information. Zip code data gathered from registering podcast recipients will help us make the case to stations that there is demand for the show in their area. We expect that podcasts and RSS feeds will greatly increase and diversify the number of people who can access the show and its content."

MTPR-led focus groups in 2008 revealed that listeners under the age of 45 rated podcasts and other electronic on-demand options for receiving content as highly desirable. This method was the focus groups' first choice for ways to increase audience size. "We want it now, and we want it on our schedule" was the most frequent comment from this under-45 age group. Listeners over 45 also gave a high ranking to podcasts and other online methods of content distribution for developing a larger and more diverse audience.

The high acceptance rate of "The Plant Detective" among radio stations during the show's first year of national distribution shows that the topic of medicinal plants is of interest and importance to people across the country and even around the world. The information in the show and its conservation message are timely as people are responding to changing realities and thinking hard about choices in how they live. Similarly, podcasting "The Plant Detective" is a proactive response to developing technologies and new freedoms of choice. Judy added, "We look forward to amazing a whole new range of listeners with our important and true stories about plants."

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Montana Public Radio

U.S. Public Radio Stations

KIYU AM 910	**Galena**	**AK**
KTNA-FM 88.9	**Talkeetna**	**AK**
KUAF FM 91.3	**Fayetteville**	**AR**
KABF FM 88.3	**Little Rock**	**AR**
KNNB-FM/AM	**Whiteriver**	**AZ**
KRIM LP 96.3	**Payson**	**AZ**
KVPR FM 89.3	**Fresno**	**CA**
KUCR FM	**Riverside**	**CA**
KHSU FM 90.5	**Arcata**	**CA**
KIDE FM 91.3	**Hoopa**	**CA**
KMUD FM/KMUE FM 91.1/88.3	**Redway**	**CA**
KCSB FM 91.9	**Santa Barbara**	**CA**
KFOK LP 95.1	**Georgetown**	**CA**
KRBS LP 107.1	**Oroville**	**CA**
KVLP-LP	**Visalia**	**CA**
KBUT FM 90.3/89.9	**Crested Butte**	**CO**
AIN Colorado	**Boulder**	**CO**
KHEN LP 106.9	**Salida**	**CO**
WMPH FM 91.7	**Wilmington**	**DE**
WXEL FM 90.7	**Boynton**	**FL**
WUGA FM 91.7	**Athens**	**GA**
KPVL 89.1	**Postville**	**IA**
Voice of Belle Plaine 92.9	**Belle Plaine**	**IA**
KISU FM	**Pocatello**	**ID**
KUMC LP 93.3	**Rupert**	**ID**
KRFP LP 92.5-Radio Free Moscow	**Moscow**	**ID**
(CRIS Radio) Chicago Lighthouse	**Chicago**	**IL**
NE IN Reading Service (NEIRS)	**Fort Wayne**	**IN**
WEDM FM 91.1	**Indianapolis**	**IN**
WBRO FM 89.9	**Marengo**	**IN**
Purdue Student Radio AM1610	**West Lafayette**	**IN**
WMMT FM 88.7	**Whitesburg**	**KY**
KELB LP 100.5 MHz	**Lake Charles**	**LA**
Audio Journal-Reading Service	**Worcester**	**MA**
WZBC 90.3 FM	**Chestnut Hill**	**MA**
WCCT FM	**Harwich**	**MA**
WHRV	**Springfield**	**MA**
WHAB FM	**Acton**	**MA**
WMUA FM 91.1	**Amherst**	**MA**
WOAS FM	**Ontonagon**	**MI**
KKFI FM	**Kansas City**	**MO**
KXCV FM/ KRNW FM 90.5/88.9	**Maryville**	**MO**
Montana Public Radio -KUFM	**Missoula**	**MT**
WZRU FM 90.1 FM	**Roanoke Rapids**	**NC**
WEZU LP	**Roanoke Rapids**	**NC**
KEYA FM 88.5	**Belcourt**	**ND**
KTLX FM	**Columbus**	**NE**
KENW FM 89.5	**Portales**	**NM**
KABR AM 1500	**Magdalena**	**NM**
KGLP FM 91.7	**Gallup**	**NM**
WAMC FM/WANC FM 90.3/103.9	**Albany**	**NY**
WETD FM 90.7	**Alfred**	**NY**
WRFA LP	**Jamestown**	**NY**
WUOW LP104.7	**Oneta**	**NY**
WMHT - R.i.s.e. 89.1 & 88.7	**Troy**	**NY**
WCSU FM	**Wilberforce**	**OH**
WDPS FM 89.5	**Dayton**	**OH**
Ohio Valley Audio Link	**Portsmouth**	**OH**
WCRS WRITTEN COM. RADIO SVC.	**Akron**	**OH**
WCYC LP 105.1	**London**	**OH**
KEIF-LP 104.7	**Enid**	**OK**
OPB Accessible Info Network	**Portland**	**OR**
KBOO FM 90.7	**Portland**	**OR**
KWVR AM	**Enterprise**	**OR**
WWEC FM 88.3	**Elizabethtown**	**PA**
WQSU FM	**Selinsgrove**	**PA**
WMSS FM 91.1	**Middletown**	**PA**
WKCV LP	**La Plume**	**PA**
GAUF DWAU 104.1	**Angeles City**	**Phillipines**
CJMQ-FM 88.9 FM	**Sherbrooke**	**QC, Canada**
WLGI FM 90.9	**Hemingway**	**SC**
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NTRB - North Texas Radio for the Blind	**Dallas**	**TX**
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WhrO Virginia Voice for the Blind	**Richmond**	**VA**
WVTF-FM READING SVC	**Roanoke**	**VA**
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WMSE FM 91.7	**Milwaukee**	**WI**
WPCA LP 95.7	**Amery**	**WI**
WRZC LP 92.3 Redcliff	**Bayfield**	**WI**


Roger Hangarter

Gap Winners
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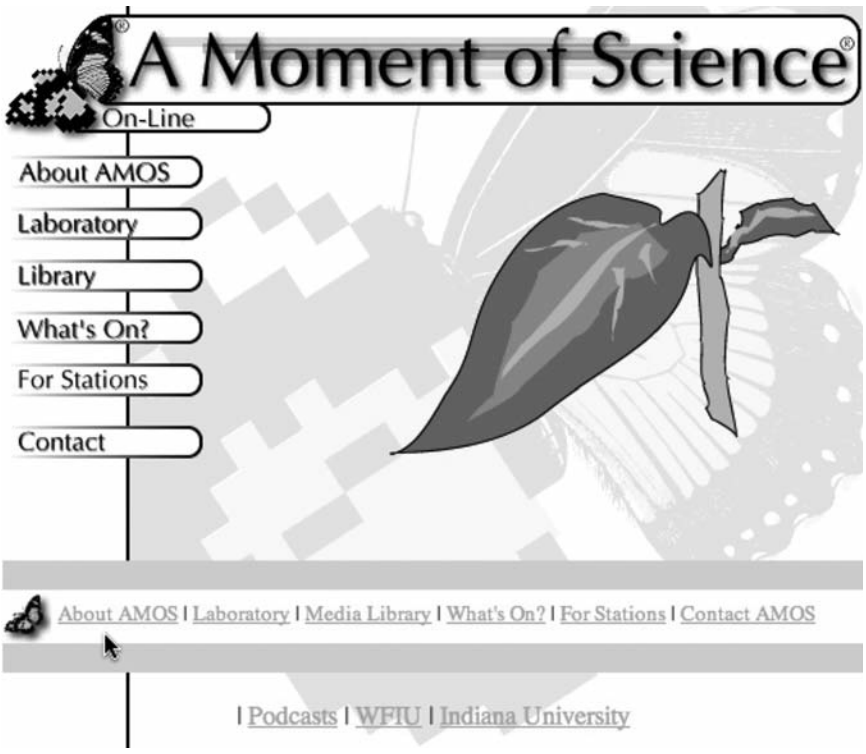
Roger Hangarter
Indiana University

The radio program "A Moment of Science" (AMOS) is produced at Indiana University via WFIU and is syndicated worldwide. AMOS covers all areas of science, including several plant-specific programs per year. For the past two years, the ASPB Executive Committee has sponsored AMOS using Good Works funds, and AMOS has produced at least 15 plant-specific programs per year. At a cost to ASPB of about $200 per episode, the plant programs produced by AMOS represent a terrific bargain for such a broad-reaching educational opportunity. Hangarter will use the funding from his 2008 GAP award to support another year of excellent plant science programming on AMOS to further the education missions of ASPB.

Hangarter explained, "The plant programs on AMOS meet many of the specific goals of the ASPB Education Foundation. The program promotes a broad understanding of the importance of plant science and provides accurate information on the latest discoveries in all areas of plant science. The programs also are appropriate for K–12 schoolchildren, can encourage young scientists to pursue careers in the field of plant biology, and can assist teacher development."

ASPB is recognized as the production supporter in all of the AMOS plant program episodes. This representation is embedded in the program and airs with it in 85 cities in 29 states and five countries (see the carriage list on the opposite page). In addition, the program is available as podcast downloads from National Public Radio. ASPB is listed in WFIU's Directions in Sound program guide, and a link to the ASPB website appears on the "A Moment of Science" webpage (http://amos.indiana.edu/). The episodes are also accessible from the ASPB website at www.aspb.org/education /NEWK12.CFM.



A Moment of Science®

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Alaska

KCHU	770 AM	Valdez
KOTZ	720 AM	Kotzebue
KSDP	830 AM	Sand Point
KTNA	88.5 FM	Talkeetna
KXGA	90.5 FM	Glenallen
KXKM	89.7 FM	McCarthy

Alabama

WRWA	88.7 FM	Dothan
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WTJB	91.7 FM	Columbus
WTSU	89.9 FM	Troy

Arkansas

KBSA	90.9 FM	El Dorado

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KAWC	1320 AM	Yuma

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Patricia Verwiel		Riverside

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Indiana

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KVLU	90.9 FM	Lake Charles

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WDET (DRIS)		East Lansing
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International Outreach: ASPB Educational Materials Exhibited in Finland at FESPB 2008

As part of its ongoing efforts to promote plant science education and outreach, the ASPB Education Committee participated in the XVI Congress for the Federation of European Societies of Plant Biology (FESPB) held in Tampere, Finland, August 17–22, 2008. FESPB is the largest and most widely representative society of plant scientists in Europe. The Congress was organized by the Scandinavian Plant Physiology Society (SPPS; www.spps.dk), an international society that works to promote all aspects of experimental plant biology, from molecular cell biology and biochemistry to ecophysiology.

During the Congress, Education Committee member Mary Williams shared an exhibit booth with ASPB publications and meetings staff. Mary showcased materials and activities developed by the ASPB Education Committee and the ASPB Education Foundation. She distributed to conference attendees a selection of inquiry-based, classroom-ready worksheets and 12 Principles of Plant Biology bookmarks. (These materials are available at www.aspb.org/education/NEWK12.CFM.)

The ASPB team also involved booth visitors in making Gardens of Lilliput: Discovery Cup Garden necklaces. This simple activity gets folks of all ages excited about plants. It also helps everyone learn how to propagate plants and study the impact of environmental changes on plant growth. Full instructions for this activity can be found at developer Paul Williams's website, www.fastplants.org/img/sandbox/uploads/82.file.pdf.

Mary reported, "Many of the conference attendees were not familiar with these materials and activities and were enthusiastic to learn of the availability of these resources."

Mary Williams demonstrates making Discovery Cup Gardens with an international array of booth visitors during the FESPB conference in Tampere.

During the conference, Mary met with others who were enthusiastic about exploring additional venues for interaction between ASPB and scientists outside of the United States. Mary's efforts laid the groundwork for a repeat of the ASPB exhibit at FESPB 2010 in Valencia, Spain, perhaps to include a hands-on demonstration workshop and/or an education and outreach minisymposium.

Volunteer efforts like Mary's at the FESPB Congress have resulted in effective outreach on ASPB's behalf around the globe. Other ASPB members have had similar successes, such as translating selected ASPB education materials into Spanish and Chinese.

Discovery Cup Garden about six weeks after planting small snippets of Azolla, Selaginella, sundew, Funaria and Philonotis moss, and heartwort.

Arthur W. Galston

Arthur Galston, president of the American Society of Plant Physiologists from 1962 to 1963, died at age 88 of congestive heart failure at his home in Hamden, Conn., on June 15, 2008. He was Eaton Professor Emeritus of Botany in Yale University's Department of Molecular, Cellular, and Developmental Biology and professor emeritus in the Yale School of Forestry and Environmental Studies.

Art spent much of his career studying the processes of higher plant development, particularly the role of light. A major contribution was his suggestion and identification of evidence for the role of a flavoprotein—not carotene, as previously believed—as the photoreceptor for phototropism, which was subsequently confirmed by other researchers more than 30 years later. He also worked in many other areas of plant growth and development, including auxin physiology, phytochrome, and polyamines. Interestingly, he was the first to present data that phytochrome was in the nucleus, again more than 30 years before confirmation by molecular techniques.

During his career, Galston worked with more than 60 postdoctoral and visiting faculty colleagues from more than 20 countries, as well as innumerable students. In his teaching and writing, he was a great storyteller, enthralling generations of students and colleagues with tales of botanical discovery and lucid explanations of how plants worked. He was also noted for his friendship to many junior colleagues.

Art served as president of the Botanical Society of America and received numerous academic honors, including Guggenheim, Fulbright, and Senior National Science Foundation fellowships and honorary degrees from Hebrew University in Jerusalem and Iona College in New Rochelle, N.Y. In 1994, he received Yale's William Clyde De Vane Medal for lifelong teaching and scholarship. In 2004, he received the Alumni Achievement Award from the College of Liberal Arts & Sciences at the University of Illinois.

Art playing jazz saxophone.

PHOTO COURTESY OF ELIZABETH GALSTON.

Art was a leading voice for the social impact of science and a lifelong proponent of bioethics. In his PhD research on 2,3,5-triiodobenzoic acid (TIBA) as an antagonist of the effect of auxin, he discovered that high levels of TIBA would induce leaf abscission. This discovery subsequently led to the use of auxin herbicides as defoliants and the development of Agent Orange, a defoliant used by the U.S. military in Vietnam. He campaigned vigorously against the use of Agent Orange, visiting Vietnam repeatedly to assess its impact. In 1971, he was the first U.S. scientist invited to visit China following the Communist revolution, and he met with Premier Chou En-lai. The *New York Times* featured his trip to China on the front page and devoted an editorial to his criticisms of Agent Orange. His outspoken criticism of the uses of Agent Orange led to its being banned by President Nixon in 1970. [Editor's note: Professor Galston himself recalled his decision to actively oppose official U.S. policy regarding the use of Agent Orange in the March 2002 issue of *Plant Physiology* (http://www.plantphysiol.org/cgi/content/full/128/3/786).]

Born in Brooklyn in 1920 to Russian Jewish immigrant parents, Art enrolled at Cornell University's New York State College of Agriculture only because he could go there free, a great advantage because his father was jobless because of the Depression. At Cornell, he fell under the spell of a pipe-smoking professor of botany, Loren Petry, who redirected his intended career away from medicine into the lifetime study of plants.

A gifted saxophone player, Art worked his way through college performing in swing bands in the Borscht Belt in upstate New York and earned his BS from Cornell in 1940. He earned his MS and PhD from the University of Illinois in 1943. He then moved to the California Institute of Technology as an associate professor, where he worked closely with Nobel Prize winner George Beadle on defense-related research, until he joined the Navy as an enlisted man. Stationed at Okinawa, he served as a natural resources officer.

After leaving the Navy, Art spent one year at Yale and then returned to Caltech. He rejoined the Yale faculty in 1955 as a professor of botany. At Yale, he chaired the Botany Department and later the Biology Department after the two merged, and he served as director of the university's Division of Biological Sciences. He retired from Yale in 1990 at the then-mandatory retirement age of 70 but continued to teach courses there until last year. He developed an introductory bioethics course for undergraduates that became one of the college's most popular courses. He remained active in Yale's Institute for Social and Policy Studies, where he helped lead the Interdisciplinary Bioethics Project.

Art published more than 320 articles in peer-reviewed science journals and wrote several widely used textbooks on plant physiology (*Principles of Plant Physiology* with

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Arthur Galston
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James Bonner, *Control Mechanisms in Plant Development* with Peter Davies, and the third edition of *The Life of the Green Plant* with Peter Davies and Ruth Satter), as well as books explaining plant function to lay readers (*Green Wisdom* and *Life Processes of Plants*). In addition, he wrote more than 50 articles on public affairs, two anthologies on bioethics, and *Daily Life in People's China*, based on his travels in China in the early 1970s.

He is survived by his wife of 66 years, Dale, whom he met while at Cornell; his son, William, of Bethesda, Md., former deputy domestic policy adviser to President Clinton and holder of the Zilkha Chair at the Brookings Institution; his daughter, Beth, a well-known artist in Carlisle, Mass.; and his grandson, Ezra, of New York.

William Galston
Beth Galston
Peter Davies, Cornell University

Remembering Arthur W. Galston

April 21, 1920–June 15, 2008

During his career, Arthur Galston's research focused on how light, hormones, and polyamines regulate the growth and development of plants. From the time he returned to Yale as a professor of botany in 1955, his lab attracted an international group of graduate students, postdoctoral fellows, and visiting faculty from Europe, Israel, the Middle East, Africa, Central America, Asia, and Australia.

This account touches only a few highlights among the great number and variety of his research projects. The interaction of phytochrome, flavonoids, and peroxidase activity was an early focus. Art's graduate student Masaki Furuya, working with Art and Bruce Stowe, isolated two new flavonoids from peas. One, a conjugate of quercetin, inhibits activity of peroxidase, an enzyme capable of oxidizing IAA; the other, a kaempferol conjugate, is a peroxidase cofactor. These two flavonoids differ by an additional hydroxylation on quercetin, which they showed to be under control of phytochrome.

Brief red light increased the content of the peroxidase inhibitor and growth of terminal buds of peas but increased the cofactor and decreased growth of the youngest internode below. Over the years, the question of whether light-modulated patterns of growth involve flavonoids, perhaps by affecting peroxidase activity and auxin concentration, motivated much work in Art's group, to which Bill Hillman, Harry Smith, W. Bottomley, D. Russell, and others contributed.

Arthur Galston. PHOTO COURTESY OF MICHAEL MARSLAND.

With Mark Jaffe, Art initiated an extensive series of physiological experiments on coiling of tendrils of peas. This led to the first report of a contractile ATPase with the characteristics of actomyosin associated with rapid movements in a higher plant. They also detected unusually high levels of conjugates of quercetin in uncoiled tendrils, which fell during coiling. They suggested that the decline of this flavonoid might activate ATPase and energize coiling.

Art collaborated with Ruth Satter and others investigating the interaction between phytochrome and circadian rhythms in the characteristic sleep movements of leaves of certain legumes. They observed that as the leaves open or close, motor cells contract on one side of the pulvinus and expand on the other. They showed that expansion and contraction of the motor cells reflect changes in turgor caused by rapid fluxes of both potassium and chloride ions. Further, they demonstrated an effect of phytochrome on these ionic movements. Open leaflets preirradiated with red light lost K^+ from contracting motor cells and closed in the dark, whereas open leaflets preirradiated with far-red gained K^+ and remained open.

Art enjoyed a scientific collaboration with Ravindar Kaur-Sawhney for more than 40 years. In the late 1970s, they found that culturing oat leaf protoplasts in the presence of arginine slowed senescence. Further, these protoplasts accumulated a high titer of putrescine, opening a major new research area on polyamines, abundant in plant cells. Art's lab accounted for their synthesis and titer during growth, osmotic and other stress, development of flowers and fruit, and senescence. Graduate students Hector Flores and Nevin Young showed that stress-induced synthesis of putrescine results from increased activity of the arginine, rather than ornithine, decarboxylase pathway.

As discussed above, in etiolated pea seedlings red light increases growth in the apical bud but decreases it in the internode below. This effect correlates with synthesis of arginine decarboxylase and consequent increase in polyamines. The final research paper from Art's lab showed that flowers of Arabidopsis have higher titers of both spermidine and putrescine than other parts of the plant. Furthermore, inhibiting polyamine

biosynthesis inhibited flowering. Supplying spermidine in the medium overrode photoperiodic control, promoting flowering under short-day conditions where there would otherwise be little flowering. Art hoped his work on polyamines made obvious their importance in plants.

Early in his career, while a senior research fellow at Caltech, Art observed that in the presence of riboflavin, auxin was destroyed by light, and he provocatively suggested that a flavoprotein might be the long-sought blue-light receptor in phototropism. He also pointed out that the action spectra for phototropism—that had been thought indicative of a carotenoid photopigment—bore a resemblance to his action spectrum for the photooxidation of auxin by an extract from peas containing both flavoprotein and peroxidase. During the 1950s, these results reawakened interest in both the means of auxin redistribution during phototropism and the nature of the photoreceptor. Winslow Briggs extended and corroborated F. W. Went's earlier work showing that during phototropic curvature, auxin is not destroyed and curvature is blocked by barriers to lateral movement of auxin. Almost simultaneously, George Curry produced a definitive action spectrum for phototropism of oat coleoptiles showing significant fine structure in the blue characteristic of carotenoid pigments, but a broad band in the near ultraviolet, suggestive of a flavoprotein.

Clearly, the photoreceptor question could not be settled without further evidence. Art searched for mutants. The few corn and barley mutants deficient in carotenoids proved nearly as phototropically sensitive as normally pigmented plants, even with as little as 0.1% of the normal amount of carotenoids, strengthening his skepticism about carotenoids being the photoreceptor. No flavin mutants were available, this condition apparently being lethal. Art turned to more accessible problems, and although he recognized that auxin destruction was not involved in phototropic curvature, he continued to maintain that the photoreceptor might be a flavoprotein.

It was 50 years before new technologies and Arabidopsis mutants with reduced phototropic responses provided the answer in the Briggs laboratory. The photoreceptor is a flavoprotein—named *phototropin*—whose fluorescence excitation spectrum bears an impressive resemblance to Curry's action spectrum for phototropism. In the end, Art Galston was pleased that his suggestion that a flavoprotein could be the photoreceptor proved correct.

Mary Helen M. Goldsmith
Professor Emerita
Department of Molecular, Cellular, and Developmental Biology
Yale University

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For your convenience, keep this listing of extension numbers and e-mail addresses handy when you contact ASPB headquarters so that you can reach the person best able to assist you.

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