Botanical Society Of America

Plant Science Bulletin

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Join the Best in botany this Summer!

In This Issue..............

From the Editor

"Is Botany a Suitable Study for Young Men?
An idea seems to exist in the minds of some young men that botany is not a manly study: that it is merely one of the ornamental branches, suitable enough for young ladies and effeminate youths, but not adapted for able-bodied and vigorous-brained young men who wish to make the best use of their powers."

—J.F.A. Adams, M.D. 1887. Science IX (209): 116.

I was reminded of this article from over 125 years ago when I saw the front page of the Tuesday, February 5, Science Times - Section D of the *New York Times*. The article "Clues to a Troubling Gap" summarized an international science test of 15-year-olds that demonstrated girls in most countries scored better than boys in math and science, including in eight of the ten highest scoring countries. A conspicuous outlier was the United States, where boys scored almost 3% higher than girls (only Lichtenstein and Colombia had scores skewed more towards males---and yes, the U.S. was not in the top 20 of overall scores).

It seems that in both 1887 and 2013, the problems are (were) the same cultural factors: stereotypes, relevance, and opportunities. During the past few decades great efforts have been made, particularly in the biological sciences, to overcome stereotypes and provide opportunities for women. (Imagine the skew if the international test excluded biology.) Nevertheless, the task remains for us to engage, challenge, and excite all of our students. But as the images in the past few volumes of this journal imply, it may be time for us to increase our focus on the young men in our classes who seem to show less and less inclination toward science in general and botany in particular. Now there's a challenge!

-Marsh

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Letter to the Editor

On the Origin of Seed Plants

Contrary to the view of William Burger in his article, "Angiosperm Origins — Monocots First?" [Plant Science Bulletin 58(4): 162 (http://botany.org/plantsciencebulletin/psb-2012-58-4.pdf)], the monophyletic origin of seed plants is not a mere parsimonious view, but rather a firm conclusion based on sound evidence. A number of structural features that appear in the primitive ovules of Paleozoic gymnosperms also appear in some extant angiosperms (e.g, *Trifolium repens, Magnolia grandifolia, Limnanthes douglasiia*) and more prominently in the bel1-3 mutant of *Arabidopsis thaliana*. These shared features provide the phylogenetic link between extant angiosperm ovules and those of gymnosperms from the Late Devonian Period. In addition, evidence from extant gymnosperms and angiosperms makes clear that: (1) the nucellus is a sporangiophore of cauline origin which bears a single, terminal megasporangium; (2) the integument evolved by the fusion of both sterile and fertile (megasporangia bearing) telomes, which retained a measure of fertility after the fusion; and (3) heterospory in seed plants is uniquely dissimilar to heterospory elsewhere in vascular plants in that energy required for gametogenesis is derived throughout the process rather than solely from energy sources previously accumulated in the megaspores and microspores. [see American Journal of Botany 82(4): 547-564. 1995 for details (http://www.jstor.org/stable/pdfplus/2445703.pdf?acceptTC=true.)

-J. M. Herr, Jr., Department of Biological Sciences, University of South Carolina, Columbia, SC.

New Issues of APPS online

BSA's new, online-only, open access journal, *Applications in Plant Sciences (APPS)*, premiered on the BioOne platform on 2 January 2013. The inaugural issue included 11 articles: an editorial, four protocol notes and six primer notes. One highlighted article describes a new method for PCR amplification of recalcitrant DNA that allows researchers to overcome some of the inhibitory plant compounds that prevent successful PCR. Samarakoon et al. added a reagent to the PCR mixture that contains three ingredients: trehalose, bovine serum albumin, and polysorbate-20 (all three abbreviated TBT-PAR). "Unlike several other studies, TBT-PAR works at the PCR stage instead of at the DNA extraction stage, so it has promise for pigeon-holed and half-forgotten extractions that previously failed to be amplified using PCR," says Samarakoon. (Read more about the Samarakoon et al. paper at http://www.bioone.org/doi/pdf/10.3732/apps.1200236.) Other highlights from the issue include a paper by Morawetz presenting a technique to effectively clear plant tissue for subsequent examination and an article by Roschanski et al. introducing a protocol for the annotation of transcriptome sequence data and the identification of candidate genes. The entire table of contents may be found at http://www.bioone.org/loi/apps.

The February issue published online on February 7 (http://www.bioone.org/toc/apps/1/2).

Featured in the February issue is an article by Stull et al. (http://www.bioone.org/doi/pdf/10.3732/apps.1200497) describing a new sequencing method that will allow potentially hundreds of plant chloroplast genomes to be sequenced at one time. This new method relies on efficient separation of chloroplast DNA from other DNA in the cell using short DNA "baits" that were designed from chloroplast genomes that have already been sequenced. These molecular baits effectively concentrate the chloroplast DNA before sequencing (a process termed "targeted enrichment"), dramatically increasing the number of samples that can be sequenced at once. Greg Stull, a graduate student at the University of Florida and lead author of the study, summarizes the versatility of the new system: "With this method, it should be possible for researchers to cheaply sequence hundreds of chloroplast genomes for any flowering plant group of interest."

(Read more about the Stull et al. study at http://www.eurekalert.org/pub_releases/2013-01/ajob-sho013113.php.)

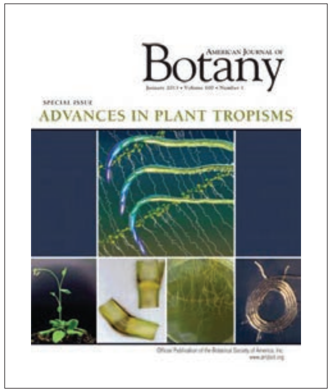
BSA members are encouraged to contribute to the success of BSA's new journal by submitting their research. The editorial board especially encourages submissions of new protocols and methods that improve investigations in any area of plant biology, including methods on genetic markers, morphological, physiological, biochemical, anatomical, and ecological data collection. As Editor-in-Chief Theresa Culley notes in her editorial in the January issue, "*APPS* will help further [the BSA's mission of promoting botany] by fostering communication within the botanical community, and by encouraging the forward movement of the plant sciences through the sharing of newly developed tools and protocols."

Authors wishing to contribute papers to *APPS* should review the newly expanded Instructions for Authors (http://www.botany.org/apps/APPS_Author_Instructions.html) for article types, editorial policies, and submission guidelines. APPS is part of BioOne's Open Access collection and shares with BioOne "the common goal of maximizing access to critical research." To sign up for eTOC alerts, citation alerts for specific content, and saved search alerts for the search terms of your choice, visit http://www.bioone.org/loi/apps and click the links for eTOC alerts and/or RSS feeds.

American Journal of Botany Publishes Special Issue on Advances in Plant Tropisms

Elementary school students often learn that plants grow toward the light. This seems straightforward, but in reality, the genes and pathways that allow plants to grow and move in response to their environment are not fully understood. Leading plant scientists explore one of the most fundamental processes in plant biology—plant movement in response to light, water, and gravity—in the January Special Issue of the *American Journal of Botany.*

Plant movements, known as tropisms, are crucial for plant survival from the second a plant germinates to how a plant positions its flowers for pollinators and seed dispersal. "They are basic processes that underlie all of plant physiology and growth," says Sarah Wyatt, Associate Professor in the Department of Environmental and Plant Biology at Ohio University. Plants adapt and acclimate to their surroundings using tropisms, including moving in response to light (phototropism), water (hydrotropism), and gravity (gravitropism).



To inspire cutting-edge research on plant tropisms, Sarah Wyatt and plant biologist John Kiss, Dean of the Graduate School at the University of Mississippi, co-edited the special issue and invited plants scientists worldwide to write 24 articles that advance and summarize the field. (Their introduction to the issue is available at http://www.amjbot.org/content/early/2013/01/01/ajb.1200591.full.pdf+html.) "Tremendous progress has been made in the field of tropism research in the past decade," comments Kiss. "This issue was an opportunity to bring the community together," adds Wyatt, "and highlight some truly incredible science that has been ongoing 'under the radar' if you will and often under difficult circumstances."

Research in outer space is just one difficult circumstance by which scientists study how plants move. Growing plants in space has become a reality. "The International Space Station is now complete and the U.S. is committed to its utilization until at least 2020," Kiss says. Food and replenishing breathing air are vital functions plants can play on the ISS, and space flight experiments help scientists understand basic mechanisms plants use to grow and move because of gravity, or lack thereof.

Back on Earth, work on gravity and other tropisms is important for understanding plant growth, development, and responses to changing climates. Basic tropistic mechanisms in response to water and light could also enhance agricultural practices, explains Kiss, since crop plants experience environmental stressors like drought and overcrowding.

Tropisms have captured the interest of scientists for centuries. The way plants move can appear so eerily human that in the late 1700s and early 1800s, Dr. Erasmus Darwin, Charles Darwin's grandfather, predicted that plants have multiple brains that can communicate with muscles to tell plants how to grow.

From Erasmus and Charles Darwin to modern-day scientists and techniques, the biology of plant tropisms has come a long way. Some of the special issue articles review the history of plant tropisms to the present day, whereas others move the field forward through new research. New genetic and molecular tools, for example, are used to shed light on the mechanisms plants employ to respond to water and gravity. Many articles focus on the famous model organism in plant science, *Arabidopsis thaliana*. Other articles on gravitropism include work on cereal grasses important for agriculture as well as the aquatic-dwelling fern *Ceratopteris richardii*.

The issue kicks off with a broad review article about how roots revolve and bend, known as circumnutation. Vines that wrap around objects as thin as wooden stakes or as thick as tree trunks all use circumnutation to climb. Research on circumnutation in stems is common, points out Dr. Fernando Migliaccio of the Institute of Agro-Environmental and Forest Biology in Italy. But as in all plant sciences, rigorous work about what goes on below the surface of the soil is scarce, even though root behavior below ground could be essential for understanding how plants establish and survive in agricultural and natural settings.

Time-lapse photography has popularized the most famous tropism—phototropism, or how plants move toward light. Phototropism may be the most well-studied tropism, but one relatively unexplored area of phototropism is how plants grow and move in green light, as studied by graduate student Yihai Wang and his advisor Kevin Folta at the University of Florida. Light becomes greener when it passes through nearby plants. A plant growing in a shady spot under a tree receives less sunlight, and it also receives different wavelengths of light that change its growth patterns. Scenarios like this happen every day in the natural world, explain Wang and Folta. "Oftentimes a plant cannot possibly compete by out-growing or over-reaching a neighbor, and it must adopt a new program of acclimation," they say. Wang and Folta explore new findings about how plant species use gene expression and physiology to cope and survive in green-enriched environments.

The special issue continues with articles tackling how gravitropism works. Recent discoveries of plant hormones and the proteins that transport them have reinvigorated scientists to investigate the pathways plants use to perceive gravity. Original research in this special issue begins to "untangle the complex interactions" of plant growth regulators like plant hormones, proteins, and organic compounds, explain Wyatt and Kiss.

Wyatt and Kiss hope to inspire young scientists to conduct research on the fundamental field of plant tropisms on Earth and in space. "Remember the seed in the Styrofoam cup: the roots go down and the plant goes up and nobody really knows how or why," quotes Wyatt of Robert Fulghum's *All I Really Need to Know I Learned in Kindergarten*. "This is the wonderment that is inherent in tropistic responses—tropisms capture the imagination."

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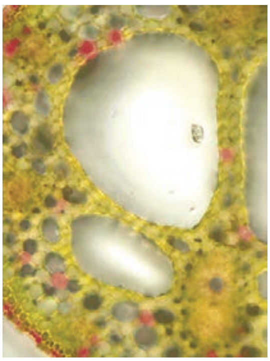
Wyatt, Sarah E. and John Z. Kiss. 2013. Plant tropisms: From Darwin to the International Space Station. *American Journal of Botany* 100(1): 1-3.

BSA seeks Editor-in-Chief for *American Journal of Botany*



The Botanical Society of America (BSA) is soliciting nominations for the position of **Editor-in-Chief of the** *American Journal of Botany (AJB)* to serve a five-year term, beginning January 2015. Both self-nominations and nominations of others are welcomed**.**

This is a rare leadership opportunity to contribute to the future of scientific publishing and the evolution of the *AJB*. We seek someone with a desire to **pursue innovation and explore new horizons in plant science** and journal publication practices.

Duties of the Editor-in-Chief include both aspirational responsibilities (helping shape a strategic vision for the Journal in a fast-changingenvironment; working with the editorial board and publications committee to shape editorial policies), as well as operational responsibilities (working with Journal staff to process manuscripts, overseeing their professional review, maintaining a strong editorial board and recruiting new members as necessary). Qualities of candidates should include a successful research career in the plant sciences, a strong commitment to the Journal, and excellent communication skills.

The Editor-in-Chief will be assisted by a professional staff, including a managing editor, a production editor, and several copy editors, as well as a team of dedicated, volunteer Associate Editors. The Editor-in-Chief receives an annual honorarium and works in collaboration with the BSA's Executive Director, *AJB* Managing Editor, and the Executive Committee to establish and work within the Journal's operating budget.

Review of nominations will begin **March 15, 2013**. For the first stage of the review process, please submit a brief letter of nomination and a detailed vita of the nominated individual to the following email address: ajb-eic@botany.org.

The committee will request additional information from candidates as the search process progresses. If you have questions or comments, please contact Carol Goodwillie, Chair, *AJB* Editor-in-Chief Search Committee (goodwilliec@ecu.edu).

-AJB Editor-in-Chief Search Committee: ***Carol Goodwillie*** *(Chair), Cynthia Jones, Elizabeth (Toby) Kellogg, Amy McPherson, Stephen Weller, and Qi-uyun (Jenny) Xiang*

BSA Science Education News and Notes

BSA Science Education News and Notes is a quarterly update about the BSA's education efforts and the broader education scene. We invite you to submit news items or ideas for future features. Contact: Claire Hemingway, BSA Education Director, at chemingway@botany.org or Marshall Sundberg, PSB Editor, at psb@botany.org.

Hearty Thanks and Hellos

We wish to thank here Susan Singer and Beverly Brown for their invaluable leadership and contributions to education endeavors as their service to the Botanical Society of America currently comes to a close. Susan steps down as the second BSA Education Director-at-Large while she assumes a new position at the National Science Foundation. Beverly steps down as chair after a stalwart commitment leading the Education Committee's activities to support the society's goal to provide resources and projects that create a greater understanding and appreciation of botany, especially through our educational system.

We welcome Phil Gibson as Education Committee Chair. Phil served as chair of the Teaching Section 2001-2002. He and his wife have co-authored three high school level reference books on Plant Diversity, Plant Ecology, and Natural Selection. He also conducts science pedagogy and education research with a focus on Tree Thinking and the integration of evolution across a course. Resources are available at http://www.ou.edu/gibsonlab.

From the Education Committee Chair by J. Phil Gibson

Regardless of where we are in our careers, we all can appreciate that science education has undergone tremendous changes recently. PowerPoint presentations and document cameras have joined chalkboards as essential tools in the classroom. Clickers, course management software, and computers are now common parts of day-to-day student and instructor life. While these tools can make teaching and learning easier (or more frustrating, depending on whether the technology cooperates or not), it does not change our goal to provide students with exciting, meaningful, and effective learning experiences in botany. We should explore using new technologies as they are developed, but we should balance this with careful consideration of how we use them and their benefits to students.

The science we teach is also changing. With new discoveries come difficult decisions about what new material to include in a class, and what topics to cut. Needless to say, these are challenges to both new and experienced teachers. Fortunately, none of us is in this alone. The BSA has a strong, vital, and enthusiastic group of people who are willing to think abut these issues and share their ideas, opinions, and experiences to help us educate better.

My goal as Chair of the Education Committee is to promote thought and discussion of how we can teach our branch of science better, as well as how we botanists fit into the larger picture of science education overall. There are numerous opportunities where we can make a difference in our own classrooms, our institutions, and at the national level. I want to do whatever I can to help us do that, because what could be more enjoyable than teaching someone about plants? I am excited and honored to have the opportunity to serve the BSA membership in this position. If you have any thoughts, questions, concerns, or ideas about botany education, please send them to me. I look forward to hearing from you. See you in NOLA!

- Phil Gibson, University of Oklahoma

Opportunities to Contribute and Participate

Planning Ahead for 2014 USA Science and Engineering Festival

The BSA Education Committee asks for your involvement in sharing the excitement of learning about plants with the public. The BSA will host a booth at the 3rd USA Science & Engineering Festival Expo to be held April 25-27, 2014 at the Walter E. Washington Convention Center in Washington, DC. http://www.usasciencefestival.org/

Do you have ideas for hands-on activities or giveaways to engage youth (and their parents/teachers) at the BSA booth? Would you like to help plan this outreach activity?

Members in the Washington area would be particularly helpful in staffing the booth. No matter your location, if you have booth ideas or would like to help plan the activity, please contact Claire Hemingway (chemingway@botany.org).

The Role of Mentors to Prepare for the Next Generation Science Standards

The release of the second draft of the Next Generation Science Standards (http://www.nextgenscience.org) coincides with President Obama's proclamation of January as National Mentoring Month (http://www.nationalmentoringmonth.org). This convergence of events presents an excellent opportunity to profile how PlantingScience mentors can serve to help teachers prepare for the Next Generation Science Standards. The new standards intentionally integrate core disciplinary ideas, cross-cutting concepts, and scientific practices. Science practices are second nature to practicing scientists, but students and classroom teachers often have minimal experience with (1) Asking questions, (2) Developing and using models, (3) Planning and carrying out investigations, (4) Analyzing and interpreting data, (5) Using mathematics and computational thinking, (6) Constructing explanations, (7) Engaging in argument from evidence, and (8) Obtaining, evaluating, and communicating information.

Planting Science Moves Ahead

Mentors in the PlantingScience program help secondary school students think through all the above aspects. If you are already volunteering as an online mentor, thank you! Your online connection with student teams helps students make sense of science investigations. It also serves to inspire interest in plants and science. The Spring 2013 session will run Feb. 4 – Mar. 29. We invite you to join the fun at www.PlantingScience.org.

A reminder about email addresses for PlantingScience mentors: If you've changed email addresses since you last participated in a session, please be sure to login to the website and update your email and any other profile information.

Growth of a Pine Tree

Rollinson, Susan Wells. 2012. *American Biology Teacher* 74 (9): 620-627.

The timing for this article was perfect (November/December issue) because it is all about activities with Christmas tree cookies—cross-sections through successive internodes of "used" Christmas trees. It is designed for high school level, but the concepts can be easily scaled both down to elementary levels and up into college. There are all kinds of quantitative opportunities here, including growth correlations and environmental correlations. And if you don't have time to gather your own materials, scans are available online.

SOME THOUGHTS TO PONDER

"A few months in the laboratory can save a few hours in the library." - Frank Westheimer's Law

"Unvouchered plant research is about as memorable as Whistler's father." - Art Tucker's Law

"That an average citizen can recognize one thousand brand names and logos but fewer than ten local plants is not a good sign." - Paul Hawken

"Humans seldom value what they cannot name." - Elaine Brooks

"Academia, where politics are so vicious precisely because the stakes are so small." - Henry Kissinger

"Practice safe eating - always use condiments." - Arthur O. Tucker

In Memoriam

David E. Fairbrothers 1925-2012

David E. Fairbrothers, a long-time Rutgers professor and eminent botanist and systematist, passed away on October 29, 2012, after a lengthy illness. He had a distinguished academic career in the field of plant molecular systematics, and he was a leader in the conservation of plants and natural areas, particularly in his home state of New Jersey. David was born and raised in Absecon during the depression years, as part of a family of commercial fishermen and duck hunters, and he grew up close to nature. Soon after graduating from high school in 1943, he joined the Army when he turned 18. An excellent marksman as a young man, he became a Sergeant Rifleman and Squad Leader of the L Company, 376th Regiment of the 94th Infantry Division. Landing at Utah Beach on the second day of the Allied invasion, his company fought its way across France and was in the middle of the infamous Battle of the Bulge during the bitterly cold winter of 1944-45. In a frozen pothole during that battle, he suffered severe frostbite of his lower legs and barely escaped having both of them amputated, injuries that affected him the rest of his life. After hospital recuperation, David was stationed in Prague; after the German surrender on May 8, 1945, he helped supervise train convoys of starving and ill refugees returning to their homes.

David was discharged from the Army in February of 1946 at the age of 20, and he took advantage of the G.I. Bill to enter Syracuse University. He met his future wife Marge while in school, and they married in 1949. He graduated in 1950 and immediately enrolled as a graduate student in Botany at Cornell University, under the direction of Robert T. Clausen. David worked in the area of grass systematics, completing a Master's degree (*A Cytotaxonomic Investigation within the Genus Echinochloa)* in 1952, and his Ph.D. (*Relationships in the Capillaria Group of Panicum)*[1] in 1954. David was recruited for a faculty position at Rutgers University by the eminent plant morphologist and head of the Graduate School, Marion L. Johnson. David began his 34-year career at Rutgers, the autumn semester of that year. He was the department's taxonomist and Director of the Chrysler Herbarium; during his tenure, its collections increased from 37,000 to over 140,000 specimens.

His successful career at Rutgers was marked by two traits: (1) an intimate knowledge of plant and habitat diversity in the small but biologically rich state of New Jersey; and (2) an interest in employing new and multiple techniques (perhaps influenced by his earlier use of cytogenetics) in plant systematics. He was in the right place at the right time. Rutgers was the home of the Serological Museum, which had contributed significantly to advances in zoological systematics, particularly among birds, from the leadership of Alan Boyden and his junior colleague Ralph De Falco.[2] With the help of Marion Johnson, David learned the immunological techniques Boyden and De Falco had used in studying animals, and they applied them to problems in plant systematics.[3] Boyden died in 1962, and Johnson in 1964; Fairbrothers then developed an independent research program in plant molecular systematics that used a growing arsenal of techniques, starting with immunology, adding polyacrylamide gel electrophoresis (PAGE) and isoelectric focusing, and secondary compounds (terpenoids and flavonoids) to a range of taxonomic problems, from population variation within species, to hybridization and introgression between closely related species, and to phylogenetic relationships among different families. This laboratory operated until his retirement in 1988, and it was the setting for the training of 29 graduate students.

David was an excellent mentor, supportive of students and always available for discussions. His students will treasure the memories of field trips in his station wagon, cruising up the New York

Thruway as David ticked off the names of roadside grasses and composites. The lab was also the temporary home of nine faculty members visiting on sabbaticals, and six post-doctoral fellows. The majority of his 122 peer-reviewed articles were in the field of plant molecular systematics. This body of research, along with the laboratory at the University of Texas, formed the backdrop for the revolution in systematics that came with the application of techniques for the analysis of DNA, starting with DNA hybridization (actually quite reminiscent of the serological research) and then sequencing.[4] Although David is considered by most to be a flowering plant taxonomist, his interests were actually more eclectic as evidenced by his co-authorship of the *Ferns of New Jersey* and, at the time of his illness, his interest in and study of the marine algae of the state parks in New Jersey.

Two of David's close friends were Arthur Cronquist (1919-1992) of the New York Botanical Garden and Armen Takhtajan (1910-2009) of the Komarov Institute in St. Petersburg. Whenever Armen was in New York, David visited Armen there and/or he travelled to Rutgers. David frequently attended the Torrey Botanical Club meetings at the New York Botanical Garden accompanied by Rutgers students. He and the students often went for the day and thus the students could use the herbarium and interact with other botanists. David met Art Cronquist for discussions about Art's system of classification and David's deep knowledge of the New Jersey Flora when Art was revising Gleason and Cronquist's *Manual of the Vascular Plants of North-eastern United States and Adjacent Canada*. As part of his commitment to northeastern botany, from 1990 to 1998, David Fairbrothers served as the Torrey Botanical Club representative on the Botanical Science Committee of the Board of Managers at the New York Botanical Garden. He was also a long-time mentor for the Flora of New Jersey Project (www.njflora.org), which has close links with both NYBJ and the Torrey Botanical Society.

David's deep knowledge of New Jersey botany was a mother lode for projects that his students pursued, and some of them involved work on endangered species and habitats. In time, he became more focused on practical issues of endangered species and habitat management, and this coincided with the environmental movement of the 1970s. For decades, the Chrysler Herbarium had grown in the range of collections, particularly of endangered species and habitats. It eventually became the resource that allowed Fairbrothers and the herbarium manager, Mary Hough, to complete (to our knowledge) the first state description of threatened and endangered plant species.[5] This publication was influential in the modification of the Endangered Species Act, first passed by Congress at the end of 1973 and modified in 1975, to include plants, and to stimulate other states to conduct similar surveys.

Figure 1. David with long-time friend Armend Takhtajan at Rutgers University in 1968.

As a south Jersey native, David had great affection for the Pinelands and deep knowledge of its plants and natural history; he worked with others to protect this special area. He helped prepare "A Plan for a Pinelands National Preserve," and presented it to the U.S. Senate (through its Parks and Recreation Sub-Committee) and assisted substantially in the passage of the act authorizing it in 1978. His study of endangered and threatened plants in the pinelands led to two publications that were instrumental in the establishment of the comprehensive management plan for the reserve,[6,7] which explicitly mentioned the initial 54 species to be protected. This act established the first Federal Reserve, similar in intent to the Catskills and Adirondack Parks in New York, but partly under the umbrella of the National Park Service and managed by the state of New Jersey. Later, the pinelands were added to the Federal Natural Preserve system, and then to the UNESCO Global Biosphere Reserve system in 1988.

Later in his tenure at Rutgers, he performed more administrative service, inaugurating the establishment of the Department of Biology (with 89 faculty members) as its first chairperson. Although he continued to be involved at Rutgers, through advising and consulting, he retired as a Distinguished Professor in 1988. His activity in endangered plant and pinelands issues at the state and federal levels continued well into his retirement.

Figure 2. David and Marge Fairbrothers relaxing at Frazer's Hill, Malaysia, in 1975, after he gave a keynote address at the symposium inaugurating the Rimba Ilma, still the only scientific botanical garden in Malaysia. David was fifty years old at the time.

He and Marge moved south to Toms River, and David lent his support to the protection of natural communities in nearby Island Beach State Park. There, he helped with the development of the Emily de Camp Herbarium at the Forked River Interpretive Center, and helped to document plants and communities at the park. David and Marge frequently visited their son and daughter, spouses, and five grandchildren. They pursued new interests. Familiar with the history of New Jersey, David became interested in the antique glass produced in the state, then in silver overlay antique glass, and they both continued studying and collecting other antiques further afield. He became a sought after lecturer on these subjects. Because of his declining health, he and Marge moved to Lebanon, NH, in 2010 to be near their son. David died two years later, at the age of 87 and after 63 years of marriage.

In recognition of his accomplishments, David received several awards. In addition to a variety of teaching, research and administrative awards at Rutgers, he was awarded the Rutgers Medallion in 1988. The Chrysler Herbarium and other collections were re-organized as part of the university biodiversity collections, and a symposium and banquet were held in his honor in 2005, to launch the fundraising effort to establish the David E. Fairbrothers Plant Resources Center. The Botanical Society of America presented him with its Merit Award in 1989, in commemoration of his research discoveries and service to the society. For his contributions to conservation in New Jersey, The Garden Club of New Jersey awarded him its Gold Medal in 2008, and the Pinelands Preservation Alliance placed him in its Pine Barrens Hall of Fame, also in 2008.

He had a long, productive and happy life, and he will be deeply missed by his family, many former students, professional colleagues and personal friends.

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-David Lee and Dennis Stevenson

Congratulations AAAS Fellows

Kathleen Donohue
Duke University

Kathleen Donohue conducts research on the evolutionary ecology of natural plant populations and the genetic basis of adaptation. Her research focuses on the evolution of phenotypic plasticity and maternal effects, and how the ability of organisms to sense and respond to their environment influences processes of adaptation. In addition to studying other species, she uses the genetic model, *Arabidopsis thaliana,* in ecological studies to investigate the genetic pathways involved in ecologically important plastic phenotypes, such as phenology. She is interested in how specific genes and genetic pathway structure can influence the evolution of plant life cycles, population performance, and geographic ranges of organisms under different climate scenarios. Kathleen can be reached at k.donohue@duke.edu.

Lisa A. Donovan
University of Georgia

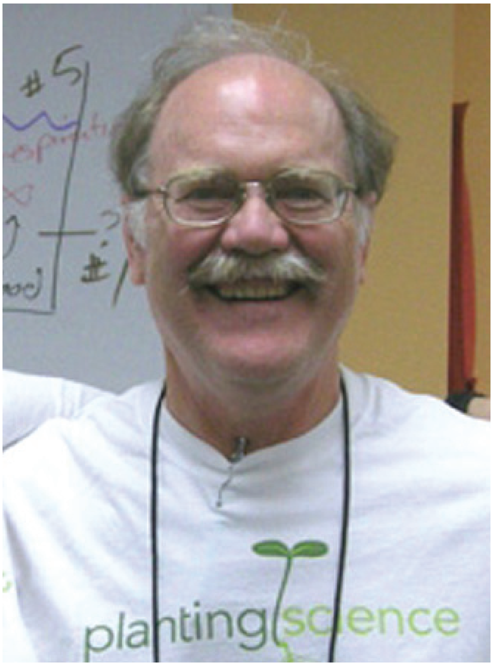
Lisa Donovan investigates plant evolutionary ecophysiology, with an emphasis on resource use and stress tolerance traits as they relate to plant performance. She examines ecological and evolutionary responses to growth limiting factors (e.g., water and nutrient limitations, drought, and salinity). Her current study system is primarily a suite of *Helianthus* species, due to their wide-ranging ecology and available genetic and genomic tools. In general, she wants to know how individual plant traits affect plant fitness and distribution, and how these traits evolve. Lisa can be reached at donovan@plantbio.uga.edu.

Elena Kramer
Harvard University

The Kramer lab is interested in the evolution of genetic pathways controlling plant development with an emphasis on reproductive biology, ranging from flowering time to flower morphology to fruit structure. Most of our current research uses the new model system *Aquilegia* (columbine) to investigate specific questions related to the evolution of novel floral organ identity programs or novel floral organ elaborations. In the case of the former, we have been studying the role for MADS box gene duplications in the derivation of a distinct fifth organ type, termed a staminodium, which is recently evolved in the lineage leading to *Aquilegia*. This underscores a broad interest in the lab in gene lineage evolution and functional diversification following gene duplication. In terms of organ elaboration, we are focused on the petal nectar spur of *Aquilegia*, which has been considered a key innovation driving speciation in the genus. In collaborations with several colleagues, we are using developmental genetic, evolutionary genomic and biophysical approaches to fully understand the origin and diversification of the nectar spur in *Aquilegia*. Elena can be reached at ekramer@oeb.harvard.edu.

Ann Sakai
University of California Irvine

Ann Sakai is interested in the evolution of plant breeding systems. She has used a diverse set of methods and approaches to explore selective factors promoting the evolution of separate sexes in flowering plants. She also has been involved in conservation and restoration efforts in the Hawaiian Islands. Sakai has a strong interest in encouraging undergraduate research and has worked to encourage and retain undergraduates from under-represented groups in the sciences. Ann can be reached at AKSAKAI@UCI.EDU



Marshall D. Sundberg
Emporia State University

Marsh Sundberg is interested in developing and evaluating activities and curricula that promote student-active learning. An early proponent of inquiry in the laboratory and the lecture room, his team produced some of the first data in biology at the college level supporting the concept of "less is more." His research has been concerned not only with improving student content learning, but also improving student attitudes towards science. Throughout his career he has been active in K-12 outreach to students and teachers and has been actively involved in the BSA's PlantingScience program since its inception as a module developer, workshop presenter, instructor and mentor. Marsh can be reached at msundber@emporia.edu

Ethel Stanley
Beloit College

Ethel Stanley is actively committed to science education in which learners pose problems, develop and use interdisciplinary approaches to solve problems, and engage in peer review of their own and others' products. Our students should grapple with issues outside of traditional silo-based disciplines. Her efforts focus on undergraduate science curricula, faculty development, and national community college outreach to include modeling and simulation (The BioQUEST Library), bioinformatics (BEDROCK), quantitative biology (NUMBERS COUNT), cyberlearning for community college faculty (C3 Cyberlearning), and extensive development of investigative case based learning (ICBL) with co-developer Margaret Waterman both here and abroad (LifeLines, ScienceCaseNet, IUBS BioED, and Singapore's NIE) through both funded projects and publications. Ethel can be reached at ethel.stanley@bioquest.org or ethelstanley@gmail.com

Susan Singer Wins *Science* Prize for Web-Based Teaching Tool

Susan Singer, the Laurence McKinley Gould Professor of the Natural Sciences at Carleton College, has earned a *Science* prize for her Inquiry-Based Instruction (IBI) teaching tool for her genomics course.

When Singer, a biology professor, was a college student, her freshman science classes were held in huge lecture halls, where she and her classmates listened and took notes, preparing themselves for a weekly test. She said it was deadening. Luckily, Singer had experienced what it was like to do scientific research much earlier, in middle school and high school and even as a child, when her parents allowed her to graft the trees in their backyard.

Wanting to replicate the kind of research exposure Singer encountered outside of her freshman science classes, Singer has developed a Web-based undergraduate teaching tool called Genomics Explorers, which is the winner of the *Science* Prize.

"We want to recognize innovators in science education, as well as the institutions that support them," says Bruce Alberts, editor-in-chief of *Science*. "At the same time, this competition will promote those inquiry-based laboratory modules with the most potential to benefit science students and teachers. The publication of an essay in *Science* on each winning module will encourage more college teachers to use these outstanding resources, thereby promoting science literacy."

As a genomics teaching tool, Genomics Explorers helps students make use of the huge opportunity that exists to explore and make discoveries using genomic data sets. Often the scope and scale of such data sets, not to mention the many ways in which the data can be approached, are overwhelming to students. Genomics Explorers, a Web site, at http://serc.carleton.edu/exploring_genomics/index.html offers, students strategies and practical tools for approaching the data so that the students can get to follow a biological line of inquiry that interests them. With some of the logistical methodology issues—such as how to conduct a gene expression analysis—handled by the Web site, class discussions are freed up for deeper questions about the research. Students as a class are able to reflect on the nature of doing research and the nature of data analysis.

An important challenge that Genomics Explorers has overcome has been calibrating the degree to which students are guided through their research, so that they are able to connect with biological questions, without the process becoming too rigidly mapped out.

Students in Singer's genomics class collect data on Chamaecrista, which they examined for possible increases in biomass, which would improve its value as a biofuel. Singer's teaching tool, Genomics Explorers, assisted the students in that process. Photo by permission of Carleton College.

"Genomics Explorers is able to strike the fine balance between providing a learning structure, while still allowing students to be thinking on their own," says Melissa McCartney, *Science* associate editor.

The organisms focused on in classes using Genomics Explorers at Carleton and at Vassar College, *Chamaecrista fasciculata* and *Aiptasia pallida,* respectively, are "non-model" organisms, which means they have not been studied or written about extensively. The beauty of that is it allows students to actually make discoveries in their research.

"What my students find is really novel," Singer says. "There is the potential for doing really interesting work."

Previous to the implementation of Genomics Explorers, Singer says students found it difficult to select the scale at which they wanted to explore genomic data, often hunting for a single, often poorly chosen gene and finding themselves inundated by irrelevant data. The question was how to allow them the possibility of doing real research while still allowing the students to follow their own fascinations and to cultivate an ownership of their research. As Singer points out, the President's Council of Advisors on Science and Technology stressed in a 2012 report that, in order to keep science, technology, engineering and math students in those majors, they need to experience real research, not "cookbook" labs that simply walk them through steps to a known outcome, with no room for following their own curiosity or thinking up approaches of their own design.

"The challenge in Genomics Explorers was getting risers between the steps to be the right height," Singer says.

Although Singer's students sometimes panic at the open-endedness of the Genomics Explorers process, they begin to develop trust in their own ideas, Singer says. For instance, one group of students became interested in the possibility of increasing the biomass of the *Chamaecrista* and improving its value as a biofuel. Their research zoomed in on their interest, and was filtered to reflect that line of inquiry.

"They owned it," says Singers, adding that such "ownership" allows the students to engage their own creativity as they look at a research question.

Singer hopes that winning the IBI prize and publishing an essay in *Science* about Genomics Explorers will allow other teachers to engage their students in similar ways. "What I hope most is that this encourages instructors to bring more authentic research experiences into their teaching laboratories."

For more information about Genomics Explorers, visit http://serc.carleton.edu/exploring_genomics.

National Tropical Botanical Garden Honors Scottish Botanist

Noted Expert to be Awarded Plant Exploration Medal

Kalāheo, Kaua'i, HI (January 9, 2013)—One of the world's leading authorities on tropical rhododendrons, Dr. Graham Charles George Argent, has been named the 2013 recipient of the David Fairchild Medal for Plant Exploration. In an announcement from its headquarters in Hawai'i, the National Tropical Botanical Garden (NTBG) acknowledged Dr. Argent for his contribution to tropical fieldwork, exploration, and conservation, focusing on Southeast Asia.

Throughout most of Dr. Argent's four-decade career in tropical botany, including 26 years at the Royal Botanic Garden Edinburgh (RBGE), he concentrated on the collection, research, and preservation of Ericaceae (the heather family), which includes approximately 4,000 species of berries, azaleas, heathers, and rhododendrons. He is considered to be the world's leading authority on Vireya rhododendrons, a sub-tropical flowering plant found at high elevations in Southeast Asia from Malaysia, Indonesia, and the Philippines to Papua New Guinea and Borneo. Roughly one-third of the world's 850 species of rhododendrons are Vireyas.

The Fairchild Medal will be presented at a black-tie dinner on February 1 at NTBG's Florida garden, The Kampong, the former estate and private garden of the award's namesake David Grandison Fairchild. During the evening's festivities, Dr. Argent will speak on 'Extreme Plant Collection'. A scientific symposium has been scheduled for the following day, featuring Argent as the keynote speaker, presenting a talk on the role tropical rhododendrons can play in education and conservation.

Praising Dr. Argent's contribution to plant exploration, NTBG's Director and CEO, said, "Recognizing that the overwhelming majority of the world's biodiversity, both discovered and undiscovered, is in tropical areas, and that life on earth hinges on this biodiversity, the importance of Dr. Argent's work becomes quite evident. He has contributed immeasurably to a deeper, broader understanding of plant life."

Upon learning of his selection to receive the Fairchild Medal, Argent said he was humbled to be honored for doing what he enjoys most, "especially when so many people have supported me in my many expeditions." He added, "I am filled with pride and gratitude that the selection committee of NTBG should think me worthy to put my name forward." Additionally Dr. Argent thanked fellow field staff and supporters, local people in the places he has worked, and his family.

The selection of Dr. Argent for the medal was made by a committee of NTBG's management and scientific staff and board members, which includes Dr. David Rae, who serves as RGBE's Director of Horticulture. Dr. Rae made the nomination, calling Argent "a natural field botanist who loves nothing more than sharing his knowledge." He said Argent "embodies the ethos of the David Fairchild Medal," adding "through a life devoted to the study of Vireya rhododendrons, [Argent] has done more than anyone else to study them in the field, collect them, promote their cultivation, and publish the definitive account of their classification. Dr. Argent's legacy at Edinburgh is not just the wonderful collection of Vireyas, but all the staff he has influenced and encouraged through his fieldwork."

Dr. David Fairchild, one of the greatest and most influential horticulturalists and plant collectors in the United States, devoted his life to plant exploration, searching the world for useful plants suitable for introduction into the country. As an

During his forty years of botanizing, mostly in Southeast Asia, Dr. George Argent became one of the world's leading authorities in tropical rhododendrons. Pictured: Dr. Argent in Papua New Guinea with field colleagues. Photo by Andrew Ensoll.

early "Indiana Jones" type explorer, he conducted field trips throughout Asia, the South Pacific, Dutch East (Indonesia) and West Indies (Caribbean Islands), South America, Egypt, Ceylon (Sri Lanka), China, Japan, the Persian Gulf, and East and South Africa during the late 1800s and early 1900s. These explorations resulted in the introduction of many tropical plants of economic importance to the U.S., including sorghum, nectarines, unique species of bamboo, dates, and varieties of mangoes. In addition, as director of the Office of Foreign Seed and Plant Introduction of the U.S. Department of Agriculture during the early 20th Century, Dr. Fairchild was instrumental in the introduction of approximately 75,000 selected varieties and species of useful plants, such as Durum wheat, Japanese rices, Sudan grass, Chinese soy beans, Chinese elms, persimmons, and pistachios. Fairchild and his wife, Marion Bell Fairchild, daughter of Alexander Graham Bell, purchased property in South Florida in 1916 and created both a home and an "introduction garden" for plant species found on his expeditions. He named the property "The Kampong," the Malay word for "village." The tropical species he collected from Southeast Asia in the 1930s and 1940s are still part of the heritage collections of The Kampong, which operates today as part of the not-for-profit National Tropical Botanical Garden (www.ntbg.org/). NTBG has five gardens and five preserves in Hawai'i and Florida and is dedicated to conservation, research, and education relating to the world's rare and endangered tropical plants. The institution, which is non-governmental, is supported primarily through donations and grants.

For more information, contact Janet L. Leopold at administration@ntbg.org

Cheekwood Botanical Garden & Museum of Art

Nashville, TN

Senior Vice President of Gardens & Facilities

Cheekwood Botanical Garden and Museum of Art is located on 55 acres in Nashville and is considered one of the finest examples of an American Country Place Era Estate in the United States. Designed by Bryant Fleming for the Cheek Family who amassed their fortune through the Maxwell House Coffee business, Cheekwood was built between 1929 and 1932. The estate was opened to the public as a 501(c)(3) garden and art museum in 1960 and currently operates with an annual budget of $6 million and over 100 full and part-time staff members.

Reporting to the President/CEO, the Senior Vice President of Gardens & Facilities (SVP) is responsible for developing immediate and long term plans to achieve horticultural excellence. The SVP will lead all horticultural initiatives in collaboration with the Senior Management Team to ensure an integrated and strategically focused outcome that realizes the institution's overall vision and values. This person will provide leadership, direction and management to both the botanical garden and facility staff including development and monitoring of the organizational structure needed to accomplish annual goals.

This person must possess outstanding horticulture or related garden design expertise as well as management, organizational and planning skills. A historical understanding of and sensitivity to Cheekwood's origins as an American Country Place Era Estate is a must. This position requires thorough knowledge of botanic garden collections, supporting science and sustainability practices with demonstrated creative design abilities. An advanced degree in horticulture or related fields such as landscape architecture, arboriculture, garden design or historic preservation is highly desirable. We seek a minimum of ten years of progressive supervisory experience and demonstrated organizational success in a similar role.

To apply, please send a current resume and letter of interest to Kittleman & Associates, LLC at resumes@kittleman.net. For more information, please visit Cheekwood's website at www.cheekwood.org.

Ohio Invasive Plants Council Releases New Evaluation Protocol

Cincinnati, OH—A first-time science-based effort is underway to identify invasive plants from other regions and reduce their impact on natural areas in Ohio, according to the Ohio Invasive Plants Council (OIPC).

Common reed grass, garlic mustard, bush honeysuckle and other plants dominate thousands of acres in Ohio's forests, grasslands and wetlands. These invaders crowd out native plants and reduce biodiversity. Utilizing a 22-question assessment protocol developed in 2012 by the OIPC and other stake-holder groups, a five-person assessment team of researchers and botanists will evaluate potential invasive plants and establish a new list of primary offenders. Concurrently, the assessment team will provide a list of alternative plants suitable for recommendation to nurseries, garden retailers and homeowners.

"OIPC is not a regulating group," said University of Cincinnati professor and OIPC Chairperson of the assessment team, Theresa Culley. "Our mission is to develop a new list of invasive plants for Ohio. We also intend to play a primary role in education, research and early detection."

"The nursery industry has already been impacted by unofficial invasive plant lists in Ohio and elsewhere," said Cincinnati Zoo and Botanical Garden Horticulture Director Stephen Foltz. "As soon as we put nursery plants on our official list, these plants will no longer be allowed for use in projects complying with Leadership in Energy and Environmental Design (LEED) standards. That's why it's so important for us to get this right."

"It's exciting to see that Ohio has a protocol and is ready to begin assessments. This will be a useful tool for addressing the problem of invasive plants," said Katherine Howe, coordinator of the Midwest Invasive Plant Network.

Under the direction of Culley the assessment team will initially evaluate 27 problematic invasive plants. The team will address a second group of plants within a year, including those produced and sold in Ohio nurseries, such as ornamental pear, Japanese barberry and burning bush.

The OIPC worked with the Ohio Nursery and Landscape Association (ONLA), Ohio Department of Resources (ODNR), The Nature Conservancy and other land-management agencies to develop the assessment protocol. John Cardina, professor of horticulture at The Ohio State University, and Richard Munson, manager of the conservatory at Miami University-Hamilton, were selected by ONLA as representatives on the assessment team. ODNR botanist Rick Gardner and Dawes Arboretum botanist David Brandenburg were selected by OIPC on behalf of conservation and land-management entities. Culley, a past president of OIPC, directed efforts to develop the assessment protocol during the past four years.

The OPIC represents a coalition of organizations and individuals who have a mutual interest in Ohio's natural ecosystems and the effects of invasive plants. OIPC is a nonprofit organization founded in 2005 working in concert with local, regional and nationwide groups. OIPC assessment documents and other information are available at oipc.info. For more information, contact, Cheryl Coon, OIPC President, e-mail: ccoon@fs.fed.us.

Developmental & Structural

Plant Physics

Karl J. Niklas and Hanns-Christof Spatz.
2012. ISBN-13: 978-0-226-58632-8
Cloth, US$55.00. 426 pp.
University of Chicago Press, Chicago, Illinois, USA

I teach a second-year course on plant form and function as though it were an architecture class. If instead I were ever to teach a fourth-year course on plant form, function, and also the environment, it would be as a physics course, with Niklas and Spatz's brilliant new book *Plant Physics* as the text. This is truly a lovely book, with all the remarkable idiosyncrasies that we have grown to expect from the whimsical, quixotic genius of Karl Niklas (sorry, but I don't know Hanns-Christof Spatz's work very well, although probably should learn it).

The material in this book is very good and exceptionally nuanced. For instance, the authors do not make a mockery of adaptation. They truly understand and care about tradeoffs and multi-level selection. For their first simple example, they examine the basic equation for photosynthesis, highlighting its two inputs—carbon dioxide and water. For aquatic plants, water is easy to come by, but carbon dioxide is not. By contrast, for terrestrial plants, carbon dioxide is easy to come by, but water is lost. Niklas and Spatz go directly to fundamental constraints and never let readers forget them, which is fantastic.

But this is not a book for the novice or faint of heart. While advertised as a book that allows mathematicians, physicists, engineers, or botanists entrée into the other three fields, you probably need expertise in all four fields to fully appreciate this book. The first two chapters are introductory, providing essentials of botany and physics, respectively. Although elegantly written, one would be hard-pressed to use these as a primer. For instance, what physicist will really understand that cork cambia can arise from epidermis, cortex, or primary phloem? This probably seems even more confusing to an outsider who might read the text to imply that vascular cambia cannot arise from cortex (or pith or medullary rays), which of course they can in anomalous secondary growth. Likewise, what botanist will want to jump straight into differential equations for transport (e.g., simple diffusion equations) unless they have previously studied fluid dynamics?

That said, the authors do their best to make plant physics as accessible as possible to botanists, who are typically not known for our mathematical acumen. This book does not start with a huge rich theoretical development of the necessary physics (except for the material on physics of solids), but instead pulls many formulae off the shelf as needed. Rather than belabor each equation, the authors are brief in their exposition, but provide just enough detail and caveats that, if you are really interested, you can find out more elsewhere.

This book is at its best when integrating or at least interleaving botany and physics. However, Chapter 4 and the first two thirds of Chapter 5 form an 80-page introduction to the physics of solids. Only in the final 20 pages of Chapter 5 do the authors show applications to plants. Even those applications, though, can be almost completely encapsulated by a single line from the Ani DiFranco song "Buildings and Bridges" (1994), in which she states, "All that steel and stone are no match for the air, my friend; what doesn't bend breaks." To be fair, Niklas and Spatz also use a modicum of applications of physics of solids in Chapter 8 (and I am clearly not cut out to be a mechanical engineer). By contrast, Chapter 6 on fluid dynamics, where the fluid could be either liquid or gas, fully integrates botany. The authors start the chapter discussing different Reynolds numbers during the life cycle of an individual kelp plant: from a very small Reynolds number when the zygote is affixed to a rock in the boundary layer to a very large Reynolds number when the mature kelp plant is many times longer than the waves buffeting it are tall. The authors end the chapter with a discussion of how pollen and seeds fly on the winds.

Chapter 8 is a potpourri of interesting ideas and something of a synthesis, which—as an added bonus—is full of great botanical factoids, such as that chloroplast cell membranes are composed mostly of glycosylglycerides (in lieu of phospholipids) and that plant egg and sperm lack cell walls.

The book ends with a pair of toolboxes, one experimental and one theoretical. The theoretical chapter starts with a gorgeous description (on p. 355) of how best to do biological modeling or any form of hypothesis formation:

In one respect, the only good model is one that fails the test of reality, because a model that gives the right answers can do so for the wrong reasons, whereas a model that yields predictions that conflict with reality immediately requires us to evaluate our assumptions about how reality works. Good models allow us to reject our preconceptions; poor models delude us into believing we have identified causalities correctly.

In fact, that makes for a fine description of science. This book has some quaintness and miscues. The authors refer to dicots, in lieu of eudicots (and magnoliids and basal angiosperms?). The publisher chose a typeface in which zeros look like the lowercase letter "O" and ones look like the lowercase letter "L," which strains reading of a text that otherwise so seamlessly integrates text and mathematics. There are no epilogues—neither for the book as a whole, for individual chapters, nor even for sections of chapters—which makes for staccato reading. The subject index is rather spartan. There are times where it is clear that the physicist (Spatz) wrote about botany without the botanist (Niklas) having proofed the material. For instance, Box 2.1 refers to leaves of water lilies in the genus *Nelumbo* that are one centimeter long that conduct passive diffusion of carbon dioxide underwater. This statement confuses water lilies with lotuses or confuses *Nymphaea* with *Nelumbo*, both of which have leaves that are 20–80 cm long and that absorb most of their carbon dioxide when above water. But, despite these minor foibles, this is a wonderful and somewhat accessible book (other than maybe Jearl Walker's *The Flying Circus of Physics*, what physics books are accessible?) that fills a long-standing gap

–Root Gorelick, Department of Biology, School of Mathematics and Statistics, and Institute of Interdisciplinary Studies, Carleton University, Ottawa, Ontario, Canada

Ecological

Beach Forests and Mangrove Associates in the Philippines

Jurgenne H. Primavera and Resurreccion B. Sadaba
2012. ISBN-13: 978-971-9931-01-0
Paperback US$90.00. 154 pp.
Southeast Asian Fisheries Development Center (SEAFDEC), Aquaculture Department, Tigbauan, Iloilo, Philippines

The authors, Dr. Jurgenne Primavera, an Emeritus Scientist at SEAFDEC and one of *Time* magazine's 2008 Heroes of the Environment, and Dr. Resurreccion Sadaba, Associate Professor at the University of the Philippines, have done an excellent job in preparing this outstanding monograph, which covers ~140 species (97 species fully described and illustrated and an additional 43 species with illustrations only) with over 1000 color photographs. The authors mention in the preface that the current volume is a sequel to their previous monograph, *Handbook of Mangroves in the Philippines–Panay* (2004).

The volume is divided into three distinct sections: the introduction, Part I: Beach forest species and mangrove associates (comprising the major research content of the volume), and Part II: Additional species collected (a pictorial collection of 43 species). In the introduction, the authors have nicely and comprehensively laid the foundation of their objectives; introduced the species, areas, and location of work; and presented the methodologies adapted for the collection and recording of specimens. The bulk of the monograph is presented under Part I, where the authors describe individual species along with their scientific, English, and vernacular names; provide botanical/taxonomical descriptions of habit, leaves, flowers, and fruits; and describe the use of the plants. The volume also has an excellent glossary, a list of abbreviations of local names, and a meticulously detailed bibliography to guide enthusiastic readers and researchers to probe deeper into the amazing world of the coastal forest species and mangrove associates. A special mention has to be made for the elegant poetry of Rafael Zulueta da Costa, entitled Like the Molave (1940) on p. 10. In the introduction, the authors note that pre-Hispanic Filipinos were well acquainted with the richness of the coastal biodiversity. This is reflected in the naming of so many coastal towns, cities, and villages with the vernacular names of local species (presented in Table 1, p. 3). Information of this sort is of both botanical and cultural interest. The book will be an exciting resource for both serious plant researchers as well as the general public interested in exploring the identification and diversity of coastal forest species and mangrove associates, their role in the ecosystem and in modern forestry practices, their traditional and commercial applications, and their medicinal and ecological characteristics. The volume contains detailed taxonomic descriptions of important species along with color photographs for easy and convenient identification in the field. Images of both vegetative and reproductive structures of plant species are included—an added asset for easy identification of key taxonomic features.

One of the most exciting aspects of the volume is the authors' ability to explain the complex dynamics of ecosystem and plant biology and connect them with engaging local history and personal experiences. While the volume includes serious descriptions of key plant species and their biological, ecological, commercial, and medicinal importance, the authors connect with the reader through personal anecdotes that bring together history, botany, society, culture, environment, and economics in a dynamic mix. For example, details on major, commercially important species such as the coconut and its agro-industrial relevance to the nation add value to the monograph that goes beyond the botanical information provided.

Often in developing and underdeveloped countries, population pressure and severe economic hardship create tremendous anthropogenic pressure on natural resources. Similar pressures on the mangrove belts are also apparent in the case of the beach forests of the Philippines, threatening the existence of many species due to non-scientific management and exploitation. Through their research, the authors have rediscovered several beach forest species and mangroves. They have been able to raise awareness of the conservation and protection of threatened and endangered plant species by connecting the communities to their local history; community beliefs; and indigenous use of different plant species for social, religious, cultural, and medicinal purposes; as well as by encouraging people to identify themselves with their immediate surroundings and take pride and responsibility to protect their local environment. I sincerely believe this approach by the authors is a monumental step that, if applied successfully, will involve communities in the protection of local species with great effectiveness and efficiency.

The volume provides thorough coverage of neglected species that are ecologically and commercially unique and important for the Philippines; it will serve as an excellent handbook for plant researchers and field and amateur botanists. The use of vernacular names will help local researchers and enthusiasts to identify the species by their local vernacular names; it will also promote conservation efforts because it connects local communities to their plant resources in terms of their language, local history, and culture more intrinsically than dry technical botanical terminologies. This work will help build awareness among local communities, the general public, students, researchers, and academics of the importance of these plant species and their intricate relationship with the fragile local ecosystem, and will play a role in the conservation and protection of the unique ecological resources of the Philippines.

In future editions, some additional information on the common diseases of the studied plant species and their association to different zoological taxa in their corresponding ecosystem would be helpful. It will be interesting to note which animals or birds forage on certain plant species, which insects are more prevalent with particular plant species, or any important plant–fungal associations in the beach ecosystem. It would also be useful to know what specific factors (including anthropogenic factors) are contributing toward the threatened or endangered status of a particular species. Lastly, current conservation efforts in progress for individual species could be included.

This is an excellent book that can serve to advocate for the subject of botany to the general public. It will be valuable for those specializing in plant sciences/biology, mangrove ecology, coastal/marine ecosystems, mangrove/beach forestry, coastal biology/botany, marine botany, applied/economic botany, mangrove taxonomy and systematics, plant taxonomy, applied ecosystem, ethnobotany and ethnomedicine, environmental studies, and plant/economic geography.

-S. K. Basu, University of Lethbridge, Lethbridge, Alberta, Canada. saikat.basu@uleth.ca

Economic Botany

Darwinian Agriculture: How Understanding Evolution Can Improve Agriculture

R. Ford Denison
2012. ISBN-13: 978-0-691-13950-0
Cloth US$39.50. 248 pp.
Princeton University Press, Princeton, New Jersey, USA

On the Origin of Species begins with a chapter on variation in agriculture, an acknowledgment that Darwin understood that human selection for crop improvement provided a rich source of information for understanding the process of natural selection. In *Darwinian Agriculture*, Denison suggests that modern breeders should take greater heed of the principles of evolution when planning strategies for further improvement. In particular, both the approach of using biotechnology to improve plants and the approach of modifying agricultural practice to mimic nature would benefit by recognizing the evolutionary tradeoffs in the past that could constrain modern efforts.

The first four chapters provide an overview of agriculture and agricultural production and the basics of evolutionary theory. What do we need from agriculture? We need food, and lots more of it as the human population continues to grow. What's more, we need to produce it more efficiently because of a variety of ecological and physiological constraints that are forcing producers to "do more with less." Denison's thesis is outlined in three core principles presented in chapter 4. First, natural selection, over thousands of years, "rarely misses simple, tradeoff-free improvements." There is not likely to be much low-hanging fruit that will allow a genetic engineer to make dramatic improvements in productivity by modifying single genes or pathways. Second, individual adaptations of a wild species relate to the conditions in the place where it evolved, which are considerably different from the conditions in an agricultural situation. It is not safe to assume, without testing, that what is optimal in nature will also be optimal in culture. Third, "We should hedge our bets…" We know the dangers of monoculture and our dependence on a relatively few plants, but this is only part of Denison's concern. We should also be open to input of new ideas.

Chapters 5, 6, and 7 address the first two of these principles in turn and focus on "What won't work." In the first case what won't work is tradeoff-blind biotechnology. Denison argues that although biotechnology, like traditional breeding, has been effective at producing specific benefits, such as pest or pathogen resistance, it has had little effect on yield potential—basically photosynthetic and water use efficiency. The reason is that natural selection already has done the experiments to improve photosynthesis and water use, effectively constraining the potential of biotechnology to make further improvements. "Selfish Genes, Sophisticated Plants, and Haphazard Ecosystems" is the title of chapter 6, in which Denison addresses the role of natural selection at each of these levels. The bottom line is that genotypes and phenotypes are "improved" through selection, but ecosystems are not—at least by the criteria important for agriculture. Here he relates the classic example of breeding for male sterility in corn, which was good for the breeder and seed companies, but disastrous for the corn crop when Southern leaf blight swept the corn belt in 1970. This leads naturally to what won't work in chapter 7—"Misguided Mimicry of Natural Ecosystems." The foil for this chapter is Wes Jackson and the Land Institute. In turn, Denison presents a case against attempts to perennialize grain crops, minimize fertilizer application, extend the scale of polyculture, and rely on biodiversity to control pests on a large scale.

The last five chapters are more positive and shift the evolutionary focus from what won't work, to what has worked—or could work. The key, according to Denison, is to be multidisciplinary, to keep the focus on evolution, and to look for tradeoffs. In general, characters associated with high yield tend to associate with low competitiveness, so we should focus on reducing competition. For instance, we have already done this by reducing the height of many crop plants but we have not addressed belowground competition such as root competition for water or nutrients. The focus on competition is expanded in chapter 9 to include between species. Again we have tended to focus on what we can see, aerial symbioses, and ignore what is going on underground, especially with microbes.

The role of evolution should not be limited to informing our efforts to improve the crop plant. Stopping or slowing evolution should be our goal when dealing with weeds and pests. Just as medicine has begun to realize the importance of understanding evolution in managing disease, we should do the same in crop management. Of course, resistance to Roundup is spreading quickly. We've strongly selected for this to happen. There are alternatives, but it will take widespread, well-informed changes in management practices to be effective.

Denison's third core principle is the focus of the final chapter: "Diversity, Bet-hedging, and Selection among Ideas." The chapter serves as a summary, but with the caveat of what are the risks if he turns out to be wrong? Hedge your bets.

This is an extremely interesting and provocative book and written in a very engaging way. While some sections are quite technical, and well documented in endnotes, there are also stories and anecdotes along the way. It is clear what Denison thinks about the topics he raises but he also brings in the opinion and experiments of others to provide breadth of examples and case studies. It is an ideal book for a graduate seminar or undergraduate capstone course. The general theme is evolution but tied to agricultural production and ecological theory. It brings in political and social issues as well as research priorities and funding issues. If you're only going to buy one hard cover book this year, this should be it. By the time you're finished, the page margins will be filled with annotations!

-Marshall D. Sundberg, Department of Biological Sciences, Emporia State University.

Mycological

Systematics, Biodiversity and Ecology of Lichens

Ingvar Kärnefelt, Mark R. D. Seaward, and Arne Thell (eds.)
2012. ISBN-13: 978-3-443-58087-2
Paperback, €87.00 (approx. US$120). + 290 pp.
Bibliotheca Lichenologica, Volume 108. J. Cramer, Stuttgart, Germany

This collection brings together 17 diverse lichenological research papers, each with a highly specialized focus. It is the 108th in the occasional series of lichenological volumes that has included biosystematic and floristic monographs, collected contributions from international congresses and symposia, and Festschriften of contributed papers assembled in honor of major figures in the field.

Falling within the latter category, the present volume is dedicated to the German lichenologist H. Martin Jahns on the occasion of his 70th birthday.

Academic librarians and readers unfamiliar with the series should be forewarned: this volume is in no way a review or general treatment of the topics of lichen systematics, biodiversity, and ecology. The title merely reflects the main subject headings under which most of these specialized contributions might be classified. Not all of the contributions fit easily within those headings, either; the lead article, by L. Arvidsson, comprises biographical sketches of the first nine presidents of the International Association for Lichenology. In the absence of any obvious organizational theme, the editors have chosen to arrange the 17 papers alphabetically by the names of the primary authors.

A very short summary of Professor Jahns' career is provided in the preface, along with a dedicatory letter from some of his former students. In the early 1970s, Jahns co-authored (with A. Henssen) an influential book on lichenology (*Lichenes: Eine Einführung in die Flechtenkunde*), which, though now dated, nonetheless remains relevant because of its comparative treatments of taxa with structural and developmental detail not found in other books on lichens. His scientific papers have contributed mainly to the subjects of lichen morphology, ontogeny, and development. However, only one of the papers in the present dedicatory volume represents those interests: a study of crustose lichen development on rocks in Gotland, Sweden, by T. Schaper and S. Ott.

Three of the contributions concern systematics of Teloschistaceae: a molecular phylogeny of xanthorioid taxa (N. M. Fedorenko et al.), a key to the Australian caloplacas (S. Kondratyk et al.), and the description of a new Patagonian *Caloplaca* parasitic on *Zahlbrucknerella* (U. Søchting and L. G. Sancho). New taxa described in other groups include an alpine *Rinodina* (J. Hafellner et al.) and an Andean *Collema* (P. M. Jørgenssen and Z. Palice). Molecular analyses are used to distinguish two species of *Cladonia* (*C. humilis* and *C. conista*; R. Pino-Bodas et al.), to determine the phylogenetic placement of the genera *Aphanopsis* and *Steinia* (C. Printzen et al.), and to confirm the identities of lichenicolous fungi isolated into culture (Hametner et al.). An extensive literature review of the large and problematic genus *Arthonia* is provided by R. Sundin et al. Floristic contributions include an evaluation of the saxicolous lichens of Munich (T. Feuerer and H. Hertel), the genus *Usnea* on the smaller Greek islands (H. Sipman), and lichens of several localities in Greenland affected by global climate change (E. S. Hansen). Climate change and pollution effects are also considered in a study of corticolous lichens in Düsseldorf (N. J. Stapper, in German). Another paper, by H. Bültman and F. J. A. Daniëls, considers the possibility of using net photosynthetic rates as a stand-in for the more problematic relative growth rate measurements in classifying lichens according to Grime's system of plant growth strategies. Finally, the culture requirements and secondary chemistry of two species of *Thysanothecium* are compared in a work by Stocker-Wörgötter et al.

–William B. Sanders, Florida Gulf Coast University, Fort Myers, Florida, USA.

Fungal Cell Wall: Structure, Synthesis, and Assembly, 2nd ed.

José Ruiz-Herrera

2012. ISBN-13: 978-1-4398-4837-1
Hardcover, US$129.95. 183 pp.
CRC Press, Taylor Francis Group, Boca Raton, Florida, USA

This slender volume offers an overview with substantial molecular detail on the construction of the fungal cell wall. The author, a long-standing contributor to research in this field, has revised and updated a work he first published 20 years ago. The book begins with an excellent introduction to cell walls, their significance, and the chief differences among those of bacteria, plants, and fungi. This chapter is regrettably brief, however, and the broad perspectives and interdisciplinary insights that the author shows himself fully capable of generating here do not often emerge in subsequent chapters. Nor is the rest of the book anywhere near as accommodating to generalists less deeply steeped in biochemistry and cell biology. The result is a reference work that will certainly be valued by cell and molecular biologists working on cell walls, but may not attract as many interested readers from related fields as a book on this important topic might otherwise.

The second chapter, on cell wall composition, presents the macromolecular cast of characters, and the following chapter describes how these components are arranged within the wall.

Subsequent chapters explore each of the main biochemical components of the wall in depth: chitin, chitosan, glucans, and proteins. While it is the signature component of the fungal cell wall, chitin, as it turns out, is often not a major constituent; variously linked polymers of glucose (but not cellulose) frequently predominate as structural and microfibrillar components. In the next chapter, "Cytological Aspects of Cell Wall Synthesis," the author details what is known about translation and exocytosis of proteins associated with the cell wall and its enzymatic synthesis. The final chapter describes the coordination of processes involved in wall growth. It presents turgor pressure as the driving force; not mentioned is any role for other mechanisms, such as amoeboid extension, discussed in other recent literature reviews. Some readers may be disappointed that such issues are not addressed in a book of this kind.

There are relatively few illustrations in this work and many occasions where additional ones could significantly aid the non-specialist. Micrographs are particularly scarce, and the reproductions are, it must be said, of generally poor quality and in several cases inadequately sized. Considering the ample price of this lean volume, one might hope that the publishers could afford to be a little more generous with production quality. They would have also done well to provide a proofreader. Although the prose represents a considerable achievement for a (presumably) non-native speaker, a substantial number of errors in grammar, punctuation and orthography appear in the text. These errors do not usually impact comprehension, but they can be a distraction to the reader.

The focus of this book is limited to the conventional hypha showing polar growth, with due consideration given to the contrasting isotropic growth pattern characteristic of yeasts. Certainly the hypha is the indisputable structural unit in fungi, which have diversified tremendously while conserving the filamentous vegetative cell that is so ideally suited for exploiting any food source from within. But fungi also emerge from their food to produce and disperse their spores; to accomplish this they have often metamorphosed their hyphae into a wide variety of cells and tissues. Some of those investigated experimentally, such as the mushroom stipe, show patterns of wall growth and elongation that are very different from those of a conventional hypha. Yet these interesting deviations from the hyphal norm are not considered at all in this work. Equally unaddressed, although less well studied, is the cell wall of lichen fungi, whose diversity of vegetative tissue types and thallus growth forms is unparalleled elsewhere in the Kingdom. These perfectly legitimate fungi (nearly 20% of all described fungi are lichen-forming) may, along with fruit-body tissues, pose significant challenges to the growth paradigms presented in this book. Experimental researchers can hardly be faulted for neglecting the lichen fungi, whose slow growth and finicky symbioses make them far too complicated for routine laboratory manipulation. But a treatise on the fungal cell wall ought to at least acknowledge that the fungi are capable of building far more than just hyphae and yeasts, and that a focus limited to these basic cell types will not adequately explain how they do it.

-William B. Sanders, Florida Gulf Coast University.

Plant Fungal Pathogens: Methods and Protocols

Melvin D. Bolton and Bart P. H. J. Thomma, eds.
2012. ISBN-13: 978-1-61779-500-8 (hard-cover)
e-ISBN: 978-1-61799-501-5 (e-book)
Hardcover, US$159.00. xvi + 648 pp. 138 illustrations, 72 in color.
e-Book, US$129.99
Humana Press, Springer, Science + Business Media, New York, New York, USA

The current volume is a unique collection of 41 chapters from a diverse group of scientists, researchers, and academics working on different aspects of the molecular basis of fungal pathogens and pathogenesis. The editors have successfully bridged the gap between classical mycology and recent molecular developments in disease diagnostics and analysis in a fairly comprehensive fashion. The volume covers a large number of recent critical techniques that are being currently employed in plant pathology laboratories, such as regular PCR, real-time PCR, genomics approaches, sequencing, blotting techniques, transformation techniques, genome walking, gene silencing, microarray analysis, cloning, nucleic acid isolation methods for different fungal species, fungal cell and tissue culture techniques, molecular genetics, genetic engineering, molecular and microbiological methods, advanced microscopy, spectroscopy, and information technology as applied in molecular plant pathology. These are only few of the most common methods discussed in addition to a wide variety of new technological approaches devised or implemented to understand the complexity of the fungal pathogens and uncover the molecular basis of host–pathogen interactions. The current volume will successfully fill the void for the need of a comprehensive volume dealing exclusively with molecular methods of fungal pathogens.

One of the most striking aspects of the current volume is the concision of each chapter. Most protocol-based volumes lose focus by providing too much detail in the procedures and the overall length. The editors have done a commendable job in limiting the length of individual chapters and maintaining simplicity of language throughout the volume. The authors deserve special credit for presenting complex protocols in simple terms and for breaking up the text with illustrations, word diagrams, schematic charts, tables, and excellent figures. This approach helps maintain the reader's attention without compromising the quality of information delivered. Instead of amassing a complete reference list at the end of the volume, the editors have placed them at the end of each chapter; to my mind this is more helpful because researchers interested in a specific technique do not need to dig through a huge combined reference list at the end. Valuable tips and suggestions on conducting critical protocol steps are provided from global leaders and experts on the topic; this will help researchers attain reproducible results and is another key feature that sets this volume apart.

The index is helpful and will assist readers in identifying specific keywords and phrases. I believe that including a listing of the abbreviations used in each chapter after the abstract would be useful for the reader; this could be considered as addendum in future editions. The excellent collection of black-and-white and color illustrations is an added attraction for the reader. This volume will be useful for both students and researchers in the fields of botany and forestry, agriculture, mycology, microbiology, plant disease and diagnostics, molecular plant pathology, horticulture science, biomolecular sciences, life sciences, fungal molecular biology, fungal biotechnology, microbial biotechnology, and food technology.

–S. K. Basu, University of Lethbridge, Lethbridge, Alberta, Canada. saikat.basu@uleth.ca

Physiological

Plant Signalling Networks: Methods and Protocols

Zhi-Yong Wang and Zhenbiao Yang, eds.
2012. ISBN-13: 978-1-61779-808-5
Cloth, US$119.00. 230 pp.
Humana Press, Springer Science+Business Media, New York, New York, USA

Plants have to adapt to a changing environment and to many external stresses. Some reactions might be transient and short, while others might result in long-term changes in metabolism and morphology. However, our knowledge of the underlying mechanisms of cellular signaling and regulation is still extremely limited. To fully understand plant reactions, it would be necessary to elucidate the perception of signals, the functioning of molecular switches, the activation of genes, translation and transcription, as well as the resulting shifts in enzymes and metabolites and their feedback reactions. In the past decades, studies with model species like *Arabidopsis* have helped us to recognize a number of these adaptations, but we are still far from having the whole picture.

In order to understand cellular decision processes, it is important to identify the molecular actors and their interactions with each other in reaction cascades. Genomics, proteomics, and the role of small molecules are the key tools to the understanding we need. To date, studying genomes has led to incredible progress in understanding biology, but this is nothing compared to the advances in the understanding of cellular reactions, it would be necessary to elucidate the perception of signals, the functioning of molecular switches, the activation of genes, translation and transcription, as well as the resulting shifts in enzymes and metabolites and their feedback reactions. In the past decades, studies with model species like *Arabidopsis* have helped us to recognize a number of these adaptations, but we are still far from having the whole picture. In order to understand cellular decision processes, it is important to identify the molecular actors and their interactions with each other in reaction cascades. Genomics, proteomics, and the role of small molecules are the key tools to the understanding we need. To date, studying genomes has led to incredible progress in understanding biology, but this is nothing compared to the advances in the understanding of reactions, it would be necessary to elucidate the perception of signals, the functioning of molecular switches, the activation of genes, translation and transcription, as well as the resulting shifts in enzymes and metabolites and their feedback reactions. In the past decades, studies with model species like *Arabidopsis* have helped us to recognize a number of these adaptations, but we are still far from having the whole picture.

In order to understand cellular decision processes, it is important to identify the molecular actors and their interactions with each other in reaction cascades. Genomics, proteomics, and the role of small molecules are the key tools to the understanding we need. To date, studying genomes has led to incredible progress in understanding biology, but this is nothing compared to the advances in the understanding of cellular adaptations in the study of proteomics. By now it is clear that one gene can encode different proteins due to post-translational splicing and protein–protein interactions, leading to results including reversible or irreversible oxidation or to phosphorylation, methylation, or glutathionylation. Furthermore, it is clear that there are signal transduction pathways linking signal perception to gene regulation. Current development of proteomic methods has allowed unraveling signaling processes on the basis of alterations in proteins. It is now possible to profile even small changes on the level of single proteins in a given tissue. Even quantitative approaches are available.

Chemical genetics focuses on the identification of small molecules and their role in changing protein functionality. It may be seen as a complement to traditional genetics, but it is also complementary to proteomics. Chemical genetics, which is being used with increasing success in pharmacology, has also begun to influence the plant sciences and the understanding of metabolic pathways.

The editors of this volume, both plant physiologists and specialists in plant responses to the environment, have chosen topics of interest for the scientific community. The present book compiles some of the most recent and promising protocols in the study of plant signaling networks. Beware, though, because of its focus on methods, this text focuses on the how rather than the why. The abstracts and introductions to each chapter give just a clue of the biochemical background and are not a substitute for further reading. The same is true for the references given with each chapter: they refer to the methods, and only a few provide an overview of the topic. It is in the nature of a protocol book to not be comprehensive on the scientific background.

The first six chapters focus on methods for the detection of post-translational changes in proteins and their quantitative analysis. Among many other procedures, stable isotope labeling, differential two-dimensional gel electrophoresis (2-DGE) or immobilized metal affinity chromatography, and advanced mass spectrometry methods are described. Processing data and database searching of liquid chromatography–mass spectrometry (LC/MS) and liquid chromatography–tandem mass spectrometry (LC/MS/MS) data sets are also covered. As the lab of one of the editors is very experienced in this field, he contributes to two of the chapters of this section.

Proteomic methods usually utilize gel electrophoresis or isotope tagging for the estimation of protein abundances. On the other hand, gel-free approaches are fast and use existing databases to identify phosphorylated key proteins from partial sequences obtained after digestion and mass spectrometry. Contrary to this, gel electrophoretic methods first separate abundant proteins and determine their phosphorylation in a second step. Both methods have significant drawbacks: the first identifies only sequence fragments, which bears a certain insecurity of the protein identity, and the second suffers from reproducibility of exact isoelectric focusing (IEF) and molecular weight (MW) data on the two-dimensional gels. Furthermore, separating and identifying hydrophobic proteins with 2-DGE is still a matter of discussion. The reader obtains a comprehensive overview of the available methods, some pitfalls, and the equipment and time needed, and can decide which setup best suits his or her requirements.

The subsequent chapters deal with the role of small molecules in signaling, as well as their detection. This section is followed by methods for the dissection of GTPase-dependent pathways. Because ubiquitin conjugation seems to be a very important step in eukaryotic protein modification, methods to study its role in vivo and in vitro are provided in two independent chapters. Genome-wide profiling is covered in the next three chapters, including novel techniques like the Illumina or Sequencing by Oligonucleotide Ligation and Detection (SOLiD) whole genome sequencing methods. Last, but not least, an important summary of a computational method for the analysis of cell growth patterns is included, providing an example of the importance of bioinformatics tools.

Each chapter contains a detailed list of materials and a description of the equipment needed for the respective experiment, followed by a step-by-step protocol for the successful completion of the tasks. In all chapters, this section is very detailed and gives important hints on incubation times, handling of equipment, and intermediate results.

Each experimental section is followed by notes. These notes to the methods differ considerably in length and detail. Some authors have spent ample time and space to further explain experimental procedures and problems, while others seemed to consider the notes section as just an addendum. Some authors also provide valuable links to lab web sites or to videos for further information. A few authors use them to add trivialities: "…results must be reconfirmed by repeating the experiment three times." In any case, it is worthwhile to read these notes thoroughly. The index is informative but very short. It will probably be necessary to browse through the chapters of interest to spot more specific information.

Overall, this protocol book is a good overview across various research approaches such as genomics, proteomics, metabolomics, and bioinformatics. Its methods are elaborate and clear, and most of the chapters provide specific hints and notes to increase the success of the experiments. This book will long stand as a guide to plant signaling networks, and it can be taken as a useful *vademecum* to the lab for the more experienced user.

–Peter Schröder, Senior Plant Physiologist, Research Unit Microbe Plant Interactions, Helmholtz Zentrum München, Neuherberg, Germany. peter.schroeder@helmholtz-muenchen.de

SYSTEMATICS

Flora of Tropical East Africa - Commelinaceae

Robert Faden, 2012. ISBN 978-1-84246-436-6 (paperback, US$75.00) 244 pp. Royal Botanic Gardens, Kew. Distributed by University Chicago Press, Chicago.

With this volume and a volume on Solanaceae, written by Jennifer M. Edmonds, *Flora of Tropica East Africa* (FTEA) has been finished in 2012. This is the largest ever completed regional tropical Flora. When first parts of the FTEA appeared in 1952, botanists expected that it would only take about 15 years to finish and they thought it would amount to around 7,500 vascular plant species in the region. Instead, it took 135 plant taxonomists and 211 illustrators exactly 60 years to write 267 volumes (about two meters of shelf space) that describe 12,104 wild plant species in Uganda, Kenya, and Tanzania. About 2,500 species are endemic to the region and more than 1,500 new species for science have been found during the FTEA project.

Robert Faden, Research Botanist and Associate Curator at the National Museum of Natural History, has been working in Africa and on systematics and phylogeny of Commelinaceae for 40 years. Therefore, he was better qualified than anybody else to prepare a volume on this difficult family for the FTEA. According to his treatment, the family Commelinaceae is represented by 11 genera and 123 species in the region. The largest genus – *Commelina* – is represented by 51 species. This is a notoriously difficult genus because the species are difficult to identify even when fresh material is available. Unfortunately, only 11 species are illustrated. The second largest genus is *Aneilema*, represented by 36 species. Nine species in this genus are illustrated. The remaining genera (*Anthericopsis, Coleotrype, Cyanotis, Floscopa, Murdannia, Palisota, Pollia, Polyspathia, Stanfieldiella*) are represented by fewer species. There are eight new species and eight new subspecies described in this volume. A few naturalized species (*Tradescantia* spp.) are mentioned in the text. Some of the species described in this volume are invasive in other parts of the world (e.g., *Commelina benghalensis, C. diffusa, C. forskaolii*).

The *Flora of Tropical East Africa* is a monumental achievement. The editors, all contributing authors, and artists should be congratulated on this milestone in tropical botany and plant systematics!

– Marcel Rejmánek, Department of Evolution and Ecology, University of California, Davis, CA 95616.

Huanduj: Brugmansia

Alistair Hay, Monika Gottschalk, and Adolfo Holguín

2012. ISBN-13: 978-1-84246-477-9
Hardcover, £68.00. 424 pp.
Royal Botanic Gardens, Kew, Richmond, Surrey, United Kingdom, kewbooks.com

Brugmansia Pers. (Solanaceae: Datureae) is a genus of seven recognized species and almost 1800 named cultivars. The common name in the title, huanduj, is in Kichwa, a major language of the indigenous peoples of Ecuador, Colombia, and Peru, which is the center of the range of most of the species of this genus. The genus is most unusual in that its species are not known to occur in habitats undisturbed by human beings; rather, the species inhabit roadsides, edges of fields, and other disturbed situations. Range maps for the seven species are given on p. 94.

The plants contain tropane (or "belladonna") alkaloids, psychoactive compounds that therefore figure in folk medicine and religious ceremonies. The tribe Datureae is especially rich in these compounds; Chapter 1, "Sacrament and Medicine," is devoted to these uses for the plants. Chapter 2, titled simply "Poison," discusses the risks and dangers of these plants.

Chapter 3, "Taxonomy," is in some respects the critical chapter in the entire book, because you cannot talk about a thing without a name for it, and the nomenclature of brugmansias is extraordinarily complex and beset with ambiguities. The underlying skeleton of the taxonomy adopted here is an unpublished Ph.D. dissertation by Tommie Earl Lockwood (1941–1975), one of three people to whom this book is dedicated. The key (on p. 100) appears workable. Problems will arise because hybrids are so abundant. These cannot be accounted for in a key, because they are so widely variable. The genus is divided into two sections, Brugmansia and Sphaerocarpium J. M. H. Shaw, and the evidence is that hybridization does not extend across sectional lines. In the treatment of each of the recognized species, there is a full citation of relevant names, with lectotypes or neotypes designated where necessary. The treatments of each species are much longer than one usually sees in revisionary treatments; the effort is evidently meant to tie up every loose end, with respect to issues including typification, history, and misapplication of names in previous literature. The authors have most admirably attained their goal.

The second half of the book is devoted to horticulture: cultivation, propagation, diseases and pests, and so on. These topics will doubtless appeal most to cultivators, of whom there are apparently thousands—some of whom are organized into groups like the International Brugmansia and Datura Society. The authors comment that brugmansia is surely acceptable as a common name for these plants, "though it is, unfortunately, all too open to contraction into the faintly lavatorial slur of 'brugs'." (I think one has to be conversant with Australian English to appreciate the flavor of this comment. In any case, the website is ibrugs.com.)

The book is replete with hundreds (perhaps thousands) of full-color pictures, carefully chosen, properly labeled, and positioned to amplify the accompanying text. The book designer is Stan Lamond, who deserves special mention. He has taken a scholarly manuscript and a very large file of photographs and turned them into a minor work of art.

–Neil A. Harriman, Biology Department, University of Wisconsin–Oshkosh, Oshkosh, Wisconsin, USA. harriman@uwosh.edu

Books Received

Dispersal Ecology and Evolution. Jean Colbert, Michel Baguette, Tim G. Benton, and James M. Bullock (eds.). 2012. ISBN-13: 978-0-19-960890-4 (Paper US$74.99) 462 pp. Oxford University Press, New York, New York, USA.

Medicinal Plants of China, Korea, and Japan: Bioresources for Tomorrow's Drugs and Cosmetics. Christophe Wiart. 2012. ISBN-13: 978-1-4398-9911-3 (Cloth US$149.95) 454 pp. CRC Press, Boca Raton, Florida, USA.

Protocols for Micropropagation of Selected Economically-Important Horticultural Plants. Maurizio Lambardi, Elif Aylin Ozudogru, and Shri Mohan Jain (eds.). 2013. ISBN-13: 978-1-62703-073-1 (Cloth US$159.00) 490 pp. Humana Press, Springer Science+Business Media, New York, New York, USA.

PLANT SCIENCE BULLETIN

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