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The Botanical Society of America: The Society for ALL Plant Biologists

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This year's annual meeting, "Botany without Borders," provided us with an opportunity to visit with Canadian colleagues on a campus with one of the strongest botany programs on the continent. In this issue we provide a summary of some of the major addresses presented during the meeting as well as other highlights and awards from our stay at the University of British Columbia in Vancouver.

One of the symposia, "Botany on Public Lands" addressed the needs of government agencies for young botanists trained in basic botany, including traditional plant taxonomy. In future issues we will provide commentary concerning federal needs and plant conservation. In this issue we feature a perspective on the educational uses of small herbaria at liberal arts colleges. Traditional plant taxonomy is one of the areas in decline at many of our colleges and universities, including some of our finest research institutions. Perhaps this is a niche that can be filled by master's universities and small liberal arts colleges such as Warren Wilson College, the focus of our lead article.

To capitalize on the theme "Botany without Borders" we thank the International Section of the Society for providing the inaugural article in a series focusing on botany abroad which will run for the next year. In this issue we feature Botany in Bulgaria. Our intent is to familiarize the membership with some of the opportunities for botanical research and collaboration in some of the less well-traveled countries throughout the world.

We hope this issue will be a pleasant reminder of a wonderful week for those of you who attended the annual meeting - and an informative summary for those of you who could not attend.

-the Editor

COLLECTING FOR EDUCATION: HERBARIA AT SMALL LIBERAL ARTS COLLEGES

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Natural history collections have served numerous valuable functions for both biologists and society for hundreds of years. Funk (2003) has outlined 72 different uses for herbaria, natural history collections of plants preserved, labeled, and systematically arranged for use in scientific study. These uses range from verifying nomenclature and providing material for DNA analysis to documenting minor cycles in climate and providing inspiration for painters. One of the most important uses of natural history collections today is the documentation and study of biological diversity (Gotelli 2004, O'Connell et al. 2004, Schatz 2002). In this time of severely declining biodiversity due to human impacts on the environment, scientists are pressed for time to determine the biodiversity that exists in the world, as well as the geographic distribution, geologic history, and ecology of that diversity(Gotelli 2004). Natural history collections like herbaria serve as repositories of all of these types of information, as well as centers for research on biodiversity (Ertter 2000, Krishtalka and Humphrey 2000, Snow 2005, Suarez and Tsutsui 2004).

A second important function of natural history collections has always been the training of new taxonomists and natural historians. Today, with the growing emphasis on molecular studies in research and funding, we face a crisis in the decline of taxonomists and natural historians. Just when these specialists are needed most urgently to study the declining biodiversity of our planet, we are

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failing to encourage students to go into studies of organismal biology and failing to support the institutions that can train them (Snow 2005, Krishtalka and Humphrey 2000).

Despite their value in the face of declining biodiversity, natural history collections today are struggling to maintain support. Universities are closing the doors of natural history museums and herbaria, ostensibly to save money despite the fact that these collections may be relatively inexpensive to maintain. Research grant priorities tend to fall on the side of molecular and medical research, leaving organismal biologists and their institutions without the funding to continue their important work (Dalton 2003, Gropp 2003, Suarez and Tsutsui 2004). Small herbaria have received even less attention, and while historically their importance has generally been limited to the institutions in which they are housed, the potential of connecting small herbaria into a large-scale database and network may lead to their value increasing and broadening in the near future. SERNEC, a collaborative of herbaria in the southeast, has recently received grant funding to work on exactly this issue (www.sernec.org).

In this paper, I report on a qualitative study of 19 herbaria at small liberal arts colleges across the U.S. My main objectives for this study were (1) to determine in what ways these small college herbaria are used, (2) to survey faculty who curate these herbaria as to what their goals, wishes, and missions are for these collections, and (3) to develop a profile of the ideal herbarium for small liberal arts colleges. After discussing the results of this survey, I will end with recommendations as to what the mission of an herbarium collection should be at a small liberal arts college and what resources could make these collections more accessible, useful, or valuable.

Colleges were chosen for inclusion in the study based on (1) the size and nature of the institution, (2) whether they had an herbarium, and (3) whether they had a faculty member who was willing to participate. I sought to include as many colleges in the study as possible. Out of the 33 schools I attempted to include in the study, 14 did not participate. Several schools chose not to participate because their collections were quite small and the faculty felt their information would not be useful to me; others were contacted but did not respond to my inquiry. The results presented below represent the 19 schools that chose to participate.

I visited five of the colleges included in the study and interviewed their herbarium curators in person. Faculty at the remaining 14 colleges were contacted via email and responded to the survey either electronically or in a phone interview, based on their preference. The questions included in the survey can be found at: http://www.warren-wilson.edu/~aboyd/herbquestions.htm.

The size of the student body at these various colleges ranged from 750 to 3500 students, with a mean of 1664. The number of biology faculty at these colleges ranged from 4 to 19, with a mean of 10. The herbarium collections at these institutions varied from approximately 500 to approximately 27,000 specimens, with a mean of 13,000. I believe that this sample mean is high relative to the actual mean size of herbaria at small liberal arts colleges; some colleges did not respond to the survey because of the small size of their collections, and other collections may have escaped my detection because of their small size. Therefore, the collections included in this survey can be thought of as generally larger and more active than the average small-college herbarium. Interestingly, I found no relationship between size of herbarium and size of student body ($r^2 = 0.014$, $F = 0.237$, $p = 0.632$) or number of biology faculty ($r^2 = 0.000086$, $F = 0.0015$, $p = 0.97$).

Universally, the herbaria are curated by biology faculty, though the person in charge is not always a

field botanist or taxonomist. In fact, one of the herbaria is curated by an entomologist (Elzie McCord, New College of Florida) at an institution that currently does not have a botanist on the faculty. Although the majority of the faculty associated with these collections are botanists, only 53% reported having specific herbarium training, and this ranged from solely undergraduate training to Ph.D.-level experience.

Based on anecdotal conversations with faculty, the existence of an herbarium, as well as its size and quality, at these small schools appears to be mostly dependent on one (or, occasionally, several) dedicated field botanist/taxonomist serving as curator at some point in the collection's history. The establishment dates for the herbaria ranged from the late 1800s through 1989. Many of the collections were largely created by a single faculty member who was particularly interested in floristic or taxonomic studies; this person may or may not have been the one who began the collection, but the bulk of the collection was dependent on that person's enthusiasm, experience, and hard work.

The organizational system used in the herbaria was split, with 50% using a taxonomic system and 50% arranged alphabetically by family. Those that use a taxonomic organization were mostly based on Cronquist (1968), though a few were based upon the published flora for their region, and one was organized according to the 1908 Gray's Manual of Botany (Robinson and Fernald 1908).

Only five of the 19 colleges included in the study had computerized databases for their herbarium collections, and these were not always complete. Five more described the rudimentary beginnings of a database or partial databasing (e.g., database for only one taxonomic group of interest, or only for one county). One reported a very old database that would be difficult to access today. Only one had a substantial part of the database online and searchable. Several reported having data on 3x5 file cards or on computer punch cards. Eight reported having no database at all.

USE OF THE HERBARIUM

The single most common use of these herbaria is as a resource in teaching undergraduate courses. Most of the faculty interviewed described using specimens from the herbaria in their teaching, and some said that other faculty in their department would occasionally use specimens for teaching as well. A few faculty used the herbarium in their own research, but this was rare due to limited time for research and/or the fact that their research interests didn't involve field collections. Several of the faculty discussed, and some lamented, the trend of college biology towards eliminating taxonomy and/or botany from the curriculum. As mentioned above, one of the schools did not have a botanist on the faculty, and those that do have botanists most commonly have plant ecologists or plant physiologists, not plant taxonomists. Only three of the faculty interviewed are actually plant taxonomists by training and/or research emphasis. All three of these use their herbaria extensively in their research.

Many of the faculty report that students use the herbarium collection to confirm ID of plants; at some institutions this is rare or periodic, while at others it is quite common. At some of the herbaria, students regularly or occasionally contribute to the collection through research projects or collections made for courses. Several of the faculty involve students in their research on floristics or plant ecology and the students learn to use the herbarium in association with this research. One school (New College of Florida) indicated that students with special interest in organic gardening or medicinal plants sometimes use the herbarium as a resource.

Use of the herbaria by off-campus parties is common, though not frequent, and is quite varied. Only 5 of the faculty interviewed indicated that there was no use of the collection by individuals or groups from off-campus. Most report some limited use: visitors from local plant societies, requests for loans or information from other scientists, reference use by farmers/gardeners, visits by faculty from other institutions or scientists from the state Department of Natural Resources, Natural Heritage Program, or Natural History Survey, U.S. Forest Service, or local environmental organizations. These uses by outside parties tend to occur once to several times a year at most of these herbaria. Several of the faculty interviewed indicated an interest in increased community outreach.

For the most part, these herbaria do not receive outside funding. Most of them do receive college funds, though these can range from plentiful to almost non-existent. Four of the herbaria have received some outside funding, in the form of small grants or scholarships, or from faculty contracts with the U.S. Forest Service or state Department of Natural Resources. Two of the schools have special herbarium funds or endowments established by alumni or emeritus faculty. Several receive work-study funds for hiring student assistants as part of their institutional funding.

When asked about who maintains the collections, almost all interviewees reported that this work was entirely or in part in their own hands. Nine have students helping out, either as volunteers or as paid work-study positions. Two have a staff member who helps with caring for the collection in addition

to many other duties, and four reported having volunteers from off-campus who help in collection maintenance.

GOALS AND WISHES

The two most common goals that the interviewees cited for their collections were maintenance of the collection, and having the collection serve as a repository and record of the local flora. Coming in a close second were updating nomenclature on existing specimens, and creation of a searchable database. Several indicated a desire to train students and get them interested in the science of taxonomy, and several were interested in creating a website for the herbarium. Two interviewees indicated that they had no goals or plans for the herbarium under their care; they seemed to have little interest in the collections and/or thought that they were of marginal value. Some other goals mentioned included training other faculty to use the herbarium, becoming more visible with displays or tours, mounting a backlog of specimens, digitizing label records or creating an image collection, increasing the collection through new specimens, or hosting community events for outreach.

When asked what a "wish list" for their herbarium would contain, i.e., what would make their herbarium more useful, valuable, or accessible, the most common responses involved more time as curator to work on the collection and a complete, searchable database. Some also asked for funding for an assistant (student or staff). A number of respondents listed things that could be done by a faculty member with more time dedicated to the collection, such as updating the nomenclature, creating an image collection, confirming ID by students, and reorganizing the collection. Others named improved facilities, such as a dedicated room, fireproofing, microscopes, and computers.

I asked each interviewee to describe what they thought the mission of a small-college herbarium should be. Universally the respondents indicated education as the first priority, including both education about plants and training of field and curation skills. Beyond this, the most common responses are research and local flora documentation. Several also thought that a small herbarium could and/or should serve as a community resource. Individuals also cited documenting campus arboretum specimens, K-12 education, and raising consciousness in the local community about plant conservation and biodiversity.

Finally, interviewees were asked to describe characteristics of an ideal herbarium for a small liberal arts college. A couple of these interviewees indicated that they didn't think herbaria were very important resources and should not be a high priority for resources or time. However, these were the minority, and most had clear ideas of what these characteristics might be, including resources, accessibility, and/or scope of the collection itself. In terms of scope of the collection, all agreed that the local flora should be the main focus for these small herbaria, with limited specimens of plants from other major biomes for teaching purposes. Other high priorities were computers and staff/student assistance. Regular maintenance and updating of the collection and a searchable database were commonly mentioned, and are tasks that could be accomplished by the staff/student assistance cited above. Faculty release time as well as faculty recognition and summer compensation for work in the herbarium were also a high priority, reflecting the need for more time dedicated to these collections as faculty have busy schedules. Facilities such as cabinets, prep room, and microscopes were also needed.

DISCUSSION

The primary use for herbaria at small liberal arts colleges is, universally, undergraduate education in botany. This matches the primary focus of the institutions where these collections are housed: small, liberal arts colleges are traditionally devoted first and foremost to the mission of educating students, and only secondarily, if at all, to the acquisition of knowledge (Michalak & Friedrich 1981). These colleges also often advocate experiential education, and herbaria can be great tools for providing direct access to and experience of the objects of study. They provide a context for botany students not only to learn about the plants themselves but to acquire skills in field study and curation. We are in a time today in the biological sciences when biodiversity is disappearing while the taxonomic skills necessary to study that biodiversity are also disappearing. Natural history collections such as herbaria may be in danger of disappearing as well at a time when they are most needed to train the field biologists of our future.

Herbaria at small liberal arts colleges are faced with the same trend in the biological sciences that face large institutions: growth in microbiology, molecular biology, and prehealth professions that has led to shrinking funding and support for natural history collections and research. In some ways, this trend has hit smaller collections harder than the larger ones. Plant taxonomy and even botany are more likely to disappear completely from a small, generalized department of biology, leaving herbarium collections in the hands of botanists without herbarium-related training, or even in some cases in the hands of zoologists or microbiologists.

Even when the collections have an enthusiastic curator, that curator is likely to be severely limited in time available. Professors at small colleges often teach a heavy course load, leaving little time for any research or other professional activities. When these collections lack a curator with the time for and/or interest in collection development and maintenance, they may easily end up discarded, deposited at larger institutions, or simply neglected, left to the exploits of bugs, humidity, and time.

On the other hand, collections at small collections also may be more likely to "fly under the radar," taking up little space or resources and therefore not seen as a significant drain on the home institution. Because of this, they may be maintained for many years with little notice, continuing to be used for teaching and occasional research or community inquiry.

The most important resource for these herbaria—the one that has made the difference between minimal, neglected collections and those that are well-developed and well-used—is an engaged faculty curator. The main resource needed to make these collections more valuable and useful, therefore, is faculty *time* for maintenance, organization, establishment of a searchable database, training of student workers, checking/updating identifications and classifications, and so on.

Small herbarium collections tend to focus strongly on their local flora and may serve as a valuable repository for local floristic data. Searchable databases, especially online, could make the collections more accessible to researchers outside the home institution, thereby increasing their scientific value.

Based on my survey, the picture of an ideal herbarium for a small liberal arts college emerges clearly and is not an outlandish, unachievable goal. The mission of such an herbarium would be focused on undergraduate education, with student research and taxonomic skills training as components. It would have basic equipment and facilities (cabinets, dedicated space, microscopes, computer) to allow maintenance, development, and usability of the collection. It would specialize on the local flora, with some additional taxonomic and ecosystem breadth as a resource for teaching. It would have an up-to-date, searchable computer database, linked to the internet to allow searching from off-site. The collection would be curated by a faculty member trained in herbarium curation skills and with an interest in the collection (though this person need not be a plant taxonomist, necessarily). The curator would have institutional support for time dedicated to the collection, be it release time from teaching, summer support, an extra stipend or other recognition. Lastly, the collection would be accessible to the outer community as a resource for study and research.

How far are existing collections from this vision? It varies widely; some are very close to what I've described, while others lack even the most basic resources. I see three categories of collections that were covered in my study, with different needs:

1) Collections that currently have no faculty member interested in herbarium use or curation. There is probably very little that would make a difference in these collections until and unless a faculty member emerges with an interest in the collection. Without faculty support, there is very little hope that natural history collections of any kind will be maintained at these small colleges.

2) Collections that have been neglected or underdeveloped but have an interested faculty member overseeing them. The most useful resource for these collections would be *personnel time*, for the faculty curator and/or for student or staff support. Personnel support would allow for repair, updating, organization, new acquisitions, and databasing, all of which would improve the value and usefulness of these collections. Where needed, funding for basic supplies and equipment (from mounting paper to cabinets and microscopes), either from the home institution or from small grants, could also be an excellent investment into the preservation and usefulness of these educational collections.

3) Collections that are well-developed, well-maintained, and have an active curator. The most common criterion missing from these collections is an online, searchable database. Support for databasing these collections and making them accessible via internet would make these collections more useful both to their home institutions and to scientists and other community members outside the home institution.

Small-college herbaria have long been overlooked and undervalued. The results of this study show that there is considerable agreement about what is needed to make these collections more accessible, valuable or useful, and that the goals are, indeed, achievable with a modest amount of support.

Acknowledgments: Many thanks to the participants in the survey that has led to this article. Thanks also to Donna Ford-Werntz at University of West Virginia for her mentoring during my sabbatical research, and to the Appalachian College Association and

Warren Wilson College for their financial support of the research.

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Botany in Bulgaria

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To most American botanists Bulgaria is the least known and least traveled portion of the "new Europe". The Republic of Bulgaria (110 980 km^2) is part of the Balkan chain of mountains. Bulgaria is bounded by Balkan nations of Macedonia and Serbia to the West, Romania along its northern border which is the Danube river, the Black Sea on the east coastline , and Turkey and Greece beyond another set of mountains on Bulgaria's southern border. Thus, it is simultaneously almost a Mediterranean country (only a few hundred miles from the Mediterranean sea, it receives weather patterns from the Mediterranean), a Black Sea nation, and a Danubian nation as well as having extensive Balkan mountains. The southern and western portions are forested (Fig 1 and 2). The average elevation is about 480 m. The Balkan Mountains cross the country from the north-western corner to the Black Sea and form the watershed between the Danube River and the Aegean Sea. The northern side of the Balkan Mountains slopes gradually to the Danube River to form the northern Danubian Plateau. Transitional plains lie to the south of the mountains and are an important agricultural region. The Rhodope Mountains, which form the boundary with Greece on the south, rise to the country's highest point, Musala Peak, at 2 925 m. The mountains contain a large number of ecosystems. The Black Sea coastal areas range from marsh lands in the north to wide beaches with a sloping shelf which create a marine benthic habitat. (Note that extensive pollution beyond the control of Bulgaria occurs both in the Black Sea , where it is at the receiving end of circulation from turkey, Georgia, Russia, Ukraine, and Romania as well as down from the Danube draining 9 nations into Bulgarian Danubian waters). The principal river draining Bulgaria is the Danube. Several other rivers, including the Iskur and the Yantra, flow into the Danube. The Maritsa River flows east to Greece and Turkey across the Thracian Plain. Other important rivers are the Kamchiya, which empties into the Black Sea, and the Struma and Mesta, which flow south to the Aegean Sea. Most of Bulgaria has a continental climate, with cold winters and hot summers. The climate in general is more severe than in other European areas of the same latitudes, although a Mediterranean climate, with dry summers and mild, humid winters, prevails in the valley of the south-western Rhodope Mountains. Climate can be defined as average January temperatures range from 2° C near the Black Sea to -17° C in central Bulgaria. July temperatures range between 16° and 27° C. The average rainfall is about 630 mm per year, ranging

from a low of about 190 mm in the north-east, to a high of about 1900 mm in the Rila Mountains. The wettest period is early summer in most of the country and autumn or winter in the southern valleys. Snowfall is generally light except in the mountains. Protected areas are generally forests or marshes. They include about 10% of the land area in 753 protected reserves. There are 16 biosphere reserves and 5 RAMSAR sites. The known number of higher plants is said to be 3,572 (FAO, 2008). Forests cover 3,625,000 ha of which 267,000 are primary, 2,028,000 ha are modified natural, 992,000 ha are semi-natural and 41,000 are plantations. This is an increase since independence in 1989 (FAO, 2005).

A large and rich region of agricultural productivity lies in the valleys between the mountains and in the delta of the Danube. This area has been in cultivation for at least 9 thousand years (Thracian and pre-Thracian cultures). The many nations who have dominated Bulgaria have prized exports from these soils (Greek, Roman, Turkish, USSR) Presently tobacco, fruits and vegetables are chiefly grown. A high value export product is the attar of the Bulgar rose (*Rosa damascena and Rosa alba*) grown in valleys in central Bulgaria, which is not a native variety, but was imported several centuries ago to service the Western European perfume business. I was fortunate to witness the late May rose production with many miles of central Bulgaria in full bloom. The forest products are largely exported lumber with no value added. This is deeply troubling since the limited forests are protected by various reserves.

The outstanding institution with ongoing botanical research is the Academy of Sciences of Institute of Botany in the capital Sofia. Universities also do some botanical research beyond their teaching and most notably are the Universities of Sofia, of Plovdiv, of Soumen, and of Stara Zagora. The Institute of Botany at the Academy of Sciences maintains field facilities in the Western Rhodope Mountains, and near Dolni Lozen village . The fields in which the Institute of Botany does research in the following areas: Flora and florogensis, Phytocoenology and Ecology, and Applied Botany (medicinal plants, regeneration of rare and endangered species, pollution effects on plants), They also have extensive collections of plant fossils, bryological and mycological, and vascular plants. Note that fossil pollen is a paleo-specialty.

There have a series of botanical investigations at the Institute of Botany since its inception in 1947 when it merged with the Royal Institute for Science and Sofia Botanical Gardens. The staff is 100 persons with 47 Ph.D.'s. The Institute of Botany has produced "The Flora of the Republic of Bulgaria" in 11 volumes, "The Fungi of Bulgaria" (1991-) in 4 volumes, "Synopsis of Flowering Plants of Bulgaria" (1980) "Guide to Mosses in Bulgaria" (1992) , "Synopsis of Plant Communities in Bulgaria" (1995), "Edible and Poisonous Mushrooms in Bulgaria" (1998) , "Cenozoic Plants of Bulgaria" (Eocene to Pliocene) (2005), "Atlas of Bulgarian Endemic Plants" (2006) and various proceedings of botanical conferences as well as other publications. The journal Phytologia Balcanica (since 1975) deals with taxonomy and biosystematics, chorology, floristics, evolution, phytocoenology, paleobotany, palynology, plant anatomy, embryology, ecology, chemistry of medicinal and aromatic plants. The mean number of annual publications is 52.

Obviously since Bulgaria is involved in the botanical research of the European Union and NATO there are cooperative programs with these nations for mapping (as in Natura 2000) and in CORINE, in the UNESCO_MAB programs, the EU Danubian and Balkan Flora programs. Also there are FAO and UNEP cooperative programs ongoing, as well as a Black Sea Association of Institutes. The European Initiative for Euro + Med Plant Base, Periodic Review of Bulgarian Biosphere Reserves, National Grassland Inventory Project, European native seed Conservation Network, Conservation and Sustainable use of Biodiversity in Strandzha Mountain (UNESCO_MAB), Transboundary Cooperation Bulgaria-Greece (PHARE), European Pollen Bank, Evolution of Climate in the Neogene (NECLIME), Mapping of the Flora of Europe (Finland) are international cooperative projects undertaken by the Institute of Botany.

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.
Map source: Global Forest Resources Assessment 2000, base map: ESRI

This is the first in a series of national botanical profiles conceived by the International Outreach Committee of the Botanical society of America to educate botanists about efforts internationally in Botany.

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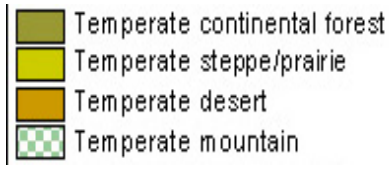
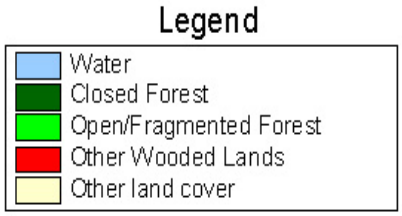
Map 1 shows the ecological zones, as shown on the FAO global map of ecological zones produced as part of the FRA 2000. Please refer to FRA Working Paper 20 for further information on the Global Ecological Zone map.



Map 2 is an extract from the Global Forest Cover map produced as part of FRA 2000. Please refer to FRA Working Paper 19 for a background to the production of the map.



News from the Annual Meeting

Botany 2008 Plenary Address Solutions from Nature: How Mushrooms Can Help Save the World

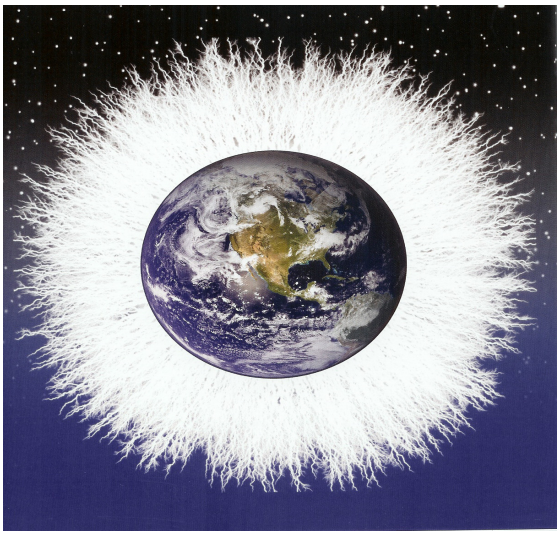
Paul Stamets
Founder, "Fungi Perfecti"

"We are an evolutionary success – so far – but if there was a U.N. of living organisms, would humans be voted off the earth?" This question was raised by Stamets at the beginning of his engaging and stunningly illustrated address that opened the scientific meetings in Vancouver. With humans implicated as the instigators of the 6th major extinction event, what can we do? GROW MORE MUSHROOMS!

After a brief review of basic mycology, focusing on the growth and ecology of the mycelium, "the true foundation of the food web," Stamets launched into a four-part explanation of mycoremediation and ended with medical and edible applications. Fungi were the true colonizers of the land and dominated

the landscape when *Rhynia* was getting its start. *Prototaxites*, an upright form 30m tall, studded the earth 420 mybp. Fossil remnants may be found in Canada and Saudi Arabia. Stamets likens the mycelium to an internet for nature – internet architecture, with nodal optimization, mimics the interwoven, branching mycelial structure. "As hikers walk across these sensitive filaments, they leave impressions, and mycelia sense and respond to these movements." And these mycelial mats can be huge – thousands of acres in size.

Fungi play a variety of roles in nature and Stamets suggested that we can take advantage of their digestive powers by enlisting fungi to cooperate with us in "mycorestoration" to clean up some of our mess. He illustrated four specific applications: mycoremediation, mycofiltration, mycopesticides, and mycoforestry. In an experiment with the Washington State DOT, a 10 yd^3 mound of diesel-contaminated soil was inoculated with oyster mushroom spawn and compared to two bacterial treatments and a control. Within two months total petroleum hydrocarbons were reduced from 20,000 ppm to less than 200 ppm, the mushrooms had fruited and inaugurated a succession of other mushrooms species and seed plants. There were no visible changes in the control or either bacterial treatment. On his own property, a small waterfront farm on Puget Sound, he created a wood chip bed inoculated with *Stropharia rugoso annulata* spawn near the top of a ravine that emptied into the bay. This bed filtered runoff from his farm animals and was a back up to his septic system. Within a year there was a hundred-fold drop in coliform bacteria from his property. Trouble with ants or termites? Try a mycopesticide! Since the 1980s and 90s researchers have been working with entomopathogenic molds, such as *Metarhizium*, whose spores quickly penetrate the exoskeletons of insects and kill them. Unfortunately, spores are quickly removed from colonies by workers who isolate and sacrifice themselves to protect the queen. Like many fungi grown in culture, this fungus produces concentric rings of vegetative, presporulating mycelium and sporulating hyphae. The insect colony will not tolerate spores, but the presporulaitng mycelium is choice food - - and natural bait. Two to three weeks after baiting colonies of Formosan termites, eastern subterranean termites, and fires ants, the colonies were exterminated by the fungus. Mycoforestry includes not just the obvious practice of inoculating the soil with mycorrhizal fungi when replanting, but facilitating decomposition and hastening forest recovery by chipping and/or shading limbs and debris left in the wake of harvesting or thinning the forest.



From
Mycelium Running
Paul Stamets, 2005
Ten Speed Press

Edible mushrooms, either store-bought or especially wild collected, are a gastronomic delights and Stamets has built his business, "Fungi Perfecti" (http://www.fungi.com) on producing and selling gourmet and medicinal mushroom growing kits and medicinal mushroom products. He concluded his presentation with examples of the antimicrobial properties of the oyster mushroom, birch polypore, and agarikon against *E. coli* 0157:H7 and *Staphylococcus aureus*. Work also is being done on the antiviral properties of various fungi.

Much of Stamets' presentation is elaborated upon in his recent book, *Mycelium Running: How Mushrooms Can Help Save the World.* Paul Stamets, 2005, Berlekey, California, Ten Speed Press, from which the above illustration is taken.

- Marsh Sundberg

Regional Botany Special Lecture: Science Education for the 21st Century: Using the tools of science to teach science.

Carl Wieman
Carl Wieman Institute for Science Education
University of British Columbia

Why Wieman? Who would be better to speak to a society of professional scientists about the importance of teaching science than the Nobel Prize-winner in Physics who also was the Carnegie Foundation's U.S. University Professor of the Year and chairs the National Academy of Sciences Board on Science Education?

Why now? Wieman pointed out that while the traditional role of science teaching was to train the next generation of scientists, today the need is to 1), prepare a more scientifically literate populace to make science-WISE decisions, and 2), to prepare a work force for the modern economy. Not only is our target audience a different group of students, but it is a much larger one.

What must we do? Our goal must be to transform how students think so that they can think about science, and use science, like a scientist (but not as a scientist). Furthermore, this goal must be the focus of individual instructors in their courses AND in the curriculum as a whole. To be effective in this endeavor we must: 1) be guided by fundamental research principles; 2) devise practices based on good data and standards of evidence; 3) disseminate the results of our work in a scholarly manner and incorporate what works for others; and 4) fully utilize modern technology.

After this brief introduction, Wieman proceeded with a personal testimony about how he used to teach (and most of us still do) and what happened to cause him to change. This grew from his frustration with graduate students who invariably came to his lab with 17- years of "successful" education behind them and yet were "clueless" about physics! Never-the-less, 2-4 years later they were "expert" physicists. What was different about the way he taught his undergraduates and the way he taught graduate students? Inquiry and investigation! What he quickly discovered is that during the past two decades there have been major advances in our understanding of effective classroom practice, cognitive psychology, and brain research and that these three areas all are interconnected and paint a consistent picture of how students learn. Student-active learning in the classroom is shown to be much more effective in information transfer and retention, developing conceptual understanding, and changing naïve beliefs about science. Cognitive psychology says that cognitive load (short term memory) is reached very quickly – we can remember and process only 4-7 items. Furthermore, novice thinkers (our students) process information very differently from expert thinkers (us - - in our discipline). The findings of cognitive psychology reinforce and explain the results from classroom studies. Effective teaching involves facilitating students' construction of new information based on what they already know. They must do the work, but we must be motivating and engaging and then follow up with monitoring and guiding their thinking. The expert teacher is an expert tutor!

This is the point where technology, if used correctly, can help. Interactive lectures, using "clickers" can keep students engaged as can interactive simulations. But this is not automatic. Used as an attendance and simple testing device they have little benefit and may even be resented. Effective use involves asking challenging, conceptual questions, involving student discussion and responses, and follow-up discussion led by the instructor with minimal but non-zero grade impact. And the perfect classroom is not enough. Develop homework with authentic problems and useful feedback. Brain research says that the brain is just like a muscle – development requires strenuous extended use! See the CWSEI web site (see www.cwsei.ubc.ca) for a variety of tutorials, powerpoint presentations, and other tools to promote more effective student learning.

- Marsh Sundberg

President's Address
Karl Niklas

The bylaws of the *Botanical Society of America* require that the President–Elect deliver "to the membership assembled at the annual banquet a botanically-oriented address". Recently, it has become something of a tradition to publish the text of this address in the *Plant Science Bulletin*. To some degree the publication of my address presents something of a difficulty. The founders of the BSA could not envision the effects of technology on how we lecture to our students or how we speak with our colleagues. Indeed, the 21st century has provided us with a vast range of tools that extend our words and concepts well beyond the lecture podium of the classroom or the banquet hall. Mindful of the stipulation that I present a "botanically-oriented address" but having a deserve to provide something that might be both entertaining as well as informative, I presented a 10 minute film entitled *Botany Without Borders* that was prepared in collaboration with Christopher Julian (director and narrator), Edward Cobb (photographic research and acquisition), and Doug Fahl (musical score). This film, which can be downloaded free of charge from the BSA website at www.botany.org, strives to attract students to the study of plant life as well as educate the general public about botany, botanists, and the roles played by botanical societies. It is my hope that *Botany Without Borders* might be useful in the classroom or as a feature added to the websites of colleges, plant biology departments, botanical societies, etc. Because this film is intended to "sell" botany and inform the public about the roles of all botanical societies, my colleagues and I have also prepared a narration-less version so that the text can be translated into any language. For this purpose, the English version of the narration is published here, which also fulfills the stipulation of the BSA bylaws and perpetuates the tradition of publishing the President-Elect's "address". The lyrics of the song *Photosynthesis* (sung by the Hot Toddies) are also provided at the end of the narration. Some may find the words amusing; others may find them informative.

Text of Film:

"Astronomers tell us we are made of stardust because the elements manufactured in the hearts of stars billions of years ago now reside in all life forms. If this is true, then it is also fair to say that we are made of starlight — because all of Earth's great ecosystems and their food-webs ultimately rest on the foundation of photosynthesis (the ability of plants to harness the energy of sunlight and convert it into their own living substance). People may call this a blue planet, but it's really a "green world"

The greening of our planet started billions of years ago when animal-like and photosynthetic bacteria entered into a symbiotic partnership that in turn gave rise to fungi, animals, and plants. This pivotal biological event changed our planet and the course of evolution in many ways — not the least of which was to produce our oxygen-rich atmosphere and the formation of the ozone layer. Today, plants continue to make the air breathable, but they also serve us in so many other important ways by providing food, fiber, pharmaceuticals, and timber. They also add beauty to our lives

In light of their great importance, it is surprising that so many people know so little about plants. Indeed, some people don't even think of them as being alive. Most plants move so slowly, we don't even notice their intricate activities with the human eye. That we live in an animal oriented world is not surprising. We are, after all, animals and it is fair to say that our household pets give us far more loving attention that our prized roses or orchids. Plants are rarely cute or cuddly. But it is equally fair to say that without plants, most of the world around us would not exist.

So, what are "plants"? What are these creatures that survive without benefit of blood, brains, or muscles, summon without self-awareness, and feed the world without intention? They are among the oldest organisms that ever existed, some achieving over 5000 years of age. They comprise some of the smallest cells floating in our oceans and some of the largest organisms that ever lived on land or in the sea. Some swim with the aid of flagella; others fly like helicopters or with the aid of parachutes; but most are sedentary. Some are colorless and parasitic. But most are green and photosynthetic. Some live in trees, while others live submerged in deep water. Their diversity in form, size, and lifestyle is truly beyond description. Perhaps this is why plants are often depicted in our popular culture as "strange", potentially dangerous, if not malignant life-forms, or as comical "creatures" from another planet. Yet, even when depicted in these distorted ways, they remain fascinating organisms that should demand our attention and admiration. Indeed, they have inspired our art as well as our science.

Who studies plants? The study of plant life is as historically ancient as is harvesting and farming. The earliest peoples who incorporated plants as an important component in their diets were botanists in the truest sense of the word. Their survival depended on recognizing and observing plants could be eaten and which were poisonous.
The first botanical writings known to us are from Aristotle. Sadly, his botanical works are lost forever. We only know of their existence because they are

mentioned by some of his contemporaries, such as his pupil, Theophrastus.

Theophrastus's interest was in the classification of medicinal plants. In many respects he was one of world's first great homeopathic physicians. This focus dominated much of botany for many centuries. But it was not until the time of the Swedish professor and physician, Carl Linnaeus, that a formal classification system was invented. It is still used today for naming species of every form of life, including bacteria, fungi, plants, and animals.

The discovery and cataloging of plants might appear to be a dry subject. But the history of plant exploration is rather romantic and, in some cases, full of tales of danger and daring. Many early explorers, like Alexander von Humboldt and J. D. Hooker, traveled the globe collecting plants and secretively making maps for military or commercial purposes. Indeed, the exploits of the great plant collector Ernest Henry Wilson traveling in China and Tibet earned him the nickname "China Wilson" — which some claim was one of the role models for "Indiana Jones". Today, many botanists continue in the tradition of these early explorers, collecting plants at their own peril. Others study plants in the peaceful setting of the laboratory or test garden, using chemistry, physics, math, or computers. Indeed, the ways in which plants are studied are almost as diverse as plants are themselves.

Why study plants? Who should care? For botanists, this is an important question. Well over 90% of the living visible world is made up of plant life. We eat them, we use them to build homes, we wear them as textiles, we extract life-saving medicinals, and communicate with the written page composed of plant fibers. What often goes unnoticed is that industry is fueled by plants in the form of their fossil remains — coal --— the organic remains of ancient plant life. In today's hectic and complicated world, plants remain as important as ever in the making of bio-fuels, the mitigation of Global Warming by binding carbon in their cell walls, and the production of genetically modified plants to feed the world more efficiently and economically. For those of us who are professional botanists, it's difficult to answer the question "why study plants?" not because we don't know the answer, but because we cannot imagine why anyone would not want to!

The study of plant life is a global enterprise involving scientists from every nation. This endeavor occurs in universities, botanical gardens, industrial laboratories, and in natural preserves everywhere. The role of botanical societies around the world is to allow scientists to share their discoveries with colleagues, students, and the general public in the form of conferences, symposia, and publications. These societies represent communities of botanists — academics of every age and ethnicity — that share a passion for the study of plant life.

The mission of these societies has a common theme, articulated in many languages. It is to "promote the study and inquiry into the form, function, development, diversity, reproduction, evolution, and uses of plants and their interactions within the biosphere, and preserve plant life for future generations to enjoy and use wisely."

Regardless of where you live, joining a botanical society and becoming part of the world-wide community of plant biologists requires little effort. Information about most botanical societies is generally available on the internet. It is also provided in many libraries that subscribe to botanical journals.

Many societies have membership dues at reduced rates for students or non-professional botanists. You do not need to be a "botanist" to join a botanical society. You just need to love plants and to have a desire to learn more about them. Members of these societies include elementary and high school students and teachers, gardeners, and farmers. The field of botany has a rich history, a dynamic present, and a fascinating future. So, come and join us in this great enterprise and learn more about our blue planet and green world."

Lyrics to "Photosynthesis" from the video.

Come on little plants, we're groovin' in the sunlight
Spread your leaves and dance, reach up for the blue sky
Soak up all the water, I won't leave your roots dry
Drink it up now, baby, let your cells multiply, multiply, multiply…

Photo, photosynthesis
Photo, photosynthesis
Photo, photosynthesis
Photo, photosynthesis

Photosynthesis is my favorite chemical reaction
When the plants are growing it gives me so much satisfaction
Chlorophyll's the green stuff, I just can't get enough
Building up your cell walls, so you grow up big and tall, big and
tall, big and tall…

Photo, photosynthesis
Photo, photosynthesis
Photo, photosynthesis
Photo, photosynthesis

note: the video, shown after the banquet, is available on the BSA web site.

Awards

2008 BSA Merit Award

Dr. Thomas Rost, University of California Davis

Dr. Thomas L. Rost is one of the world's foremost researchers on root development. His research record spans four decades and includes more than 80 published papers in highly regarded journals and chapters in scholarly books. He has led his students and post-doctoral researchers to a modern and accurate understanding of the development of this model root system. Specifically, he and his colleagues have shown that the architecture of the root apical meristem changes as the meristem ages and that the pattern of root apical meristem ontogeny is associated with periclinal divisions and gives rise to a three-dimensional arrangement of periclinal derivatives arranged in a helix.

Tom Rost has done more than any other current structural botanist to bring the plant root to our attention as a dynamic developmental entity. However, his research has not been limited to roots. He has authored or co-authored impressive articles regarding seed structure and histochemistry, plant morphogenesis, and agriculture, and especially the recent studies on Pierce's disease in grapevine. Further, Tom's contributions to botanical education via his teaching/mentoring and his writings have been quite well known and recognized. The Botanical Society of America is proud to recognize Dr. Thomas L. Rost with this highest award.

Dr. Warren Wagner, National Museum of Natural History

The botanical community is indebted to Dr. Warren L. Wagner for his major contributions: monography of Oenothera, The Manual of the Flowering Plants of Hawaii, studies on speciation and relationships of Marquesan plants, and service at the National Museum of Natural History (Smithsonian Institution) are among those that will be most rememberedIn 1982, he undertook what was probably one of the most difficult and most needed contribution in floristic botany: a flora of Hawaii. The previous flora (Hillebrand, 1888) was out of date, and subsequent contributions featured varied species concepts and were published in scattered places. The 1990 Manual (rev. 1999) was a major factor in permitting botanists to explore the amazing insular evolutionary phenomena that the Hawaiian flora contains. Wagner's work on islands continued with the Marquesas, where cladistic studies and contributions using DNA permitted an understanding of the biogeographic nature of the remote and neglected archipelago. Wagner is both imaginative and practical, and has served as Chair of Botany at the Smithsonian, managed funds for IAPT and ASPT, and served in numerous capacities for professional societies. Through his mentorship of younger botanists, his identity in monographic, floristic, and phylogenetic botany has been multiplied significantly.

Charles E. Bessey Teaching Award

Dr. Beverly Brown, Associate Professor of Biology, Nazareth College, Rochester, New York, and Immediate Past Chair of the Teaching Section of the Botanical Society of America.

Dr. Michael Pollan, Knight Professor, University of California--Berkeley and Director of the Knight Program for Science and Environmental Journalism.

Phycological Section Student Travel Award

Kendra Bunner, Illinois State University, Normal, IL - Advisor, Dr. Martha Cook - Botany 2008 presentation: "***Description of Zoospore Structure and Development in* Entransia fimbriata *(Charophyceae)***."

Pteridological Section Student Travel Awards

Jay Bolin, Old Dominion University, Norfolk, VA - Dr. Lytton J. Musselman - Botany 2008 presentation: "***Unraveling the reticulate evolutionary history of the* Isoetes hyemalis *complex***."

Emily Butler, University of Wisconsin, Madison, WI - Advisor, Dr. Thomas J. Givnish - Botany 2008 presentation: "***In the Light of Evolution: A Proposal to Integrate Phylogeny and Ecophysiology in New World* Dryopteris**."

Amber Churchill, Stonehill College, North Easton, MA - Advisor, Dr. J. Edward Watkins - Botany 2008 presentation: "***A Site for Sori: Consequences of Fertile/Sterile Leaf Dimorphism in Ferns***."

Michael Sundue, New York Botanical Garden, Bronx, NY - Advisor, Dr. Robbin Moran - Botany 2008 presentation: "***Systematics of grammitid ferns:* Lellingeria, Melpomene, *and* Terpsichore**."

Southeastern Section Student Travel Award

Nicole Hughes, Wake Forest University, Winston-Salem, NC - Advisor, Dr. William K. Smith - Botany 2008 presentation: "***Winter color change: The adaptive role of anthocyanin pigments in leaves of broadleaf evergreen species***."

Genetics Section Graduate Student Research Awards

The 2008 recipients of the Genetics Section Graduate Student Research Awards, each of which provides $500 for research funds and an additional $500 for attendance at a future BSA meeting, are:
Renate Wuersig, Purdue University (PhD student) and
Sunni J. Taylor, Texas State University (MS Student)

Phytochemical Section Student Travel Award

Cary Pirone, Florida International University, FL - Advisor, Dr. David Lee - Botany 2008 presentation: "*A Mammalian Pigment in the Plant Kingdom*."

News from the Society

And The Survey Says: Taking the Pulse of BSA Members

In July 2008, following on the heels of a productive meeting of BSA's Strategic Planning Committee, the Botanical Society of America released a comprehensive survey of its membership. Since a survey of the entire membership had not been conducted in at least the past five years, the Strategic Planning Committee recognized a distinct need to gather as much feedback as possible from members in order to better inform the decisions of the Council and the Executive Committee as new societal goals are set. Utilizing the web-based SurveyMonkey tool, BSA staff crafted the questionnaire with input from the American Society of Association Executives (a national resource for non-profits like ours), President Pam Soltis, as well as the Strategic Planning Committee. Two thousand seven hundred sixteen members received the survey via an email link (undeliverable emails have been excluded from this total). In addition, paper surveys were mailed to 140 members. This is the first in a series of surveys that are being analyzed by staff and society leadership in an effort to provide insights into new areas for growth, membership engagement, and impact on the society's mission. In essence, this data gathering exercise is and will become a continual part of the fabric of the BSA as we strive to deliver the best value and opportunities to our members. The results are highlighted below, and they provide some fascinating insights into this community of scholars, scientists, and educators that will help shape the future of the Botanical Society of America.

The respondents

Compared to other surveys of this type, where a 5 or 10% response rate is considered favorable, the BSA membership survey received a resounding 20% response rate. The diversity of responses also matches up with the current distribution among membership categories. Professionals were well-represented at 70%, Students at 16%, Emeritus response at 9%, K-14 Educators at 2%, and Retired members at 2%; Amateurs, Affiliates, and Associates made up the remainder of the respondents.

Overall highlights

The exciting news from the survey is that BSA members rate their society experience and satisfaction very positively. Of those who responded, 62% state that they are "highly satisfied" with their BSA membership. Together with the 28% that ranked their experience as "somewhat satisfied," this places 90% of respondents in the satisfied category. Only 1.5% of respondents expressed dissatisfaction with their BSA membership. Recent research by the American Society of Association Executives has shown that academics and members of scientific societies are among the strongest society supporters and also strong promoters of their professional affiliations (Dalton & Dignam, 2007). This finding seems to have been replicated here with the BSA members. In fact, 97% of respondents would recommend BSA membership to a colleague or student. This is a key finding, as one of the best ways to grow a society such as ours is through word-of-mouth and member-to-non-member campaigns.

Overall, the survey results reaffirm the direction of the society that has been laid out in the draft strategic plan crafted earlier this year (to view the Strategic Plan, visit the following web link: (www.botany.org/governance/papers/Strategic_Plan_DRAFT-033008.pdf). Members also spoke highly and rated favorably the areas where the society has traditionally excelled. For example, the annual scientific conference and BSA publications like the *American Journal of Botany* and *Plant Science Bulletin* score very highly throughout the survey. These membership benefits are not only long-time staples, but according to members, they are the building blocks to which new and exciting ideas and strategies can and should be added.

Member Benefits – Publications

As previously mentioned, the publications of the society are highly valued. The *American Journal of Botany* (AJB) is the number one reason why potential members choose to affiliate with the society. The overwhelming majority of respondents read the journal monthly, and almost 50% read *AJB* solely online while 20% read only the print version. The remainder of respondents said that they rely on a combination of both formats. The journal's Table of

Contents (TOC) is prime real estate space as most readers use the TOC to find articles in their main areas of specialty or other articles that perk their interest. Only 16% of respondents say that they read the entire issue. When selecting where to submit an article for publication, BSA members rate the quality and reputation of the journal as the leading factor in their decision-making, followed by speed of publication and ease of submission/peer-review, which ranked head-to-head as the second most important factors. The journal is another area for future growth as it can raise the profile of the society internationally and reach a diverse base of plant scientists. Respondents expressed deep passion for the journal and topics they wish to see covered. Open-ended feedback converged around the inclusion of high impact review articles, article summaries in the journal's front matter, and maintaining the diversity of the journal's coverage. Much discussion also revolved around publishing articles on educational topics in botany, which are highly desired by many members, but do not necessarily find a proper home in the *American Journal of Botany*.

As for this publication, the *Plant Science Bulletin (PSB)*, 50% of respondents read all or more than half of each issue. The *PSB* is currently placing articles for the next issue online before publication in print format. However, the membership expressed deep misgivings regarding abandoning the print newsletter, as 34% stated that they would read the *PSB* less often if it were only available online. This feeling permeated all categories of membership, including students, who are recognized as the leaders in researching and utilizing online content.

Member Benefits- Career, Community and Collaboration

Another overriding result of the survey, which was fairly expected, is that there is a strong need to view the needs of BSA's membership through the lens of career development. Students, Professionals, Emeritus, K-14 Educators, and Amateurs all place differing values on BSA offerings and benefits. Key areas for growing the society appear to focus on the creation of community as well as opportunities for peer contact and networking. The concept of "fostering community" includes reaching out as a leader and catalyst to bring differing plant societies together in collaborative efforts (96% state this is important), as well as bridging the "America" gap to resolve disconnects between domestic and international members (as evidenced in many open-ended responses). Indeed, it was a top priority for many members to make the society more user- and benefit-friendly to our international members so that the BSA becomes truly THE home for ALL plant scientists and enthusiasts around the world.

Member Benefits-Personal and Professional Development

Only one third of our respondents expressed that that they are involved in some way with BSA inner workings. Overall, the key ways that our membership volunteers for the society is through submission or editing of articles in the *American Journal of Botany* or *Plant Science Bulletin*, serving on BSA committees, and mentoring in the PlantingScience educational outreach program. Given the current high level of regard and satisfaction with the society, it is somewhat surprising how little the membership gets involved in volunteering or contributing to the BSA. Since it has been demonstrated that members who are involved in a society are more likely to stay loyal to and promote the organization (Dalton & Dignam, 2007), membership involvement and volunteer opportunities will be a key to membership retention and satisfaction in the future.

It is important to note that while BSA members cite networking and peer contact as a high motivator to the join the society, it appears that BSA members are overwhelmingly not aware of current offerings that foster community and the creation of networks (PlantingScience/educational outreach, committee service, career/job board, volunteer opportunities, Student's Corner). Creating more opportunities for the development of social and professional networking will be a main target area for growth as the society evolves. In open-ended questions, members suggested ideas such as regional/ smaller specialized meetings, blogs, listservs, and collaboration with other societies as future possibilities that might meet their needs for interaction.

Next Steps

This membership survey is just the beginning. It provides the keys that let all of us know how BSA members determine value. It also gives intriguing insights into new strategies and exciting ideas for bettering the society's offerings and attracting more colleagues and students to this botanical home. In the future, you will see the society continue to gather data, test these survey results further, and tease out new information. As new ideas and strategies evolve, they will be shared with you. As a result of this survey, the *Plant Science Bulletin* will begin to feature short articles on different benefits and BSA offerings

Please feel free to contact President Karl Niklas kjn2@cornell.edu, Executive Director Bill Dahl wdahl@botany.org, or Membership & Subscriptions Director Heather Cacanindin hcacanindin@botany.org, with your feedback and ideas for the future of the BSA.

For those that thrive on data, here are some of the highlights from the survey results. You can also visit the following web site to view more detailed aggregated data:
http://www.surveymonkey.com/sr.aspx?sm=Hrtxj_2biVh3DMpETMSQ6C_2blG3uzJ4EpwHd5qggEjuvao_3d

Membership

Most BSA members belong to many scientific societies. The largest crossover occurs with the following groups:
American Society of Plant Taxonomists (42%)
Society for the Study of Evolution (22%)
Ecological Society of America (26%)
American Society of Plant Biologists (14%)

Other highly mentioned societies that were not included in the selection options are: International Association of Plant Taxonomists, International Organization of Paleobotany, Linnean Society of London, Geological Society of America, and the American Society of Naturalists.

Top four reasons members originally joined the BSA:
Receive access/subscription to the *American Journal of Botany* (61%)
Peers/Community/Networking aspects (48%)
Publish in the *American Journal of Botany* (35%)
Attend the Annual Scientific Meeting (30%)

It should be noted that student members, as might be expected, place a much higher value on social aspects of membership, such as networking and the annual meeting, than other membership categories. In fact, for students, one of the main drivers for joining BSA was a recommendation to join from another student or professor.

BSA Members Express High Awareness for the Following BSA Benefits:
Top notch, peer-reviewed journal
Annual scientific meeting
Encouragement for lifelong development
Place to publish primary research

BSA Offerings with Low Awareness:
Associate and Gift Memberships
Student's Corner
PlantingScience Program
Job/Career Board

BSA Members Do Not Perceive They Are Receiving:
Personal Development/Volunteer Opportunities
A Voice in Public/Government Policy
Educational Outreach Opportunities

BSA Publications

Of top importance to Authors' Decision-Making Process on Where to Publish:
Quality and reputation of the journal (92%)
Speed of publication (51%)
Ease of manuscript submission and peer review (50%)
Page charge and/or color figure policy (29%)
Online accessibility of articles (26%)
Ability to publish ahead of print (3.5%)

Methods Members Support to Fund the Journal (in addition to paid subscriptions)
Capital campaign to increase endowment support (68%)
Increased paid advertisements (67%)
Increased price for subscriptions (30%)
Author pays model (19%)

References

Dalton, James and Monica Dignam.2007. *The Decision To Join: How Individuals Determine Value and Why They Choose To Belong.* ASAE and the Center for Association Leadership, Washington, D.C.

Respectfully submitted by Heather Cacanindin, Director of Membership and Subscriptions, hcacanindin@botany.org

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.

A Bonanza of Summer Botany for Secondary School Teachers

This summer the BSA held its first professional development sessions for secondary school teachers in conjunction with Co-PI Carol Stuessy in the College of Education at Texas A&M University. These complementary programs bring plant biology into secondary classrooms across the nation, while supporting innovative approaches of investigative case-based teaching and open-ended inquiry learning.

myPlant IT Summer Institute for Teachers, July 7-18, 2008.

The Plant IT Careers, Cases and Collaorations summer program allows secondary teachers and students to explore plant-related biology problems and career connections. Co-PI Ethel Stanley and Margaret Waterman introduced teachers to investigative cases focusing on pollen forensics and remote sensing. In the second week, teachers tried out the cases they had adopted/adapted with students attending the partner summer career camp. Students also visited laboratories and learned about podcasting with "Dr. Biology" Charles Kazilek. Read more: http://tlac.tamu.edu/articles/plant_science_camp_teaches_students__teachers and www.myPlantIT.org

High school teachers Deborah Chabi (from Palatine, IL), Cynthia Castillo (from Brownsville, TX) and Torrye Hooper (from Houston, TX, not pictured) present their poster to fellow teachers.

Students interview forensic palynologist Dr. Vaughn Bryant in the TAMU Palynology Laboratory.

PlantingScience Summer Institute for Teachers, August 4-13, 2008.

The PlantingScience program has connected scientists as online mentors to 2,500 students since 2005. NSF funds now provide the opportunity to prepare teachers for the mentored open-ended plant inquiry experience during summer institutes. Kicking off the first professional development session was a team of scientists (Beverly Brown and Marshall Sundberg) who authored the plant inquiries and teacher leaders (Toni Lafferty of CH Yoe High School and Allison Landry of the Louisiana School of Math, Science and the Arts) who have implemented the plant inquiries in their classrooms.

Beverly Brown (Nazareth College) and Marshall Sundberg (Emporia State University) share a laugh and the fun of investigating seed germination, respiration, and photosynthesis with 11 teachers from across the nation.

Lisa Thompson (from Macon, GA) and Naomi Volain (from Springfield, MA) conduct photosynthesis experiments on leaf disks from samples collected at the TAMU Horticulture greenhouse.

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Administrative Coordinator: Wanda Lovan

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Office hours are 7:30 am to 4:30 pm Central Time
http://www.botany.org/

President: Karl Niklas
niklas@cornell.edu

All inquiries about the Botany 2009 meeting (and any other future meeting) should be directed to:

Mrs. Johanne Stogran, Meetings Manager.
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meetings@botany.org
Voice: 614-292-3519 Fax: 614-247-6444
http://www.botanyconference.org/

Editor's Choice

Gynoecium Structure Tutorial Web Site

Previously I had noted that my botany and plant identification students could not confidently determine if leaves were alternate/opposite/whorled or if leaves were compound what level of division they displayed (e.g. trifoliolate/pinnate/palmate/etc). I devised a tutorial (http://www.csu.edu.au/herbarium/HRT202/intro/intro.htm) based on numerous scans of living material for each feature, complimented with an interactive ToolBook-based test. This web site has been well received by a wide range of students and evaluations have shown it is particularly useful for distance education students and as a pre- and post-practical exercise for fulltime students.

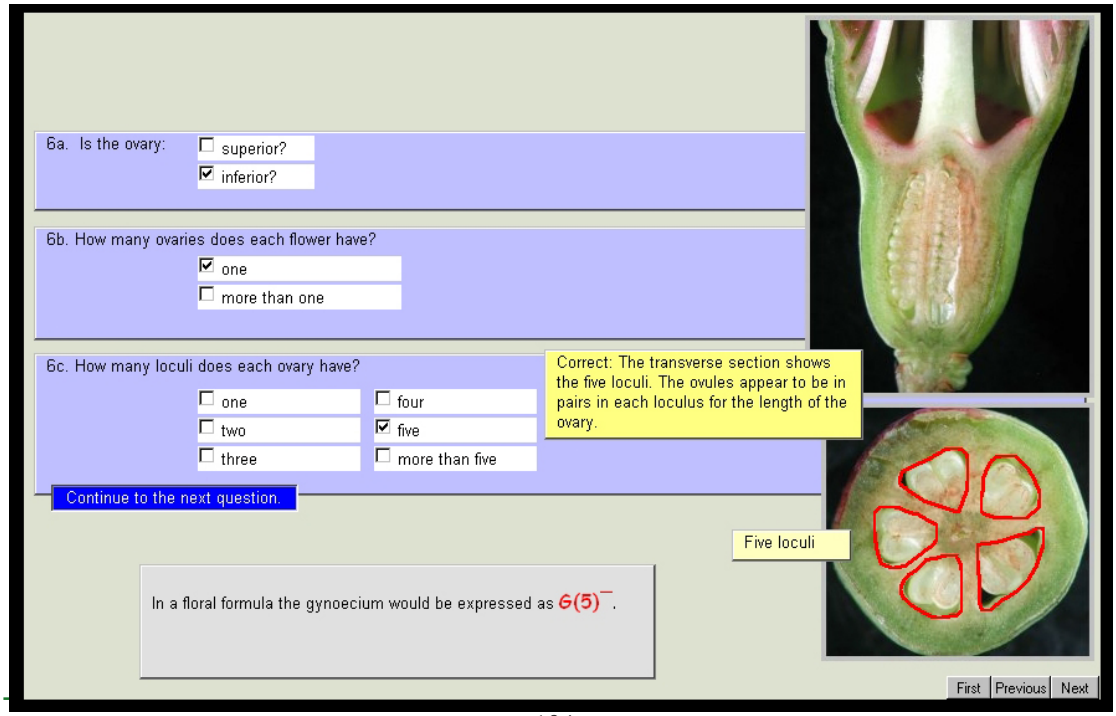
Possibly from a student's perspective the most problematic part of floral structure (and thus keying plants out) is the gynoecium. Determining whether the ovary is superior/inferior or whether the carpels are free/fused or assessing the number of carpels can cause considerable confusion. Part of the problem, for both students and teachers, is that the floral parts are often very small and for many months of the year the number of samples available to show the diversity of structure is limited. With the help of Kylie Kent (web page design) and Scott Black (ToolBook based tests) I have developed another tutorial and test, this time on gynoecium structure.

See: http://www.csu.edu.au/herbarium/HRT202/Gynoecium/intro.htm

Obtaining images for the leaf morphology tutorial was relatively simple as shoots and leaves could be quickly collected and scanned. The gynoecium tutorial required transverse and longitudinal sections of flowers to be prepared and then photographed using a dissecting microscope. Approximately 50 species were used in constructing the tutorial and another 12 species were used in the test. The species are a mix of Australian natives and crop, weed and garden species that have been introduced into Australia.

I haven't seen anything of direct equivalence on the www but wouldn't be surprised if there is. If this is the case hopefully the additional examples will be useful. We would welcome feedback on the tutorial and tests – from factual faults, layout improvements, the inability to run some or all of the tutorial or tests on some computers, etc.

Geoff Burrows, Charles Sturt University, gburrows@csu.edu.au



Announcements

In Memoriam:

Arthur Galston, Ph.D. (1920-2008)

Arthur Galston passed away the second week of June 2008 after a short illness serving as Professor Emeritus from the Yale University Department of Molecular, Cellular, and Developmental Biology in his retirement. He served as President of the Botanical Society of America (1968) wherein he and Graeme Berlyn resurrected the Physiological Section (from the large number of members who had switched to the American Society of Plant Physiologists from the BSA). Galston also served as President of the ASPP. He was awarded a series of academic honors, including Guggenheim, Fulbright and Senior National Science Foundation Fellowships, both Phi Beta Kappa and Sigma Xi visiting lectureships, and two honorary degrees. His research concerned plant photobiology, hormones, protoplasts and polyamines. The research contribution for which he is most noted is his suggestion and first evidence of the role of riboflavin (not carotene) as the photoreceptor for phototropism first published in 1949 in the American Journal of Botany 36: 773-780. 1949 (also PNAS 35: 10-17, 1949; Science 111: 619-624, l950). He published more than 320 papers in refereed journals, as well as more than 50 articles on public affairs, several successful textbooks of plant physiology and two edited anthologies of papers in bioethics. (This suggestion has recently been proven by others, notably the laboratories of Winslow Briggs.)

He was a leading plant physiologist in the 1940s to 1970s in the Botanical Society of America and American Society of Plant Physiologists, both of which he belonged to throughout his life and continued to contribute. In his lifetime he contributed not only to Botany, but to International Relations, especially in the Far East and to the field of Bioethics. He was born in Brooklyn, NY in 1920. Galston received his undergraduate degree from Cornell, and Ph.D. in Botany from the University of Illinois in 1943, then spent a year at Yale and then became an assistant then associate professor at the California Institute of Technology. He returned to Yale in 1955 as an Associate Professor of Plant Physiology in the former Department of Botany. He retired in 1990, at the (then mandatory) retirement age of 70 and subsequently began teaching and doing research in Bioethics. His unhappiness with the government use of Agent Orange as a bio-weapon in Vietnam caused him great personal distress so that he instituted at the BSA Business Meeting in 1967 a coalition of botanists and eventually other scientists who finally testified before the US Congress and were important in ceasing the use of Agent Orange on the battlefield. He made contact with the Chinese

during his travels to Vietnam and lived in China, becoming friends with Chou En-Lai. This helped pave the way for the BSA exchange delegation to China in 1978 wherein we were asked frequently about Professor Galston.

In his own words: "In 1936, at the age of sixteen, I found myself enrolling as a freshman in the College of Agriculture at Cornell University, where, importantly, tuition was free for residents of New York state. I came not to study botany, but to spend one year of study required as a prelude to entry into the College of Veterinary Medicine at the same institution, where tuition was also free. Veterinary medicine was also not my burning passion: Inspired by Paul de Kruif's "Microbe Hunters" and similar books, my true aspiration had always been to become an M.D. But the year was 1936, The Great Depression was on the land, my father had been out of work for several years, and there seemed not the slightest possibility of my being able to enter the long and expensive study required to become a physician. A friend happened to tell me about the Agriculture and Veterinary Schools at Cornell, where "the price was right". Since I was confident that I could use my saxophone-playing skills to earn my living expenses, after an arduous freshman year and a successful application for admission to the Veterinary School, I declined the offer of entry by then Dean William A. Hagan, and remained in the College of Agriculture to major in Botany.

"The reason for this unanticipated change in direction was, simply, infatuation with Professor Loren C. Petry, who taught the yearlong course in Elementary Botany. Not only his remarkably skillful lectures, but also his entire persona attracted me. I so admired him that I wanted nothing more than to imitate his life style, impractical though that might have been. The attractiveness of the academic career, with its opportunities in teaching and research, seemed to me an ideal worth pursuing. So I stayed on in Botany, but deviated from Petry in choosing to concentrate on plant physiology rather than on his specialty of paleobotany.

"Cornell was then a center of excellence in the plant sciences. I took advantage of this excellence by enrolling in every possible botany course, then bootlegged as many College of Liberal Arts and Sciences courses in chemistry, physics, mathematics, and geology as were permitted to students in the Agriculture school. I emerged with a BS in Botany in 1940. In the depression year of 1940 I received only one offer of a Teaching Assistantship to support my graduate study, which I gratefully accepted. In the fall of 1940, I ventured into the terra incognita of the American Midwest, to begin my graduate study in the Department of Botany at the University of Illinois in Champaign-Urbana. After a year of looking around, I chose to work with Harry Fuller, a plant physiologist who was a brilliant lecturer and coauthor, with another young faculty member, Oswald Tippo, of an outstanding textbook in Botany. Fuller introduced me to the world of plant hormones and photoperiodism that were the subject of my 1943 PhD dissertation. Unfortunately, because World War II had engulfed the United States in December 1941, Fuller was not able to give me much guidance, for when the Japanese conquest of Malaysia made rubber unavailable to the Allies, he was sent on an extended mission to South America to locate remnant stands of Hevea brasiliensis. He remained absent for several years, and I thus muddled through my research pretty much on my own, except for occasional critiques by mail. Under a wartime mandate, I had to finish my graduate work in three years, working full time every summer. I felt short-changed, because of the shortened period of study and also deprivation of my advisor.

"I had expected induction into military service immediately after the receipt of my degree, but again, serendipity intervened to change the course of my life. I had taken several courses in biochemistry, including a lively literature seminar run by a young faculty member, Herbert Carter. While every other student reported on animal and microbial biochemistry, I spoke on such topics as photosynthesis (Ruben, Kamen, and Hassid), auxin (Thiemann, Bonner) and "florigen" (Chailakhian). Carter was delighted with my "atypical" presentations. Convinced that I could be of greater use to the country as a scientist than as a soldier,

Carter arranged for me to join Bonner's group at Caltech, working on the Emergency Rubber Project, which sought to convert the Mexican shrub, guayule (Parthenium argentatum Gray), into an important rubber-producing plant. This was an exciting and ultimately successful project, whose potential importance was short-circuited by the simultaneous success of the synthetic rubber program. Finally drafted, I joined the Navy as an enlisted man, and after many vicissitudes, served as Natural Resources officer in Naval Military Government on Okinawa.

"By the time I was slated for discharge in the spring of 1946, my wife and I had become parents, and since all four grandparents lived in New York City, I was urged to find a job in the east, despite an offer of continued employment at Caltech. I spent the academic year of 1946-7 as an Instructor at Yale. I then spent nine happy and productive years in Pasadena, first as Research Fellow, and ultimately as tenured Associate Professor. I flourished in the plant physiology group led by Went and Bonner, with young colleagues like Sam Wildman and George Laties, and frequent contact with outstanding scientists like George Beadle, Linus Pauling, Max Delbruck, and Richard Feynman. Yet early in 1955, mainly for family reasons, I succumbed to an attractive offer from Oswald Tippo, newly appointed Chairman of Botany at Yale, to return to Yale as a full Professor. This was an important fork in the road for me; before the move, I was doing experiments mainly with my own hands, but thereafter I was greatly involved in planning, equipping, and staffing laboratories, teaching courses, and overseeing the research of numerous grad students and postdocs. This was fulfilling work, but very different from Caltech! In 1961, working with Edgar J. Boell, I was instrumental in fusing Botany with Zoology to form the Department of Biology, and planned the first unified Biology course taught by the new Department. In 1966-7, I served as Director of the Division of Biological Sciences and in 1985-8, was Chairman of Biology. I opposed the dismemberment of Biology into MCDB and EEB, but note with pleasure the recent strengthening of organismal biology in EEB.

"Since retirement, I have been associated with the Institution for Social & Policy Studies, and serve on its Executive Committee for the Interdisciplinary Bioethics Project. For 12 years, I taught College Seminars in Bioethics, and for two years, have taught a new introductory bioethics course in Yale College, which in 2003-4, attracted more than 460 students, making it one of the largest courses in Yale College.

"My major research contribution, made at Caltech, was to provide the first evidence for flavin-based photoreception. This heterodox idea, opposed by many pundits who favored carotenoids, including Thiemann, Went, Bünning, Skoog, and Nobelist George Wald, led me into difficulties with granting agencies, and I accordingly shifted my research to other areas. Time has proved this to have been a mistake; one need only note the outstanding recent results in flavin photoreception achieved by Briggs et al. with phototropins and by Cashmore et al. with cryptochromes.

"Two other "decision points" affected my life greatly. From 1956 to 1978, I had been a consultant to DuPont, and at one point was tempted by an opportunity to leave academia for industry. It was mainly my love of teaching and contact with students that deterred me. The second critical decision developed out of our government's use of Agent Orange and other chemicals to defoliate and kill vegetation during the war in Vietnam. This violated my deepest feelings about the constructive role of science, and moved me into active opposition to official U.S. policy. Starting with the business meeting in 1967, and working with like-minded colleagues around the country, I began a time-consuming and distracting campaign against this type of chemical warfare (Galston, 2001). Our small group was eventually successful in helping to change our country's policy, when President Nixon ordered the end of the spraying at the end of 1970, almost five years before the end of the war. Since we now know that Agent Orange contained significant levels of teratogenic dioxins, this was an important accomplishment. It was followed by five visits to Vietnam and six to China, including the honor, with Ethan Signer of MIT, of being the first American scientists invited to visit the People's Republic of China. In 1971, we met Chou En-lai, then Prime Minister, as well as King Norodom Sihanouk of Cambodia, who then resided in Shanghai. This pre-Kissinger-Nixon visit to China, as well as my family's subsequent (1972) summer on an agriculture commune (Galston, 1973) was page 1

news in many newspapers, including the New York Times.

"Agent Orange also seems to have turned on other activist genes in my makeup, and since then I have been drawn increasingly by an interest in the social and ethical consequences of scientific research. After my mandatory retirement from Biology in 1990, I helped to organize a Bioethics Project at Yale, and am now an active member of that group, teaching, leading seminars, and helping to plan activities. Life does play funny tricks with our career plans!"

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-Anitra Thorhaug and Graeme Berlyn. School of Forestry and Environmental Sciences, Yale University.

Ray collecting *H. gracilis* seed (photo by June Jackson)

R. C. Jackson (1928-2008)

Raymond Carl Jackson, Horn professor emeritus at Texas Tech University, died on April 7, 2008 following a long illness. He grew up in rural Indiana and fell in love with nature as a boy. He and his other love from Indiana, June, were married in 1947. After three years of service in the U.S. Army Air Corps-U.S. Air Force, Ray entered Indiana University in 1949 earning a BA in 1952. Upon completing his Master's degree at Indiana, he moved on to Purdue in 1953 where he earned a Ph.D. in 1955. His fondness for the Asteraceae began at IU thanks to some persuasion from his mentor and long-time colleague and friend, Charles Heiser. Soon after graduation, he packed up his wife, two-year-old son and newborn daughter, and moved cross-country to Albuquerque (UNM) where he accepted a faculty position that included herbarium curator. Here he continued working on *Helianthus* and other local composites, most notably, *Haplopappus*. It was in New Mexico that he encountered the unassuming desert annual, *Haplopappus gracilis* and found it to have n=2 chromosomes, the lowest number ever reported for a plant. Realizing the potential goldmine of this easy to culture, short life-cycled composite as a model for chromosomal, genomic and genetic linkage studies, Ray shifted his focus to cytogenetics – a shift that coincided with a career move to the University of Kansas in 1958. Here he flourished professionally, becoming a leading figure in cytogenetics and plant biosystematics. In 1969 he was appointed Chair of the Botany Department at KU and served in that role until 1971 when he accepted the chairship of the Department of Biological Sciences at Texas Tech University. In the 1980's Ray became an authority on chromosome pairing behavior in polyploids, proposing and testing models based on random synapsis and non-random distribution of chiasmata. He modified and applied these models to diploids, triploids, and tetraploids through octoploids. He also proposed similar models for predicting meiotic behavior in translocation heterozygotes. Ray published eighty-some peer-reviewed articles throughout his prosperous professional career including three in *Science*. He was a member of several honor societies including Sigma Xi, Phi Sigma, and Delta Phi Alpha (a national German language honor society); and an active member of many professional societies serving in several capacities including editor of the *University of Kansas Science Bulletin* and of the *Transactions of the Kansas Academy of Science*; associate editor of *Evolution*; chair and founding member of the Genetics Section of BSA;

founding member of the Mid-continent Section of BSA; Chair of the Botanical Section of AAAS-SWARM Div.; and President of AAAS-SWARM Div., to name a few. Throughout his career he was recognized with many honors and awards including the BSA Merit Award, the BSA Centennial Award, the AAAS-SWARM President's Award, Outstanding Educator of America (1974-75), and an annual award established in his name for outstanding student presentation in the Mid-continent section of the BSA. But perhaps the ultimate honor was in 1996 when he was eponymized with the genus, *Rayjacksonia* in the Asteraceae. The family suggests memorials to the Department of Biological Sciences, Texas Tech University. Type in "biology" in the search window on the On-line Giving page (https://securejava.tosm.ttu.edu/onlineGiving/landing.do) to select an endowed fund.

-Don Hauber, Department of Biological Sciences, Loyola University, New Orleans.

Charles Adam Schexnayder (1926-2008.)

Charles Adam Schexnayder, professor emeritus of LSU and husband of Claire Brown Schexnayder, passed away at 1 a.m. Wednesday, June 4, 2008, at his home. He was born on April 18, 1926, at Lauderdale Plantation in St. James Parish. He had been ill for almost a year with pulmonary fibrosis. He graduated from White Castle High School in 1943, joined the Naval Aviation Program and studied to be a naval aviator in World War II. Following the cessation of hostilities of the war, he enrolled at LSU, where he obtained a bachelor's degree in vocational agriculture in 1948, a master's degree in botany in 1950 and a Ph.D. in plant pathology in 1953. Upon completion of his degree in plant pathology, he worked for the U.S. Department of Agriculture at the Houma Federal Field Station with a specialty in sugar cane production. In 1958, he was offered a position working with the South Puerto Rico Sugar Corp. in La Romana, Dominican Republic, where he worked as a plant pathologist and plant breeder with sugar cane in the area of agronomy research. After four years, he moved his family back to the United States and joined LSU with the Department of Plant Pathology and Botany. He served on the LSU faculty in 1962 as professor and chairman of botany for 12 years. He was appointed director of International Programs through the LSU Agriculture Center. Dr. Schexnayder accepted a position in Jamaica in 1988, where he worked to build an agriculture college in Port Antonio on the Caribbean. The project was sponsored by LSU and the Department of State for the benefit of Third World countries. Much of his work with international programs was performed in West African countries as chief of party providing educational programs for helping African natives to cultivate crops for their livelihood. He retired as professor emeritus in 1991 due to developing problems with his health.

He is survived by his wife, Claire Brown Schexnayder; daughter, Jacqueline Schexnayder MacMurdo Schneider and husband Brian; son, Dr. Michael Schexnayder and wife Charlene Curole Schexnayder; and five grandchildren, Christopher James MacMurdo, Ross Bailey MacMurdo, Laura Elise Schexnayder, Charles Michael Schexnayder and Matthew Steven Walker. Also survived by his brothers, Jean Manfred Schexnayder and wife Sandra, Harold Joseph Schexnayder and wife Mary Janice, and Lawrence Schexnayder and wife Jill.

-Russell L. Chapman, Ph D., FLS, Executive Director, Center for Marine Biodiversity and Conservation 0202, Scripps Institution of Oceanography, University of California San Diego, 9500 Gilman Drive, La Jolla, CA 92093.

Personalia

DR. BRENT ELLIOTT RECEIVES GREENSFELDER MEDAL FROM THE MISSOURI BOTANICAL GARDEN

The Missouri Botanical Garden has awarded Dr. Brent Elliott, librarian and archivist at the Royal Horticultural Society Lindley Library in London, with the 2008 Greensfelder Medal. Dr. Elliott was honored at the dedication of the Doris Waters Harris Lichtenstein Victorian District at the Garden on June 13.

Dr. Elliott is a renowned authority on Victorian gardens who collaborated on the landscape design and interpretation of the new Victorian District. The unified and enhanced area comprises the historic southeast corner of the Garden and includes the Kresko Family Victorian Garden and Tower Grove House, country home of Garden founder Henry Shaw.

The Albert P. and Blanche Y. Greensfelder Medal was established in 1980. It honors individuals who have made significant contributions to landscape, garden and park planning, and design for urban improvement.

Dr. Peter H. Raven, Renowned Botanist and Environmentalist, Speaks at World's Largest GIS Gathering

The 2008 ESRI International User <http://www.esri.com/events/uc/index.html> Conference (ESRI UC) featured renowned botanist, environmentalist, biodiversity expert, and president of the Missouri Botanical Garden, Dr. Peter H. Raven. Raven discussed the significance of biodiversity and the environment for sustaining our world.

"Dr. Raven has played a vital role in teaching others about the importance of biodiversity and in researching our planet's ecosystems," says Jack Dangermond, president, ESRI. "He's making a difference in securing our environmental resources. We're honored to have him as our guest and we're excited about the opportunity our users will have to hear from such a distinguished individual."

The ESRI UC, the largest conference in the world devoted to geographic <http://www.gis.com/whatisgis/index.html> information system (GIS) technology, was held August 4-8 at the San Diego Convention Center in California. The conference drew approximately 13,000 users from more than 120 countries who came together to learn, collaborate, and discover the latest developments in GIS technology. The conference theme this year was GIS: Geography in Action.

Raven talked about the importance of biodiversity and how it influences our daily lives. He discussed the threats-including loss of habitat, overconsumption, and climate change-that impact biodiversity and the solutions available for us to preserve and improve our planet's sustainability. As part of the presentation, GIS was used to analyze ecosystems and the myriad of plant and animal life that inhabit them. In addition, GIS was used to model future impacts to these bionetworks.

Symposia, Conferences, Meetings

African Journal of Plant Science (AJPS)

The *African Journal of Plant Science* (AJPS) is currently accepting manuscripts for publication. AJPS publishes high-quality solicited and unsolicited articles, in English, in all areas of plant science research. All articles published in AJPS will be peer-reviewed.

Our objective is to inform authors of the decision on their manuscript within five weeks of submission. Following acceptance, a paper will normally be published in the next available issue.

One key request of researchers across the world is open access to research publications. The *African Journal of Plant Science* is fully committed to providing free access to all articles as soon as they are published. We ask you to support this initiative by publishing your papers in this journal.

Please visit our website www.academicjournals.org/AJPS for the Instruction for authors and other details. Prospective authors should send their manuscript(s) to ajps.acadjourn@gmail.com , ajps@academicjournals.org

AJPS is also seeking for qualified reviewers as members of its editorialboard. Please contact me if you are interested in serving as a reviewer.

Best regards,

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http://www.academicjournals.org/AJPS

55th Annual Systematics Symposium Missouri Botanical Garden

"Climate Change and Biodiversity in Africa and Madagascar"

17-18 October 2008 With support from the National Science Foundation

REGISTRATION: SATURDAY, October 18 Alison Cameron: **Species distribution modeling of Madagascar butterflies and primates under climate change, and implications for protected areas network design**Kerry H. Cook: **The African climate**Lee Hannah: **Impacts of climate change on South African Proteaceae**Jaclyn Hall: **Remote sensing and area analysis in relation to East African vegetation and conservation**E.A. Kellogg: **C4 grass evolution in relation to past and future climate change**Sara Oldfield: **Climate change and the conservation role of botanical gardens** Jonathan Patz: **Making the links to sustainability/ human dimensions of climate change**David Western: **Integrated biodiversity studies and landscape-scale conservation in East Africa**

SPACE LIMITS REGISTRATION TO 400; PLEASE REGISTER EARLY
Registration must be accompanied by a $75.00 registration fee, which covers the cost of refreshments at the Friday mixer and lunch and dinner on Saturday. Information on local hotels and motels will be available to registrants. There is no guarantee of food being available if you register after 9 October. For electronic payment, see future updates on symposium webpage. **No refunds will be granted after 24 September.**

I plan to attend the Systematics Symposium. Enclosed is my $75.00 registration fee. Please make checks payable to "Missouri Botanical Garden" I enclose my registration fee of $75.00 _____ I request vegetarian meals: _____ My name and professional address:

_____
_____
Phone:_____
Fax:_____
e-mail address:_____
Please indicate if you are a)a graduate student _____ or b)an undergraduate student _____

Mail registration form to: Systematics Symposium Missouri Botanical Garden P.O. Box 299 St. Louis, MO 63166-0299
For further information, contact: P. Mick Richardson Email: mick.richardson@mobot.org Tel: 314 577 5176 Fax: 314 577 0820

Positions Available

Department Chair, Department of Biological Sciences, Eastern Illinois University

Responsibilities:
Provide effective leadership and vision to advance the department, college and university mission and goals. Administer all instructional programs in Biological Sciences. Work with faculty and staff to develop curriculum, and coordinate appropriate academic assessment activities. Make recommendations regarding all personnel matters including hiring and evaluation of faculty and staff. Advance faculty/student mentoring and research programs. Administer all departmental budgets. Communicate with alumni and facilitate actions which promote diversity.

Qualifications:
An earned PhD in Biological Sciences or related field. The successful candidate will have a teaching, research and service record commensurate for tenure at the rank of full professor. Evidence of instructional excellence, scholarly achievement, administrative experience, and effective leadership is essential, as are strong communication and interpersonal skills.

Starting Date:
July 1, 2009

Closing Date:
Review of applications will begin **October 3, 2008** and will continue until the position is filled.

Applications:
A complete application includes a letter of intent addressing the applicant's strengths relative to the position, current curriculum vitae, three letters from professional references which address the candidate's qualifications for a department chair position, and official graduate transcripts. The application letter, current curriculum vitae, and three reference letters should be sent via e-mail as MS Word or PDF attachments to Dr. Diane Hoadley, Chair, Biological Sciences Chair Search Committee, coscand@eiu.edu.

Official graduate transcripts should be mailed to Dr. Diane Hoadley, Lumpkin College of Business and Applied Sciences, Eastern Illinois University, 600 Lincoln Avenue, Charleston, IL 61920-3099.

Northwestern University Offers a Doctoral Program in Plant Biology and Conservation

The biological world is currently confronted with more rapid changes than it has faced during the course of human history. Addressing a growing need for expertise in plant science and conservation, and in
partnership with the Chicago Botanic Garden <http://www.chicago-botanic.org/>, the doctoral program in Plant Biology and Conservation will provide students advanced training in plant ecology, evolution, and biology and in applied plant conservation theory and methods - allowing them to help solve real environmental issues, and to pursue careers in academia, governmental and non-governmental agencies, and beyond. The application deadline for Fall 2009 admission is / December 31st, 2008./

For more information please visit our website: http://www.plantbiology.northwestern.edu/index.html

Award Opportunities

American Philosophical Society Research Programs

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

Information about All Programs

Purpose, scope

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

Eligibility

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

Contact information

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

Franklin Research Grants

Scope

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

Eligibility

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

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

Deadlines

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

Lewis and Clark Fund for Exploration and Field Research

Scope

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

Eligibility

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

Award

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

Deadline

February 15; notification in May.

Harvard University Bullard Fellowships in Forest Research

Each year Harvard University awards a limited number of Bullard Fellowships to individuals in biological, social, physical and political sciences to promote advanced study, research or integration of subjects pertaining to forested ecosystems. The fellowships, which include stipends up to $40,000, are intended to provide individuals in mid-career with an opportunity to utilize the resources and to interact with personnel in any department within Harvard University in order to develop their own scientific and professional growth. In recent years Bullard Fellows have been associated with the Harvard Forest, Department of Organismic and Evolutionary Biology and the J. F. Kennedy School of Government and have worked in areas of ecology, forest management, policy and conservation. Fellowships are available for periods ranging from six months to one year after September 1st Applications from international scientists, women and minorities are encouraged. Fellowships are not intended for graduate students or recent post-doctoral candidates. Information and application instructions are available on the Harvard Forest web site (http://harvardforest.fas.harvard.edu). Annual deadline for applications is February 1st.

Other

International Organization Launched to Address PROBLEMS in Cultivated Plant Taxonomy

Plants have been in cultivation for millennia, but it is becoming evermore difficult to maintain clarity and understanding in the science of naming cultivated plants. This has been exacerbated in recent decades by the proliferation of not only cultivars, but trade designations and other devices used to market them. To provide necessary leadership in the field of taxonomy and nomenclature of cultivated plants, a new organization was launched during the 5th International Symposium on the Taxonomy of Cultivated Plants in Wageningen, The Netherlands on October 18, 2007: the International Association for Cultivated Plant Taxonomy (IACPT).

Although often underestimated, there is significant value of knowing a plant's precise name and understanding its origin, development, description, classification and performance potential. Stability and harmonization in cultivated plant names can be achieved only with clear and widely accessible information. The IACPT seeks to make information sharing the core of its mission, and will encourage international cooperation among individuals and institutions interested in this field and related disciplines.

To achieve its goals, the association will sponsor symposia, publish a journal dedicated to cultivated plant taxonomy, develop databases and on-line resources for improving stability in the nomenclature of cultivated plants and become a vehicle for discussion and provide advice on the implementation of the *International Code of Nomenclature for Cultivated Plants (ICNCP)*.

Members include taxonomists, international cultivar registration authorities, representatives of plant breeders rights authorities, industry scientists and specialists, public garden professionals and many others. Memberships are now being solicited, and as of April, 2008, there are 70 members from 13 different countries. Five individuals represent the US and Canada on the IACPT council: John Wiersema, Michael Dosmann (Vice-president for the Americas) and Dennis Collins (Secretary) for the US; Freek Vrugtman and Bernard Baum for Canada. Additional information on joining can be found at: www.iacpt.net. Although there is yet no policy for institutional memberships, inquiries on the subject are welcome and some mechanism will address this in the future.
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For more information, contact Dennis Collins at 617-607-1961 or e-mail at dcollins@mountauburn.org

"Perhaps the most striking point by which the educational methods of the present are distinguished from those formerly in vogue is the great prominence which is given to inductive methods, and as a consequence, the little attention that is now paid to mere facts, as contrasted with the great stress laid on the processes by which those facts are acquired...and teachers seem almost unanimous in believing that the training in methods is the primary object of such work, and that the informaiton involved, important though it is, must be given a subordinate place."

Biological Teaching in the Colleges of the United States
John P. Campbell, **1891**

Brooklyn Botanic Garden Announces Summer Highlights—Reflections: Water in the Garden

Find cool relief from the sizzling summer heat at Brooklyn Botanic Garden (BBG) with its Reflections: Water in the Garden interpretive program highlights, from July 12 through September 7, 2008. In the glittering reflection of BBG's exquisite aquatic features, visitors can experience the many diverse displays of water throughout the "gardens within the Garden," learn more about water and conservation, and explore how plants use and live in and around water. Reflections: Water in the Garden is BBG's first-ever program focusing on its exhilarating water features and offers visitors an interactive self-guided tour of the aquatic elements of BBG, free guided strolls, special educational workshops for children and adults, and more.

The sound of a trickling brook calms the nerves, the glassy surface of a pond inspires contemplation, and the playful jets of fountains elicit joy. Water itself is an essential element, vital to all living things. Reflections: Water in the Garden invites visitors to revel in BBG's distinctive landscape—including fountains, water lily pools, a running brook, small waterfalls, and an interactive water table for kids. Interpretive panels at some of the most popular water features and colorful informative signs about flora living in or near them will introduce visitors to the myriad ways plants interact with water.

Visitors can pick up a special Reflections brochure and embark on a self-guided adventure or meet one of BBG's enthusiastic Garden Guides for a FREE Reflections tour and receive a narrated introduction to the featured water displays. On Tuesdays, FREE Reflections tours begin at 11 a.m. and 1 p.m., as well as 3 p.m. on weekends. The Reflections tour will supplement the popular 1 p.m. free Seasonal Highlights tour.

Reflections: Water in the Garden will highlight ten areas within the Garden, each of which is anchored by water. An interpretive placard nearby also includes other interesting plants in the immediate area. Compelling, on-site interpretive text helps visitors learn about wetland plant species, submerged and emergent ecosystems, and other water-related topics. Highlighted water features in the Garden include the elegant Rose Arc Pool, where the Call of the Sea statue is enveloped by cattails (Typha species) and celebrates the freedom and vitality of open water. The Native Flora Garden's bog, pond, and ephemeral stream, which represent water habitats native to this region that play a vital role in sustaining plant and animal life in the Northeast.

Throughout the summer, visitors will experience the colorful Discovery Carts with hands-on water-related activities for the whole family. The Gardener's Resource Center will help visitors find answers to frequently asked water questions and inspire them with a collection of beautiful books on water gardening, rain gardens, and water features in breathtaking gardens around the world.

The Steinhardt Conservatory Gallery will present Reflections in Collage: Works by Diane Miller, an exhibit of striking collage work that echoes the movement and textures of BBG's water features. Miller's unique collages are inspired by the rocks, trees, mists, clouds, and rain of the North Temperate Zone, and offer a vision of unpolluted nature full of dramatic movement and the textures of the earth.

In the Wonderful Water Plants! Discovery Workshops (Sunday, July 13 and Sunday, August 10, 2–4 p.m.), children will experience the Garden's interactive water table and learn all about water plants. On Special Reflections Saturdays (Saturday, July 26 and Saturday, August 16, 2–4 p.m.), water-related mini-workshops will include potting up a water plant or making a pond postcard and can be enjoyed by visitors of all ages.

A container water garden display will be featured near the Terrace Café during the summer season, adding to the sensual pleasure of dining in the Garden. Home gardeners will be inspired to incorporate water into their own garden designs. And to help them get started, the Garden Shop and Gift Shop will offer a special collection of interesting plants, fountains, books, and other water-inspired gifts.

Romi Ige, manager of interpretation at Brooklyn Botanic Garden, says, "We are very excited to present Reflections: Water in the Garden and to offer our summer visitors an opportunity to cool off beside the myriad water features of Brooklyn Botanic Garden. Whether reveling in the lushness of the Native Flora Garden, relaxing in the shady calm of the brook and terminal pond, or gazing at the stunning composition of the lily pools, visitors of all ages will be able to learn about plants while experiencing the multisensory pleasures of water." Ige adds, "Water has a unique capability to alter or reflect a range of emotions given all of its many permutations, from shooting sprays to placid pools to gurgling brooks to splashing waterfalls—water ignites the senses."

In addition, there will be a special Reflections-themed display in exhibition cases in the Rotunda. It will feature herbarium specimens of aquatic plants and illustrations of water-lilies and lotuses from the Garden's rare-book and Florilegium Society

collections. Patricia Jonas, director of Library Services, is also utilizing the Library's new tagging feature to identify and showcase nearly 100 books from the BBG Library that amplify the Summer Interpretative program. Going to the online catalog on the BBG Library pages and typing "Reflections" in the tag field will allow visitors to look at Jonas's recommendations or create their own personalized water-based book list to share with family and friends.

During the Reflections: Water in the Garden Opening Day Celebration, July 12 from noon to 4:30 p.m., the festivities will pay tribute to the wonderful water features of BBG. Visitors will have a special opportunity to meet one of BBG's curators who maintain and nurture the plants in our Living Collections. The knowledgeable Garden Guides will offer tours highlighting the water features through out the Garden. Robin Simmen, director of Brooklyn GreenBridge, will offer a free informative workshop, "Creating a Rain Garden."

CONTACT: Leeann Lavin, 718-623-7289 or Kate Blumm, 718-623-7241

Chicago Botanic Garden to Break Ground on Rice Plant Conservation Science Center

The Chicago Botanic Garden has announced that it will break ground June 3 on the Daniel F. and Ada L. Rice Plant Conservation Science Center, a facility designed to serve as an international center for plant conservation research and home to the nation's only doctoral program in plant biology and conservation.

When completed in fall of 2009, the 36,000-square-foot Daniel F. and Ada L. Rice Plant Conservation Science Center will provide state-of-the-art laboratories and teaching facilities for over 200 PhD scientists, land managers, students, and research staff, and will include teaching facilities required for a unique doctoral program in plant biology and conservation that the Chicago Botanic Garden will conduct with Northwestern University.

While the Chicago Botanic Garden has conducted a plant conservation research program for more than ten years, the Rice Center will enable the Garden to expand research capabilities into the study of native plants for medicinal and economic benefits, reproductive biology, seed biology and population genetics, and soil research that could lead to better understanding of the manner in which native plant habitats can absorb carbon from the atmosphere.

The building will feature a viewing gallery designed to provide the Garden's 760,000 visitors with an opportunity to see Garden plant scientists at work. It will also feature a 10,000 square-foot living green roof, open to the public to demonstrate the best plants for green roofs in the Midwest.

Designed by Booth Hansen, the Rice Center will use materials and systems to earn a "gold" rating for sustainable design from the U. S. Green Building Council.

The groundbreaking ceremony will be preceded on June 2 with an afternoon "Seeds for the Future" ceremony involving students from three Chicago Public Schools. Together with Garden scientists, the students will contribute items to a "Seeds for the Future" time capsule, which will be placed in the Rice Center to be opened in 50 years.

Why Save Plants?
According to the World Conservation Union, 30 percent of the world's plants are threatened with extinction by 2050. Since plants provide all the necessities of life, food, shelter, clothing, medicine and oxygen, the continued loss of plant life poses enormous threats to the health and well being of humans.

The new Rice Center will provide the facilities to enable the Garden to conduct research that will impact the work of those trying to save plants around the world.

For example, the Chicago Botanic Garden is on a mission to collect 20,000 seeds from each of the 1,500 native plant species of the tall grass prairie, one of the world's most threatened ecosystems, now reduced to less than 0.01 percent of its former range. The Rice Center will provide the seed banking equipment and facilities to bank seed more effectively, seeds that one day may cure disease, provide food for millions or become viable parts of healthy ecosystems.

REVEALING DOUBLE LECTURE EXPLORES THE SHROUD OF TURIN

WHAT: Double lecture, "Botany of the Shroud of Turin," by Dr. Avinoam Danin, and "The Shroud of Turin: The Holographic Experience," by Dr. Petrus Soons

WHEN: Monday, Aug. 18 at 5:30 p.m.

WHERE: Shoenberg Theater, Missouri Botanical Garden, 4344 Shaw Blvd. in south St. Louis

COST: Free

INFO: General Garden info, www.mobot.org or (314) 577-9400

The Shroud of Turin, believed to be the traditional burial cloth of Jesus of Nazareth, has been on public display only a handful of times in the past century, yet it is one of the most studied and researched artifacts in the world. Dr. Avinoam Danin, Emeritus Professor of Botany at the Hebrew University of Jerusalem, has spent decades examining images of plant remains he discovered on the shroud; collectively, these indicate a geographic origin of the burial in the vicinity of Jerusalem during the months of March or April. Recently, he located about 300 additional flowers and parts of plants on the cloth, providing additional evidence about its provenance. Dr. Petrus Soons, retired M.D., has used digitized photos of the linen cloth to create another device for study: three-dimensional holograms. Discover what their research has revealed about the botany of the shroud during a double lecture on Monday, Aug. 18 at 5:30 p.m. at the Missouri Botanical Garden. The event is free.

The "Botany of the Shroud of Turin" will be presented by Dr. Avinoam Danin, who is co-author of the Flora of the Shroud of Turin. Of the plant images he originally uncovered on the shroud, the presence of three plant species were used as geographic indicators to show the origin of the garment as the Holy land between Jerusalem and Hebron. Eight of the species were used by Danin to determine that the placing of these plants on the deceased person's body took place in the months of March or April.

Using photographs of the shroud taken by Vernon Miller in 1978, Danin recently discovered over 300 additional flowers and plant parts on the head area of the cloth. The size and morphology of the flowering heads closely resemble those of Matricaria and Anthemis, two genera in the sunflower family. The stalks and stems of the flowers have been removed, and the flowers appear in an orderly arrangement, suggesting their intentional placement on the body that was covered by the garment. More recent research has uncovered what appear to be four flowering heads from the Carduus genus of thistles, and three spines from the deciduous shrub Rhamnus lycioides; possible evidence of the Biblical "crown of thorns."

"The Shroud of Turin: The Holographic Experience" will be presented by Dr. Petrus Soons, whose work involves the digitization of shroud photographs taken in 1931. Soons enhanced the original photos to improve details, and then translated the enhanced grayscale images into depth data. The result was a sequence of nearly 625 images for each photo, which computer expert Bernardo Galmarini combined using a Holoprinter to produce three-dimensional (3-D) holographic images of the shroud. This unprecedented new view of the artifact yielded the discovery of previously unseen details, confirmation of many previous findings, and a few surprises.

"The production of the first 3-D photographs greatly benefited both Dr. Soons' and my ongoing study of the shroud," said Danin.

"These studies represent an impressive case of the application of botanical information to the interpretation of a venerated historical object," said Garden President Dr. Peter Raven. "They offer telling information about where and when it was used."

The double lecture will be held in the Shoenberg Theater, lower level of the visitors' center at the Missouri Botanical Garden, 4344 Shaw Blvd. Admission to the event is free and open to the public. For general information, visit www.mobot.org or call the recorded line at (314) 577 9400.

Since 1983, the Vatican has owned the Shroud of Turin, which is kept in Turin's Roman Catholic cathedral in Italy. Pope Benedict XVI recently announced that the shroud will go on public display in 2010.

Books Reviewed

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Trees in the Life of the Maya World. Aguirre de Rojas, R., & E. de Pöll. - David Johnson.....121

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Nature's Palette: The Science of Plant Color, Lee, David - Neil Harriman.....126

Flow Cytometry with Plant Cells: Analysis of Genes, Chromosomes, and Genomes. Dole•el, Jaroslav, Johann Greilhuber, and Jan Suda (eds). 2007. ISBN 978-3-527-31487-4 (Cloth US$190.00) 454pp. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany. In the era genomics, transcriptomics and proteomics it is difficult to keep up to date with all these new technologies. Older methods are therefore often overlooked, although they may actually find new applications. The book by Dolezel and co-editors on flow cytometry is a wake-up call. In 18 chapters the most prominent authors in the field demonstrate the many possibilities that this technique, originally designed for biomedical purposes, offers for many questions in all kinds of botanical studies. Although as pointed out by Loureiro & al. (chapter 18) more than 80% of the current applications of flow cytometry are concerned with ploidy level and genome size estimation, it is used in as different fields as ecology, systematics, physiology and genetics. Flow cytometry has many advantages as repeatedly stressed throughout the book, such as ease of sample preparation, rapidity of the analysis, no requirement for dividing cells and low cost once the flow cytometer has been set up. But the book is not a one-sided promotion of flow cytometry. Technical problems such as those caused by secondary compounds are again and again considered for the various applications discussed. Consequently, the book is not so much

a book discussing results from studies using flow cytometry but rather a guide to best laboratory practice. Its main purpose, however, seems to be highlighting the possibilities of the method. What Pfündel & Meister (chapter 11, p. 252) wrote is probably true for most of these chapters: "We believe that the rare use of FCM [flow cytometry] in chloroplast research results from a lack of awareness of its possibilities rather than from any limitations of the method".

The book starts with an extensive history of the technique by Shapiro, leading on to an in-depth description of the technique by Robinson & Grégori, which is probably over the head of most plant biologists. Although these may be the less frequently visited chapters of the book, they definitely round up the book. After these introductory chapters, Dolezel, Greilhuber & Suda introduce the diverse applications, from genome size measurement to flow sorting and phytosanitary screening and onto the quantification of secondary metabolites. Additionally, they introduce the plant-specific problems with the technique that are then discussed in more detail in the specific chapters. The chapter, thus, forms the central cornerstone of the book. Whenever a plant biologist thinks he doesn't need flow cytometry, he should read this chapter. Chapter 4 by Greilhuber & al. gives an introduction to the complex terminology of genome size studies and a detailed analysis of methodological problems in genome size estimation. The part on the terminology is a must-read for anybody publishing on genome size and ploidy variation. The methodological part of the chapter represents a highly useful compilation of these small observations and recommendations that are normally not found in publications other than in well-hidden side notes and so the chapter will likely spare users from desperate emails on the various email listservers.
The variation of ploidy levels discussed in chapter 5 (Suda & al.) may be the most frequently used application of flow cytometry, because it allows a rapid survey of populations for its ploidy level. For groups in which chromosome numbers are known this presents an easy way of detecting the distribution limits of cytotypes and rapidly increases our knowledge on ploidy level variation within populations, occurrence of intermediate cytotypes such as triploids and so on. Chapter 6 by Matzk extends the question of ploidy level variation to the intraindividual level and the question of reproductive modes such as detection of unreduced gametes and the determination of endosperm ploidy.

Leitch & Bennett (chapter 7) review what is known about genome size variation and its implications. Of course, a single chapter can only discuss correlations of genome size with some biological features but not all that have been suggested. Nevertheless, the chapter provides an insightful overview over the topic to those not as familiar with the topic. A more specialized topic is discussed by Meister & Barow (chapter 8). Comparing the measurements of the same material once with a base-specific dye and once with an unspecific dye allows estimation of GC/AT-content in different genomes. Considerable differences between GC/AT-contents exist in investigated species but these do not seem to have a taxonomic significance and currently no convincing biological relevance is known. After this the more unusual applications of flow cytometry are presented, although the order is not entirely clear to me. It starts with the screen for plant pathogenic microorganisms discussed by Bergervoet & al. (chapter 9), probably the most applied application rather than one used in basic research. Galbraith (chapter 10) then discusses the technical approach to measure protoplast size, senescence, cell death, protein content and physiological parameters using flow cytometry. These topics are so diverse that here most often only the topics are briefly touched upon and the reader is then referred to the original literature. The analysis of chloroplasts introduced by Pfündel & Meister (chapter 11) seems to be in its infancy. The chapter is mostly preoccupied with discussing methodological problems and only mentioning one issue, in which flow cytometry has been used successfully, the detection of C4-photosynthesis.

Whereas most of the studies using flow cytometry worked with vascular plants, the potential applications in the study of non-vascular plants are even more diverse as outlined in the next two chapters. While Voglmayer in chapter 12 focuses on the technical problems of genome size estimation in bryophytes and algae and reviews the current state of knowledge, chapter 13 by Dubelaar discusses the application of flow cytometry in the study of phytoplankton. Here, flow cytometers have been developed furthest and sometimes look rather like a submarine. The lack of morphological characters to distinguish plankton species has been overcome by flow cytometry when it was shown that different types of plankton can be distinguished by their autofluorescent characteristics (i.e. that of their chlorophyll). The parallel species identification and number estimation allows detailed ecosystem monitoring and changes over short times and distances. Further advancements in these kinds of analyses are to be expected by staining plankton with species-specific oligonucleotides. This could, for example, allow in-situ detection of toxic algae species.

From ecology, the theme then shifts in the next four chapters back to plant genetic topics. Pfosser & al. review the analysis of cell cycles, not only using flow

cytometry. As the authors state that the use of flow cytometry in cell cycle analysis is rather limited, I wonder whether this excellent chapter may not be well hidden in this book from researchers interested in cell cycles. The authors give an extensive list of drugs affecting the cell cycle and systems for its study as well as a guide on how to synchronize cell lines. In contrast, the review of endopolyploidy by Barow & Jovtchev (chapter 15) depends to a large extent on flow cytometry and, therefore, a review of its estimation and factors modifying endopolyploidy was to be expected. Dolezel & al. (chapter 16) then introduce into the topic of flow sorting mitotic metaphase chromosomes. It is certainly one of the most demanding applications of flow cytometry and the extensive difficulties are discussed in much detail. It finds its use in karyotyping, for example in agriculture, and assigning sequences to specific chromosomes when combined with FISH, providing a resolution of as little as 70kb. The authors finish by outlining a strategy to generate chromosome-specific markers and BAC-libraries. A technically even more demanding application of flow cytometry is its use in gene expression analysis (chapter 17). Galbraith discusses extensively microarrays and only briefly mentions how flow sorting protoplasts could help locating the expression of specific genes. Overall, however, I had the impression that in this topic flow cytometry plays and will play only a minor role. (Alternatively, Galbraith did not convince me of its importance.) Finally, Loureiro & al. present the FLOWer database (chapter 18; http://flower.web.ua.pt), a comprehensive database with bibliographic information on all articles dealing with flow cytometry in plants. This database is surely a remarkable resource for anyone interested in flow cytometry for various reasons, for example when looking for technical help. It allows searching and sorting of the literature according to buffer, standards, fluorochromes used in the study, the purpose of the study, the journal in which the study was published and the country in which the study was conducted.

Overall, the book is certainly a must-have for any plant biology library and I recommend reading the chapters closest to your interest. I am sure, several ideas on how to use flow cytometry in your own research will come to your mind. However, the book also gives ample warnings that things may not be as easy as they may appear in the beginning. Especially, the more demanding applications will certainly continue to be conducted only in a handful of laboratories world-wide.

-Dr. Dirk Albach, Institut für Spezielle Botanik, Johannes Gutenberg-Universität Mainz, Bentzelweg 9b
55099 Mainz. Germany.

Life in the Soil: A Guide for Naturalists and Gardeners. James B. Nardi. University of Chicago Press. 293 pp. ISBN 13:978-0-226-56852-2.

Now here is a book I've been waiting for. Like most BSA members, I've got shelves full of books about plants – how they are related, how to identify them, which ones I can eat, which ones I could use for what ails me. Yet I've got far fewer references on the substrate upon which most of those plants are growing. Sure, there's my old, worn copy of The Nature and Structure of Soils and there's Miller and Donahue's Soils in our Environment, the textbook used for my undergrad soils course. But where is that one book that really, finally, illuminates the dark and dynamic habitat lying under our feet and the biota it supports? As far as I can tell, it didn't exist until now.

Let me just come clean (or soiled, perhaps) right off the bat: I love this book. As I read it, I got that old feeling that used to come over me when I was a kid engrossed in a Golden Guide – like I was being let in on some big secret in nature and all I needed to decode the mystery was the book in my hand. That's what Life in the Soil is like, and in no small part this is due to James Nardi's wonderful illustrations. These are scattered throughout the book and provide detailed views of critters we never see so clearly, for reasons of scale or because they lead hidden subterranean lives. Whether the rendering is a comparison of several types of actinomycetes, a cut-away view of a pocket gopher's burrow, or a step-by-step breakdown of rotifer locomotion, Nardi's artwork is a show-stealing complement to the written text.

This is not to say that the text is lacking. Rather, it is written in a style that is indicative of an author who is obviously an effective teacher. Complex concepts are tackled with ease, and much of the text reads more like a good story than a textbook. This is no small accomplishment because this book is packed with a volume of information that could easily be presented in a less accessible and far less colorful manner. I imagine that arriving at this goal took much hard work and editing, and it appears to have been a worthwhile labor.

The book is divided into three main sections. Part One, titled "The Marriage of the Mineral World and the Organic World", is where most of the plant-related information is encountered. The short, general treatments of roots and their nitrogen-fixing symbionts (2 pages), mycorrhizal associations (4 pages), and the direct interactions between roots and soils (7 pages) have the potential to leave botanists somewhat dissatisfied (I was, at first). Plants do, however, get their due in the remainder

of Part One as Nardi highlights their importance as the foundation of all that is living in our soils. This includes an enlightening journey in which he traces an abscised oak leaf from the moment it lands on the ground to the time it becomes any number of tiny fragments in a bit of humus.

Having already laid out the five factors that contribute to the making of soils: climate, topography, parent material, time, and living organisms; Nardi dedicates what is by far the largest section of his book to the last factor, the soil biota. In Part Two, "Members of the Soil Community," the author provides treatments of 60 different taxonomic groups. Eight of these are included in the "Microbes" section: 1) Eubacteria and Archaebacteria; 2) Actinomycetes; 3) Algae; 4) Fungi; 5) Chytrids, Hypochytrids, Oomycetes; 6) Lichens; 7) Slime Molds; and 8) Protozoa. The systematists among us may cringe at a few of these partitions, but a detailed reading of the treatments of these groups shows that Nardi is fully aware of where things really belong. These categories are used by convenience and, most importantly, because they make sense to the audience for which the book is largely written: amateur naturalists and gardeners with a biological acumen. I took comfort in the information boxes inserted at the beginning of each treatment in which the taxonomy and diversity of the group is summarized. As an example, the Algae (including cyanobacteria) inhabiting soils are described as members of seven listed groups from three kingdoms. [Nardi chose to use a three-domain system in which the Eukaryotes are divided into five kingdoms: Protozoa, Chromista, Fungus, Animal, and Plant.]

The bulk of Part Two (around 170 pages) is dedicated to invertebrate and vertebrate animals, from flatworms to kangaroo rats. It's all fascinating reading, and the text in this section is chock full of entertaining and informative narratives describing the myriad ways that animals create, use, and maintain soils. You might be familiar with the importance of earthworms, or dung beetles (great stuff here on them), or burrowing mammals (woodchucks excavate as much as 700 pounds of subsoil and associated material for a single burrow!), but Life in the Soil casts an equal opportunity spotlight that shines on many others. To wit: Woodlice, already of considerable interest as landlubbing crustaceans, are among the first things to begin breaking down leaves into humus. Mites, some predatory and others scavengers, are present at densities of up to 100,000 per square meter of soil. Moth fly larvae (Family Psychodidae) are not only colored like the soils in their neighborhood but they camouflage themselves further by attaching chunks of soil along their backs.

The third and final part of the book, "Working in Partnership with Creatures of the Soil," is a short (11 pages) foray into the things we can all do as soil stewards. The prevention of erosion and salinization, wise use of fertilizers, avoidance of biological invasions, and the use of composting "as an antidote to soil abuse" are all given attention here. This is followed by three appendices: a guide to observing life in the soil (including tips for locating and collecting soil organisms), a glossary, and three pages of suggested additional readings.

This review now done, one would expect that I would put my copy of the book on my shelves and leave it there for future reference - but I am actually inclined to just start reading it again. Life in the Soil is what descriptive natural history books should all be, but too few actually are. It is appropriately detailed and comprehensive, but it is also easy and fun to read. The enthusiasm of the author and his own sense of wonder come through loud and clear in both his words and his artwork. There is more happening beneath us than most folks could ever imagine, but Nardi has made it a heck of a lot easier to do so.

-Christopher T. Martine, Department of Biological Sciences, SUNY Plattsburgh

Natural dyes: scope and challenges. M. Daniel, S. D. Bhattacharya, Arun Arya and Vinay M. Raole. 2006. ISBN: 81-7233-445-1. 271 pages. Scientific Publishers, Jodhpur India

This book is a reprint of a series of papers that had appeared in the Journal of Economic and Taxonomic Botany, a journal that specializes in plants of India. The papers were presented at a national seminar held in Baroda India in February 2004 which also featured dying workshops and demonstrations of over 100 natural dyes. Most participants reported on original research done on a variety of natural dyes and processing techniques in response to increasing concerns about pollution and the carcinogenic properties of synthetic dyes which had been in use in India since 1856.

Introductory chapters listed potential uses of such plant-based natural dyes included food, phamaceuticals and paint, however the main emphasis throughout most of the book is on fiber. Different chemicals that impart color such as quinones and flavonoids are described and listed according to the species of plants and plant parts

where they are found and general methods for analysing and extracting these chemicals are described. The majority papers are reports on laboratory tests conducted by several scientists using a variety of plant dyes to determine their potential for substituting for synthetic dyes. Different combinations of plants, fibers and methods are tested especiall for color fastness since that is the main benefit of synthetic dyes. Both historically important dyes such as henna (*Lawsonia inermis*) and indigo (*Indigofera tectproa*) and new sources such as the dried leaves of coconut palm (*Cocos nucifera*) and the bark of mangos (*Mandifera indica*) were examined.

The conference was intended to assess what is known and not known about natural dyes with the goal of developing a strategy for replacing as many synthetic dyes as possible with natural dyes. Therefore papers were really intended for other dye specialist and are mostly very technical in nature. They are uneven in content and quality with much repetition of introductory material and few including such topics as cost estimates. It would have been interesting had the book concluded with some general interpretation of the results and a summary of the prospects for future use of natural dyes in India.

-Joanne Sharpe, Coastal Maine Botanical Gardens, Boothbay Maine

Trees in the Life of the Maya World. Aguirre de Rojas, R., & E. de Pöll. 2007. ISBN 13 978-1-889878-18-8. Fort Worth: Botanical Research Institute of Texas Press

This book presents a sampler of ethnobotanically important trees in Guatemala as an invitation to readers to recognize and support forest conservation efforts in that country. Thirty-eight species have been chosen by the authors for this purpose, and are presented in a series of seven categories, each with a brief preface: Trees in the Popol Vuh (*Ceiba pentandra*, *Pinus* spp., *Cupressus lusitanica*, *Abies guatemalensis*, *Erythrina berteroana*, *Crescentia cujete*, *Crescentia alata*); Trees as Nourishment (*Theobroma cacao*, *Brosimum alicastrum*, *Pouteria sapota*, *Pachira aquatica*, *Byrsonima crassifolia*); Trees Used in Building and Carpentry (*Tabebuia rosea*, *Roseodendron donnell- smithii*, *Swietenia macrophylla*, *Cedrela odorata*, *Enterolobium cyclocarpum*, *Manilkara zapota*, *Sabal mexicana*, *Attalea cohune*, *Rhizophora mangle*); Trees as Firewood (*Quercus* spp., *Leucaena leucocephala*); Trees as Medicine (*Bourreria huanita*, *Bursera simaruba*, *Calophyllum brasiliense*, *Sambucus mexicana*, *Liquidambar styraciflua*, *Guaiacum sanctum*), Other Uses (*Alnus* sp., *Gliciridia sepium*, *Ficus costaricensis*, *Haematoxylum campechianum*, *Platymiscium dimorphandrum*, *Castilla elastica*, *Vochysia guatemalensis*); and The Special Place of Trees (*Cecropia obtusifolia*, *Cyathea* spp., *Persea donnell-smithii*).

Each individual species account begins with the common name, a short literary quotation emphasizing the plant, and a full-paged photograph, occasionally with an archeological setting. Technical information is then given (botanical name and family classification, taxonomic synonyms, additional common names, a small line drawing of the plant), followed by review of the significance of the tree in traditional lore, a brief botanical description, an enumeration of ecological requirements, and information on propagation, planting, production methods, and main uses. Small color photographs accompany this text for each species. The book concludes with a glossary of 50 cultural and botanical terms (e. g., atol (corn drink), Ixquic (princess in Popol Vuh), Kaqchikel (Mayan language), mycorrhiza), a bibliography with entries up through 1996, and an index.

This book has many things to recommend it. It's a quick introduction to one of the world's great agricultural systems, one with tree crops mentioned prominently in its surviving literature, a review not readily obtained elsewhere. The taxonomy and technical descriptions are accurate. Many of the photographs are excellent. The inclusion of propagation and production data is something that for tropical plants is often buried in technical publications and yet should be emphasized to the public if wise management of forest resources is to be practiced. The authors have chosen species to represent the breadth of forest habitats in the country (fir from high elevations, cacao from the humid lowlands, black calabash from the drier forests), and also species that occur widely in Mesoamerica and are thus likely to be familiar to residents of Mexico and other Central American countries as well (or even temperate North America—*Liquidambar styraciflua*!).

And yet I opened this lavishly produced coffee table-

sized (9.5 x 12") book for the first time hoping for much more. The small number of species included somehow does not capture the ethnobotanical richness of the region, when with minor embellishments it might easily have done so. For example, the account of cacao (*Theobroma cacao*) begins with a passage from the Popol Vuh that mentions the plant pataxte. What's never mentioned is that pataxte is a second species of *Theobroma* (*T. bicolor*) of regional ethnobotanical importance. A third species, *T. angustifolium*, figures in Guatemalan recipes as well. For very little more text a good deal more information might have been presented.

A few more sources might have been included in the bibliography. Two particularly surprising omissions were Standley's monumental Trees and Shrubs of Mexico (Standley 1920—26) and Pennington and Sarukhán's (1968) Arboles tropicales de México, the former in particular containing a wealth of ethnobotanical information. In general the book seems "disconnected" from the literature, perhaps because of its focus upon empirical observations of the plants as they occur in Guatemala, but inclusion of such references would have extended the usefulness of the work: the reader might be referred to Morera (1982), for example, for more information about *Pouteria sapota*, or to Kunow (2003) for more information about medicinal uses of plants in the region.

-David Johnson, Department of Botany-Microbiology, Ohio Wesleyan University, Delaware, OH 43015

Carolus Clusius. Towards a cultural history of a Renaissance naturalist. Florike Egmond, Paul Hoftijzer and Robert Visser [eds.] 2007. ISBN 978-90-6984-506-7 (Cloth US$75.00) 349 pp. Koninklijke Nederlandse Akademie van Wetenschappen, Amsterdam, Netherlands.

The book is divided into four parts (see below), each of which consists of 2–4 essays written by specialists with mainly history of science backgrounds. It is a collection of "interdisciplinary essays" [cover text] which are the outcome of a workshop ("Clusius in a new context") held at the Scaliger Institute in Leiden 2004 and which are largely based on the papers presented at this conference. As such the book highlights selected aspects of Clusius' life with a clear focus on his correspondence and the broad cultural background. Botanical information is rare and not the main emphasis of this book.

The preface of the book highlights the crucial importance of Carolus Clusius or Charles l'Eclusé (Arras 1526 – Leiden 1609) as a "key figure ... in the innovation of botanical sciences" (p. 1) and that "no major historical study has been devoted to Clusius during the past 60 years" (p. 3). Therefore the present attempt to change this situation must be highly appreciated. Because of this lack of recent and easily accessible works on Clusius it would have been good, to start this volume with some in-depth biographical notes. Without this information the reader who is not already familiar with the famous scientist will get biographical information only scattered (and incomplete) throughout the book. A very brief (and also not complete) biography can be found on the internet (http://www.clusiusproject.leidenuniv.nl)

The text is illustrated with 56 b/w illustrations, of which 17 are given additionally as color plates in the middle of the book. Some of the figure legends are rather scanty. For example, Fig. 3 (p. 21): "A beautiful watercolor of a *Clematis* in *Libri Picturati*, vol. A 23, f. 18v." Readers with some botanical interest almost certainly want to know more about the pictured plant. On the sheet it is named "*Clematidis alterius*", a name which we can also find in Clusius (1601; "*Clematis altera*") and which we find again in Linnaeus' *Species plantarum* (1753). Here *Clematis altera* is a synonym for *Clematis viticella* L., a nowadays frequently cultivated and highly ornamental garden plant. The inclusion of this brief information makes Fig. 3 (not only for botanists) much more interesting and valuable. Another oddity is the illustration of identical plates of fungi (Figs. 50a–c, 51a–c) which were copied from the original Leiden Clusius Codex into the Oxford Album (which is an exact copy of the former) and the Brussels Album (in which the identical fungal samples are rearranged). Therefore, six illustrations show only two sets of different fungi, for which again no details are given (the legends only read: "Table 6 in the Leiden Clusius Codex" etc.). Finally, the legends of the color plates 8 and 9 (*Hibiscus rosa-sinensis* L. and *Muscari botryoides* L.) are reversed.

In part I ("Clusius' network and exchanges") the introductory paper ("Clusius and friends: Cultures and exchange of European naturalists") gives an analysis of Clusius' wide and active network with at least 300 correspondents. This network is documented in about 1500 preserved letters of which the bulk are addressed to Clusius and which were archived by him. However, this information reads slowly and the paper starts rather unconventionally with the subheading "Clusius and Darwin". Since Darwin was born almost exactly 200 years after Clusius' death I wondered how he made

it into this Clusius-and-friends-article? What follows is a somewhat forced comparison of the correspondence of the two celebrated scientists. Only later the paper becomes more concrete and analytical about Clusius and his correspondents. However, by focusing on the extant correspondence only, some important friends of Clusius are neglected, such as Johann Aichholz, with whom Clusius undertook fieldtrips to the Austrian Alps and who was Clusius' landlord during most of his stay in Vienna. The following paper analyses Clusius' French connections and it teaches the reader that multilingualism was not only essential for the success of Clusius (he read and wrote in Latin, Dutch, French, German, Italian and Spanish) but that it is still of some advantage to understand more than one language: extended parts of this article are in French without translation. Clusius' time in Montpellier and his exchange with Spanish scholars are further articles in this part of the book. Of particular interest is Josep L. Barona's analysis of Clusius' exchange of botanical information with Spanish scholars. Part II ("Clusius and individual correspondents") focuses on two case studies, the Hungarian Boldizsár Batthyány and the German Henrik Høyer (who is introduced in the preface, p. 4, as "Norwegian Hendrik Høyer"). Part III ("Clusius' translations and illustrations: processing information") gives an idea of how Clusius obtained and disseminated mainly botanical information from the Americas, how he dealt with it in his *Exoticorum libri decem* and how he made use of illustrations. The final part IV ("Ideas and influence of Clusius") was for me the most disappointing part of the book. The first paper deals with Clusius' non(!)-relations with the Italian *Accademia dei Lincei*. The second paper gives a very brief overview of Clusius' Hungarian and Italian relations and the final chapter deals with Clusius' influence on the worldwide efforts of the Jesuits (i.e. the Catholic order "Society of Jesus") to distribute knowledge about medicinal drugs. Since Clusius' work was the scientific standard at that time (sixteenth to eighteenth century), it seems as an obvious necessity that the Jesuits made use of it. However, knowing that Clusius and his family suffered heavily from religious reformation and counterreformation, it appears to me somewhat inappropriate to close the book in this manner. From a botanical point of view, it would have been more interesting to explore how Clusius and his contemporaries influenced the work of e.g. Carl Linné and the birth of modern nomenclature.

This first attempt of a modern approach to Carolus Clusius, his correspondence and contemporaries is partially successful. Further attempts are apparently under way (e.g. a PhD study on Clusius' time in Habsburg Austria) and will hopefully also cover botanical aspects in some more detail (after all, Clusius is regarded as the founder of modern botany). It certainly will be very interesting to track further progress and output from the Clusius Project. Everybody interested in Carolus Clusius, in 16th century science and correspondence will find interesting parts in this book.

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– Gerhard Prenner, Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3DS, UK.

Flora of China Illustrations. Volume 22, Poaceae.
Wu Z. Y., P. H. Raven & D. Y. Hong, eds. 2007. ISBN 978-1-930723-61-0 (cloth, US$140.00) xii + 937 pp. Missouri Botanical Garden Press, St. Louis.

This publication is the 12th in a series of 24 volumes of illustrations that parallel the text volumes of the *Flora of China* (FOC). It accompanies FOC Volume 22, which was published in 2006 and treated 226 genera with 1,795 species in the Poaceae. This volume of illustrations includes 904 plates representing 1,271 species, 24 subspecies, and 50 varieties in 226 genera of Poaceae. The illustrations are arranged according to the sequence of tribes, genera, and species in FOC Volume 22. Latin names of recognized taxa are followed by their Chinese names with the pinyin transliterations. Scale bars are given for about half of the plates.

The family Poaceae was covered in five volumes of the *Flora Republicae Popularis Sinicae* (FRPS), published between 1987 and 2002. Most of the beautiful drawings that were published in FRPS (particularly Bambuseae) are now available in the volume under review. However, for taxa not or insufficiently illustrated in FRPS, this volume also includes many original drawings and illustrations

from other published sources (particularly Poeae). The total number of illustrations in FRPS was somewhat larger, but this is partly due to smaller number of currently recognized species in some genera. For example, 231 species in the genus *Poa* were recognized in FRPS and 127 of them were illustrated. There are only 81 recognized species in this genus in FOC and 44 of them (plus 18 subspecies) are illustrated. Illustrations are, in general, of very high quality, clearly showing inflorescences, spikelets, florets, glumes, etc. Cross sections of leaf blades are included in almost all illustrations of 45 *Festuca* species. Personally, I would like to see more vegetative characters (ligules) in some of the illustrations.

The Flora of China is a monumental international achievement. The editors, all contributing authors, and artists should be congratulated for this milestone in plant systematics!

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

Handbook of Plant Science, Volume 1. (Functional Plant Anatomy, Plant Tissues and Cells, Plant Cell Biology, Plant Growth and Development, Molecular Genetics and Biotechnology) **Handbook of Plant Science, Volume 2** (Evolution, Plant Primary Metabolism, Plant Secondary Metabolism, Photosynthesis, Plants and their Environment, Plants and Other Organisms) Roberts, Keith (ed.). 2007. ISBN 978-0-470-05723-0 (Cloth US$590) 1599 pp. John Wiley & Sons Ltd., The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, England.

This two volume compendium is comprised of over 250 articles extracted from a larger opus, the Encyclopedia of Life Sciences (ELS), now published by Wiley, but first on-line in 2001. The ELS has about 4,000 articles, and is "updated regularly". Thus, the present volume ought to be a snapshot of what was available in a certain range of disciplines on a certain date, sometime in 2007, if one judges by citations in the newest articles.

The editor of this volume is a well known scientist, now emeritus of the John Innes Center in the U.K. There are about 400 contributors, each focusing on their own specialty, with articles varying from 2 - 10 pages in length, averaging about 5 pages of text. Some have no specific citations, only a list of further readings, while others are extensively annotated with more than 20 specific references, and sometimes more general "further readings". This is, in part, a deliberate matter of style, with some articles that provide broad overviews to major topic areas, such as evolution of flowering plants, or plant bioenergetics, and others examining more specialized topic like the shikimic acid pathway of amino acid synthesis or fitness costs of plant disease resistance.

Articles with few specific references, and a limited number of "further readings" are what one would expect of traditional encyclopedia entries. Those with many citations are more like mini-reviews that are commonly published by cutting edge research journals and would be suited only for advanced students and specialists. There are in total 48 pages of color plates tipped into the centers of the two volumes. These repeat illustrations that appear in black and white in the articles, which are well written and produced to a high standard. The exposition is usually clear, although in some subject areas the use of many acronyms is an impediment to easy understanding. No doubt a few errors have crept in but I didn't pick up any big ones. The Handbook, taken as a whole, is probably best viewed as a supplement to traditional textbooks, or for post-graduates to broaden their knowledge outside their own specialty.

There is unavoidably some overlap between individual chapters when a plant is dissected into topical areas of functional anatomy, tissues and cells, cell biology, growth and development, molecular genetics and biotechnology, evolution, primary metabolism, secondary metabolism, photosynthesis, plants and their environment, plants and other organisms. Any such overlap of content is probably essential for articles to make a coherent read in themselves. Most topic areas have 20-30 articles and something over 100 pages allocated, with evolution the shortest section having only 7 articles and a total of 50 pages. Articles are cross-referenced to a limited extent, so that it is possible to follow some topics from one article to another.

The 50 page subject index contains over 1700 entries, fairly well insuring that there are several entries for each article. For instance, parenchyma has 22 subtopics, with 6 of these in articles other than the primary one. On the other hand, "organ primordia", and its subtopic patterning, has no citations outside the primary article. Yet, an entry for "radial patterning" turns up this same article and another, while hand searching through articles on

the meristem turns up still more instances. I would expect that a good search engine going through this same encyclopedia would identify many more overlaps. Such on-line search capability would make this a much more useful collection.

Biochemistry and molecular biology of plants one way and another receive a large emphasis here. This is an area growing so rapidly with application of bioinformatics, that one cannot hope to keep up with it. This book is no exception to that problem. Also, it should be noted that Wiley sells a Handbook of Plant Biotechnology, for a price approaching $1000. So they are unlikely to have put much of their new material into this volume. For instance, just one chapter addresses micro-arrays in a substantial way, and bioinformatics is nowhere in the index. While a description of genetically modified organisms (GMOs) is quite up to date, the article on potential impacts of GMOs is unfortunately an extremely biased, out of date (~1998) view from a strictly European perspective.

The original concept of an online encyclopedia was developed more than a decade ago, and had a long gestation. Looking at the references within each of the articles once can see that the most recent citation for some articles is as long ago as 1994, which means that any progress since that time, may well have gone unnoticed. Of course in some areas there may not be such rapid progress that citing the latest publications is essential, but authors typically tend to pull in a few citations to very recent works, just to make their article look up-to-date. So we may conclude that a fraction of the work discussed here is at least a decade old. For close to 60 % of the articles, the most recent citation is from 2001 when the encyclopedia went on-line. For about 1/4, the most recent citation is in 2005-2007. The years in between are sparsely represented.

The pattern of citation indicates that what we have is in fact two books merged. First came an encyclopedia that went online around 2001. Then there is the product of an updating process, like the yearbooks produced to supplement a classical encyclopedia. Some of these were written relatively recently. Genome sequencing projects are covered briefly through 2006 but the discussion of transgenic plants is about a decade older. Interfering RNA is discussed in an up to date way through 2006 in an article on systemic signaling rather than in the article on gene silencing. The latter, initially written about 2001, has a number of references through 2005 appended as “further reading” with no mention of their relative significance. That is a bit of a dodge that really doesn’t work except for the most sophisticated reader.

Why should I belabor this point? Because I believe that you should know what you are buying. Pulling an article at random, I came upon a review by Daniels and Chrispeels, on aquaporins. It is a well writen, clear exposition, but the most recent citation is from 1998. Since that time our understanding of this specialty has exploded. Those authors had only very vague cryoelectron microscopy images to work with. Now the same technique has been used with a plant aquaporin to gain a better than 4 A resolution (2005) and for a bovine aquaporin a 2.2 A resolution X-ray structure is available since 2004. Recent textbooks (2007) show this structure, complete with mechanistic details. You need only do a quick search of the internet to learn all this.

So, for whom is this book likely to prove useful? Regretfully, I would say, only for those with lots of money and little internet access. One could purchase the past decade of Annual Reviews of Plant Biology with over 200 reviews, current at the date of their publication, for about the same price as the present volumes. Or for teaching, one might buy a couple of good textbooks in botany and plant biochemistry and then use the internet to supplement them more effectively for less money.

True, the example I happened to draw on might be an extreme case, but it might not. It does reflect the difficulty with the traditional encyclopedia model, even when translated to the online world. Few of us like to write revisions of articles, or course notes. We’d rather go on to something new, or use the old ones until they turn yellow and crumble. Keeping an encyclopedia, or text book, current, is a herculean task. Getting authors to revise their reviews is a sisyphian task.

The ELS, with 4000 articles, would have to add 400 new ones per year to have a revision time of a decade. The apparent pace is slower than that, with 300 added during 2007. Searching the on-line version indicates that 55 articles were added to the area designated Plant Science, during 2007. They appear to be included here as part of the 1/4 with recent citation patterns..

A more effective model for an on-line encyclopedia is to discount the access price of older editions, and to update them frequently. This actually has been done for a source that I happen to use in teaching about psychopharmacology. The publishers of that series are in the “fifth generation”, and the fourth, now over a decade old, is available free, at least where I live. Incidentally it is published by Wiley, for a society.

A much better buy than the present volumes for most libraries would be a subscription to the online

version of Handbook of Plant Sciences at some reasonable rate of say $100/yr. That works out to $1000/ decade, higher than the purchase price of this book. But it would assure that new information could be added to articles as needed, keeping them up to date. Or new authors could be persuaded to write new chapters. Unfortunately, the price from Wiley for the entire ELS is close to $3000/yr for an institution the size of mine. For the Handbook, which is 1/15 of the whole ELS it would likely be over $300/ yr, and it is not offered yet on a subscription basis. (The annual subscription price of the Handbook of Plant Biotechnology having about 70 articles and 1500 pages is over $500, indicating that a purchase price for the paper bound version is a "bargain" at under $1000, for it is surely not being revised more often than once in three years.) The present subscription model is clearly not a workable one, or a good buy, for most institutions. But it is hard to see that the present volumes justify their price.

-Lawrence Davis, Kansas State University, Manhattan, KS.

Nature's Palette: The Science of Plant Color. Lee, David W. 2007. ISBN-13-978-0-226-47052-8 (Cloth; US$35, but $23.10 at amazon.com). xvi + 409 pp. University of Chicago Press; www.press.uchicago.edu

The author is a botanist through and through (born in 1942 in the state of Washington, he presently lives in Miami, Florida; throughout the book, there are multiple allusions to his age, his boyhood, and his current home, so it might be helpful to establish these upfront). He is at pains to convey his twin delights in plant anatomy and plant physiology to the non-specialist. He does this very well, indeed.

Were I to start over, I'd read his last chapter first – Chlorophilia, "for the love of green." Professor Lee places himself and the evolution of our species in a color context that is both appealing and convincing. I'll confess I sometimes got lost in the verbiage; for example, the caption for figure 12.6 in this chapter refers to "crown shyness," which I can find nowhere in the text (nor in the index). A brief excursion into the marvels of Google will reveal the meaning. There's also in that figure a graph of spectral distribution of sunlight and shadelight in a tropical rainforest; there is a scale on the left-hand Y axis and an identical one on the right-hand Y axis, but it's not obvious which scale goes with which line (one red, one black) in the graph; the caption warns the reader, "Note different scales," but the scales are identical, except for the words "sunlight" and "shadelight." This figure is referenced way back in Chapter 2, page 45, so it sort of reverberates. Still, the chapter is a delightful one.

Chapter 2, "Light, Vision, and Color," is a primer on elementary optics and physics, written in the same gentle, "let's-explore-this-together" manner as the rest of the book. Figure 2.10 nicely demonstrates the difference between the wavelengths at the outer reaches of the atmosphere versus the wavelengths that actually reach the earth's surface – one can see at a glance why the sky is blue, though the author never makes that point. The lower, surface-of-the-earth curve has some deep indentations in it, colored sort of brown; I haven't figured out what their meaning is, and the caption is mute on the subject.

It is explained at length in Chapter 2 that most color perception occurs in the *fovea centralis* of the vertebrate eye, with 200,000 cones per square millimeter. There is an elegant, full-color sagittal section of the eye, figure 2.12, which shows the fovea but does not label it. Google on fovea and you'll find out more than you ever wanted to know. You may be thinking "There's a lot of googling involved in reading this book." Well, yes. I suspect the problem may have arisen because the author and the graphics people didn't get together as often as they might have. When the author explains the bare elements of DNA transcription and translation, the diagram (figure 5.2) indicates DNA, messenger RNA, ribosomes, etc. But the artist also lettered in sRNA, in addition to mRNA, and neither I nor my molecular colleagues are quite sure what that stands for. There is no mention of sRNA in the text itself. From Google, I infer it might simply be "soluble RNA," a synonym of transfer RNA (most likely guess), or it might refer to "small RNA," which are molecules that may be involved in gene regulation.

The colors of flowers, fruits, stems, and leaves: all are explained with clarity and precision. And it's not all pigments, either – the role of refractive cells is extensively explored. The scholarly apparatus is not ignored. To avoid cluttering the text with parenthetical references or superscripted numbers, Lee elected to gather all these into Chapter Notes and Illustration Notes. "All the facts" are there, sometimes line-by-line, sometimes with reference to larger pieces of text.

One can do no better than to paraphase one of the publisher's blurbs on the dustcover, this one from Peter Raven: "A delightful journey through the joys and complexities of color in plants."

– Neil A. Harriman, Biology Department, University of Wisconsin-Oshkosh, Oshkosh, WI 54901; harriman@uwosh.edu

Books Received

If you would like to review a book or books for PSB, contact the Editor, stating the book of interest and the date by which it would be reviewed (15 January, 15 April, 15 July or 15 October). E-mail psb@botany.org, call, or write as soon as you notice the book of interest in this list because they go quickly! Note that books in green are already in review and no longer available. Books received are now posted on the web site as they become available and may be requested as soon as they are posted. - Editor

The Aliveness of Plants: The Darwins at the Dawn of Plant Science. Ayres, Peter. 2008 ISBN 978-1-85196-970-8 (Cloth US$99.00) 227 pp. Pickering & Chatto, 21 Bloomsbury Way, London WC1A 2TH, UK.

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Plant Biotechnology and Genetics: Principles, Techniques, and Applications. Steward, C. Neal Jr. 2008. ISBN 0470043814 (Cloth US$100.00) 374 pp. John Wiley & Sons, Inc.

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Plants at the Margin: Ecological Limits and Climate Change. Crawford, R.M.M. 2008. ISBN 978-0-521-62309-4. (Cloth US$80.00) 478 pp Cambridge University Press, 32 Avenue of the Americas, New York, NY 10013.

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Student Chapters of the Botanical Society of America

New York

Plattsburgh, New York - State University of New York at Plattsburgh

The Student Chapter of the Botanical Society at Plattsburgh State was originally created to bring students with an interest in botany together. Once organized we realized that botany can be power. Not only can we share ideas and learn from each other, we have the opportunity to get the community involved with botany and science. Our main objective is to work with the community and children, through mentoring and community planting projects, to make people more appreciative and interested in botany. We feel that children are important and are most impacted by experiences with people willing to take on projects with them. We will be going to local schools and working with children K-12, in an attempt to create a community interest in botany as well as a community interest in our chapter.

Missouri

Kirksville, Missouri - Truman State University

Interested in discussing how your group can become involved? Contact wdahl@botany.org or by phone at 314-577-9566. We'll help you come up with a plan for establishing a student chaper on your campus, including member benefits and rates.

Check the BSA web page under "Membership."

BOTANICAL SOCIETY OF AMERICA