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BOTANICAL SOCIETY OF AMERICA

This issue has a little bit of education for everybody! Two years ago Katrina hit the Gulf Coast and suddenly the entire country began to learn about the role of wetlands and wetland loss in South Louisiana. Of course, this is something the natives have known for years. In our first feature we learn about a program, run out of LSU since pre-Katrina, that has school groups growing and transplanting wetland plants to "reroot" coastal Louisiana.

Our second article takes us to the west coast where non-science students at UCLA get some "hands on", "whole plant" biology in the Molecular, Cell, and Developmental Biology Department. "The Green World" provides students with a little bit of the old and a little bit of the new in a format that provides them an awareness of what can be found in the produce section of the local supermarket.

-The Editor

Errata

It seems that the publishing equivalent of a transposable element slipped into Lee Kass' paper, "Landmarks and Milestones in American Plant Biology: The Cornell Connection," in the last issue and deleted individual letters in a number of words. Corrections include: on page 92, "More Notable Botany Departments" section. **relevant** replaces releant; **Director** replaces Diretr, **1913** replaces 113, **and** replaces an, **professorships** replaces proessorships.- - bottom of page 95, last paragraph on left; **after** replaces ater, and **Wellesley** replaces ellesley. A corrected PDF copy has been placed on the web page.

Also, in the review of Rice's "Encyclopedia of Evolution," the reviewer's citation of "Gone with the Wind" should have been "Inherit the Wind."

Coastal Roots: A Pre-college Plant-based Stewardship Program to Connect Students with Coastal Issues

Abstract

The LSU Coastal Roots Program is a sustained pre-college plant-based stewardship program in which students grow native plants in their school-based plant nursery that they will later transplant on a habitat restoration trip. The program integrates both plant and earth science content within the context of a real-world problem, i.e., coastal land and habitat loss in Louisiana, and was initiated to provide a students an opportunity learn about these important issues and have a hand in taking positive actions to preserve and rebuild our coast. Operating in 18 public and private schools in southern Louisiana since 2000, the program has brought nearly 2,000 precollege students (grades 4-12) on 57 restoration trips to plant about 18,000 student-grown plants. Students are involved in every phase of the program, from installing the automatic irrigation system and nursery yard at the start of the program, to planting seeds and propagating grasses, and finally transplanting the seedlings at their long-term partner's restoration site.

Key Words

stewardship, environmental science, pre-college, responsible citizenship, horticulture, habitat restoration

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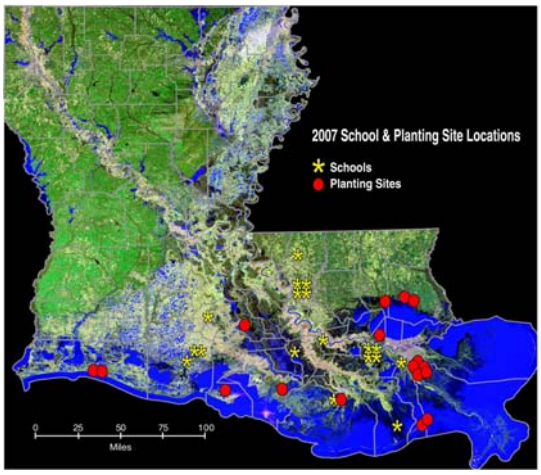
Rationale for the Program

A. Educational Place of Stewardship Projects

The Coastal Roots Program is a sustained pre-college plant-based stewardship program in which students grow native restoration plants in their school plant nursery that they will later transplant in a habitat restoration trip. The program grew out a need to inform students about important issues affecting Louisiana's coastal resources. In 1999, the Louisiana Sea Grant College Program's educational coordinator (the author of this paper) met with LSU wetland and fisheries specialists to discuss how to unite independent efforts to help students grow restoration seedlings into a single project. With the help of a LSU College of Agriculture horticulture professor the group began assembling an outreach program that combined the learning of geological and horticultural science with information on critical coastal issues in a hands-on stewardship project involving student-grown and transplanted native plants. The *LSU Coastal Root (CR) Program* was born. Today, the *CR Program* currently operates in 18 schools in ten parishes (counties). Participating classes are from grades 4-12 and from both public and private schools. School involvement takes many forms, from formal science classes to extracurricular environmental and science clubs to agriscience classes.



B. Louisiana's Situation

Louisiana is losing its coastal land at an alarming rate. Between 1978 and 2000, Louisiana lost 658 square miles (1,704 square kilometers) of land, representing almost half the land area of the state of Rhode Island, with an annual loss rate for this period at nearly 30 square miles (77.4 square kilometers) per year. Future land loss (2000-2050), with consideration for existing restoration projects and diversions, is projected to be 513 square miles (1329 square kilometers), with an annual loss rate of 10.26 square miles (26.6 square kilometers) per year (Barras, et al, 2003).

Land change in Louisiana is the result of a number of both natural and human impacts (Louisiana Coastal Wetlands Conservation and Restoration Task Force, 2003). The leveeing of the Mississippi River reduced and mostly eliminated the replenishment of sediment to the marshes and instead shuttled these sediments into the Gulf of Mexico. Furthermore, the levees served to shuttle the sediment load of the Mississippi River into the deep waters of the Gulf of Mexico, rather than the natural distribution and replenishment that had been in place through a myriad of distributaries into the coastal marshes. The natural subsidence of old Mississippi River delta sediments also accounts for some of the land change. Other impacts include salt water intrusion, herbivo ry (e.g., by invasive species - nutria, *Myocastor coypus*), alterations to the natural hydrology of coastal wetland systems, storm impacts, dam building up-river, oil and gas exploration and canal dredging, and harvesting of wetland forests. Most recently, hurricanes Katrina and Rita in 2005 resulted in an estimated land loss of 217 square miles (526 square kilometers) (Barras, 2006). These two storm events represent nearly half of the projected net land loss for 2000-2050.

The coastal land loss in Louisiana has serious state and national economic ramifications. Louisiana is the largest producer of shrimp, oysters and blue crab, with a fisheries industry valued at over $2.85 billion. Over 40,000 residents earn their livings through work related to the wetlands or in the fisheries industry. Louisiana brought in more than $10 billion dollars during 2004 (pre-Katrina) in the tourism industry. In terms of oil and gas, Louisiana ranks first in crude oil production and second in total energy production, natural gas production, petrochemical production, and refining capacity. The oil and gas industry employs more than 42,000 men and women at a cost of $2.7 billion dollars. Sugar cane, an agricultural crop found mostly along the coastal plain has an annual economic impact of $1.7 billion dollars (Bourque, 2007). Despite the obvious value of these commodities to the nation, convincing the nation to invest in saving these fragile coastal lands has been a long and arduous process.

Given the coastal land loss crisis and the importance of these lands to the economic well-being of both Louisiana citizens and the nation, the Coast 2050 Executive Summary (Louisiana Coastal Wetlands Conservation and Restoration Task Force, 1998) gives a clear call to action, “Stewardship requires us to care for and nurture what we have and what we are given. For the coast of Louisiana to survive, we must change the way we do business” (p. 11). The *CR Program* was initiated to provide a sustained hands-on school-based stewardship activity that offers students an opportunity learn about these important issues and have a hand in taking positive actions to preserve and rebuild our coast.

Structure of the *CR Program*

The primary goal of the *CR Program* is to assist students in developing an attitude of stewardship toward our natural resources and to provide an active learning situation in which they can explore strategies for sustaining our coastal habitats. Three objectives align with this goal: (a) to conduct an on-going school-based nursery program involving the growing and restorative transplanting of native plants, (b) to develop in students an attitude of stewardship toward natural resources, and (c) to provide teachers and students with instruction on relevant issues such as ecological stewardship, wetlands functions and values, habitat restoration and conservation, as well as basic geology and horticulture skills.

The program components were developed based on a desire to make the program both as hands-on as possible and as meaningfully integrated into school subjects as possible. The program components include school-based plant nurseries, restoration planting trips, teacher professional development, and supporting program materials. The *CR Program* involves a one-time start-up expense of about $1,250 for the can yard and irrigation system materials. Annual expenses of about $200-300 cover materials such as planting media, fertilizer, seeds, and miscellaneous gardening supplies. The annual restoration trip generally costs about $300-500, and includes the cost of the school bus(es), substitute teacher, drinks and snacks, and miscellaneous equipment.

A finished LSU Coastal Roots can yard. One year old cypress seedlings are in the yellow cells; two-year old cypress and wax myrtle are in the black one gallon tree pots.

School-based plant nurseries

When schools join the program, the first task is to have the students help install their plant nursery, which is contained within a 10’x10’ area on school property. This involves digging trenches for irrigation lines, helping to assemble the irrigation system, installing gravel and a groundcover cloth, and assembling a dog kennel to keep stray dogs, balls and children out of the nursery area (Coleman and Bush, 2002; Bush and Blanchard, submitted). An automatic irrigation timer is fitted into the system to facilitate daily watering, as well as watering over school holidays and summer vacations. The teacher

Middle school students help LSU Coastal Roots staff dig the trench for the irrigation system.

and school staff check the irrigation system once or twice a week during the summer to insure that it is working properly and that the plants are receiving sufficient irrigation.

In the early spring, students clean and sterilize reusable plant cells and trays using bottle brushes and a mild soap/bleach solution. Then they plant their seeds in the plant cells filled with planting media. Each plant nursery is outfitted with 980 plant cells that are held in 10 trays. These trays are placed in the plant nursery and students monitor the germination of their plants. After about a month, students begin adding small amounts of fertilizer to

Environmental club students planting cypress seeds.

the cells to enhance plant growth. In the fall, the students continue to monitor seedling growth, pull weeds, and fertilize the plants on a monthly basis until it is time to transplant them in their new habitat.

In 2006-7, each school was partnered with a long-term restoration site. Restoration sites range from state parks, hurricane protection levees, city parks, conservation areas, wildlife refuges, to private property. The restoration site partners agree to allow students to access their property in order to transplant their seedlings, to monitor and help sustain the newly transplanted seedlings, and to help the partner school teacher and students understand the need for the particular seedlings that were requested by the restoration site manager. The current list of native plants growing in the *CR Program* school nurseries includes black mangrove (*Avicennia nitida*), bitter panicum (*Panicum amarum*), ?southern waxmyrtle (*Myrica cerifera*), ?hackberry (*Celtis laevigata*), ?smooth cord grass (*Spartina alterniflora*), ?southern baldcypress (*Taxodium distichum*), ?live oak (*Quercus virginiana*), ?long leaf pine (*Pinus palustris*), ?loblolly pine (*Pinus taeda*), and ?swamp red maple (*Acer rubrum*). Since Louisiana is in one of the main migratory bird flyways in the United States, many of the chosen seedlings fulfill specific food or habitat needs of some of the migratory bird species. Ultimately, the goal for the restoration partnership is for the teacher and students at the school to communicate with the site manager on a regular basis so that they can jointly determine what species of seedlings would best fill the needs at the site in the coming year.

As students ready for their transplant trip in the fall, they will retain about 200-250 trees in their school nursery. These selected seedlings will be “bumped up,” or transplanted, into one-gallon tree pots and grown in the school nursery for an additional year. This extra year of nursery growth ensures a stouter seedling for transplanting the next year – one that will better withstand the rigors of growing in the wild. Thus, after the first year in the program, most schools are transplanting about 300 one-year-old seedlings and 200-250 two-year old seedlings on their fall restoration trip.

Plantings at partner restoration sites

Once a year, generally in the fall or early winter, students transplant the plants they have grown to their partner restoration site. This restoration planting trip generally lasts a full school day, sometimes longer, depending on the distance students have to travel to get to the transplant site. When students arrive at the restoration site, they are instructed about how to properly plant their seedlings, including how to use a dibble and fertilize their seedlings. Students are divided into planting teams, given a bag of slow-release fertilizer and a shovel or dibble, and are sent off to plant their seedlings. In addition, some teachers have students collect data on their newly transplanted seedlings, such as seedling diameter, height, and GPS

A middle school student unloadfing one-year old cypress seedlings at a restoration site.

coordinates. In areas with large populations of nutria and beaver, students install plant protectors to help guard small seedlings. Some restoration sites physically mark areas where seedlings need to be planted with flags, others have personnel on hand to direct the student planting teams. While

most of the plants are grown by the students, *CR Program* students have also helped plant seedlings donated by landowners, the LSU AgCenter, as well as seedlings purchased through school grants.

Part of the planting experience is a tour of the restoration site to learn from the site manager why the site needs assistance and how the specific plants transplanted that day will help restore the habitat at the site. Some of the many ways the student-grown seedlings benefit their planting site partners include helping to stabilizing levees, reforesting wetland preserves and damaged areas from runoff and construction, beautifying areas, replacing invasive vegetation with native plants, reclaiming wetlands that have been drained for agriculture or crawfish ponds, and providing food resources and nesting habitat to local and migratory wildlife species.

Middle school students planting bitter panicum along a badly eroded beach in Cameron Parish

Middle school students planting *Spartina alterniflora* on a hurricane protection levee in Terrebonne Parish

CR Program seedlings have been transplanted in a variety of habitats, including salt marsh, swamp, bottomland hardwood forests, bayou banks, and levees. These habitats can be found in a variety of locations, such as hurricane protection levees, state parks, National Wildlife Refuges, nature preserves, private lands, botanical gardens, wetlands reserves, boat landings, local parks, and zoos.

Supporting CR Program Materials

Information necessary to successfully carry out this type of stewardship program with students is not typically found in text books, and thus, it quickly became apparent that teachers would need access to a wide variety of supporting program materials. These materials range from lesson plans, to a handbook on installing and running a school-based nursery (Coleman and Bush, 2002), fact sheets about plants and specific coastal issues, as well as a multitude of "how-to" information sheets ranging from how to set the irrigation timer to how to bump up one-year-old seedlings. The most expedient and economical way to distribute these materials is via a website.

The *LSU Coastal Roots* website (http://calvin.ednet.lsu.edu/~coastalroots/) accomplishes a number of important tasks. It is one of the primary means of communication with the teachers, students, and families participating in the project and serves as a source of information for those interested in becoming affiliated with the program. The website makes available a list of current schools, a newsletter archive, nursery instructions (e.g., seed preparation and nursery production, fact sheets on selected plants, can yard and cold frame information), teacher information (e.g., grant possibilities and information on the Louisiana Wetland Education Coalition listserve), event calendar, helping hands (acknowledgements of individuals and organizations that have helped the program and individual schools be successful), newsflashes (copies of newspaper articles about school accomplishments in the program) and lesson plans. Occasionally, teachers will have students produce PowerPoint presentations on topics that are of use to others in the *CR Program*. These student-produced materials are also posted on the website and are testimony to some of the learning outcomes these students are taking with them by participating in the program.

Coleman and Bush, in *Putting Down Roots* (2002), introduced the concept of stewardship restoration projects, described the basic decisions that have to be made (including funding sources, what to plant, and where to get seeds), how to build a school nursery (with complete instructions and photos), how to grow and care for seedlings, and how to transplant seedlings at a restoration site. New teachers entering the program are given a copy of this short handbook to help explain what will happen as they progress through the program.

Standards-based lessons and activities are available for teachers to integrate the *CR Program* with the science concepts required by the state science curriculum. The lessons strive to be hands-

on and cover issues about wetlands and coastal restoration (typically found in middle and high school earth science courses, as well as high school environmental science courses) and horticulture (typically found in middle school life science courses, as well as high school biology courses). These lessons are posted on the *CR Program* website (URL above).

Teacher Support

Teachers have many responsibilities, especially in light of the high stakes accountability environment currently in place in the United States. Thus the program resources discussed above are critical support components if the participating schools are to be successful in the program. The most successful schools in the *CR Program* have full

Two teachers"bumping up" one year old cypress seedlings into gallon tall pots.

support of their administrative staff and usually more than one teacher involved in the program. Each year, two professional development workshops are organized for the participating teachers. The summer institute is two days in length and is held immediately after school is dismissed for the summer. This workshop covers critical issues such as the current status of land loss in Louisiana and how to help students manage a successful seedling nursery. The institute includes a number of fieldtrips to highlight specific issues that are discussed during the workshop, such as land loss and restoration efforts. Hands-on training is also an important component of this workshop and includes activities such as on how to troubleshoot irrigation timers or bump up one-year-old seedlings. Perhaps most importantly, teachers have time to talk and share with one other how they integrate the *CR Program* into their existing courses. Institute staff have found that these formal and informal exchanges allow teachers to teach each other how to run a successful program. A second professional development workshop occurs in mid-January. At this one-day Saturday workshop, participating schools share updates on their nurseries, lessons and nursery management ideas, and pick up planting media and seeds for their spring seed planting.

Technical Support

Technical support is key in helping the teachers successfully manage their school programs and begins with the can yard installation at the school. It continues throughout the program in the form of troubleshooting of plant and irrigation system problems, which includes posting useful information on the program website as well as monthly visits by program staff to the schools to ensure that the seedling nursery is weed-, pest-, and irrigation-trouble free. *CR Program* staff also help facilitate the conversation between the teacher and the long-term planting site manager with regard to the plant selection and transplanting trip details. Staff often accompanies the schools on their restoration field trips, and the program loans out shovels, dibbles and other transplanting tools for these field trips. *CR Program* personnel write all the program information that is posted on the website and edit teacher-written lessons for science content accuracy and pedagogical content. Another aspect of the technical support is securing ongoing funding for the program. Grant writing is an important function provided by the *CR Program* staff. More than $175,000 in funded grants since 2000 has supported the program. Staff also assist interested teachers in learning how to write grants to support their individual nursery programs.

Project communication is as important as technical support. Project communication includes newsletters, school visits by Coastal Roots staff, and emails. Newsletters are written by Coastal Roots personnel four to five times over the school year and include timely reminders of information teachers need in order to successfully help students manage their plant nurseries. Also featured are school nursery news articles, which are often written by student authors that describe recent events the schools have participated in. The newsletters contain photos from the events and are a way of encouraging schools to communicate with *CR Program* staff about their accomplishments with the program. Newsletters are sent by mail to teachers, principals, superintendents and supporters of the program. They are also sent by email as PDF files to teachers and principals and are posted on the *CR Program* website for public viewing. As mentioned previously, monthly school visits are made by program staff, with the purpose

of accomplishing two objectives: (1) make sure that the can yard is operating properly and that there are no visible problems, and (2) provide a face-to-face opportunity for the teacher to ask any questions they might have about the program.

Research

Two LSU Master's theses, one in horticulture (Karsh, 2004) and one in education (Somers, 2004), have been based on the *CR Program*. Ongoing research is being conducted by this author on the nature and value of stewardship projects.

Benefits of Fostering Stewardship

The *CR Program* combines science with hands-on opportunities to make a difference. Students in this program learn science by actually doing science. They use plant biology, botany, math and geology skills, and also learn about how the culture of south

A middle school teacher participating in a demonstration planting of bitter panicum on Grand Isle during the Summer Institute

Louisiana is intertwined with and tied to the spaces and places of the coast. Students take ownership of their nurseries, participate in a restoration planting trip that benefits not only themselves but the broader community, and come to realize that they too can make a positive difference. They have the satisfaction and pleasure of seeing the products of their labor being put to good use.

Teachers participate in the *CR Program* for a variety of reasons. Some participate because it makes learning science and math relevant and connects these subjects to serious current issues in Louisiana. It provides a way to integrate a variety of subjects, including math, science, history, civics and geography. The technical support is helpful and the teachers are not left to fend for themselves when it comes to troubleshooting problems or figuring out the best way to teach a particular point. In addition, they can take their students on a restoration planting trip that emphasizes stewardship of natural resources.

In the long run, Louisiana benefits from this project in a number of important ways. The habitats that are the beneficiaries of student-grown seedlings are improved. Students, their families and teachers, become better informed about critical issues facing the residents of Louisiana, especially those issues facing citizens living within the coastal zone. Through the *CR Program* students have had a positive model of how to be a responsible citizen and a better steward of the environment in which they live. It is hoped that this experience will carry over to the places where they choose to live as adults and that they will continue to take action based on an awareness and knowledge of environmental issues.

Highlights of the program

Students in the *CR Program* have been working hard to rebuild or preserve the landscape of south Louisiana. From 2001-2007, *CR Program* schools have involved more than 1,930 students in grades 4-12 in 57 planting events at 25 locations across the Gulf Coast of Louisiana (Table 1). The students, representing 21 schools in 11 parishes, have transplanted 10,283 shrub and tree seedlings, and over 7,660 grass plugs.

CR Program staff and supporting administrative departments at LSU have assisted schools in getting positive news media coverage of student restoration plantings. Many of the participating schools have been featured in the local newspaper and on the evening news. Several schools have had more wide-reaching opportunities to share what they are doing to restore the Louisiana coast:

- Grace King High School students were featured in a National Geographic's TV program entitled *EarthPulse* (2002)
- Montegut Middle School students were featured in the *EstuaryLIVE* video on Elmer's Island (2002)
- Coastal Roots students were invited to visit with Christy Todd Whitman, EPA Director, on her visit to Thibodaux, LA (2003)
- Lafayette Middle School students were featured in *Southern Living Magazine* (summer issue, 2007) doing a restoration trip Fifi Island (near Grand Isle, LA)
- Montegut Middle School students participated in the IMAX production of *HURRICANE!* (2005)
- *CR Program* was awarded the 2003 Gulf of Mexico Program's Gulf Guardian Award (2nd Place).

Table 1. Summary of *CR Program* school participation and restoration plantings

	2001	2002	2003	2004	2005	2006	2007	Totals
Total schools in program	8	14	15	14	14	17	18	n/a
# schools planting	8	13	9	9	8	2	4	n/a
# students planting	227	415	365	409	240	136	141	1933
# plantings	9	13	10	10	8	2	5	57
total plants	1963	1979	2464	1837	2770	580	6350	17943
# shrub seedlings	1963	1979	2464	1757	940	580	600	10283
# grass plugs	0	0	0	80	1830	0	5750	7660
total # plant species	3	3	5	8	4	1	4	n/a

Partners and Support

The Louisiana Sea Grant College Program began the *CR Program* and provided staff time and funding during its first six years. During this time, additional funds supporting the program came from the Barataria-Terrebonne National Estuary Program, the Coalition to Restore Coastal Louisiana through a Restore America's Estuaries grant, and the Coastal Impact Assistance Program for Terrebonne and Lafourche Parishes. In 2006, the program transferred over to the main LSU campus, with several LSU units contributing staff time and expertise to the project, including the LSU Department of Educational Theory, Policy, and Practice, LSU School of Plants, Soils and Environmental Science, and the Louisiana Sea Grant College Program/LSU AgCenter Research and Extension. Both the Louisiana Sea Grant College Program (2000-2006) and the LSU College of Education (2006-present) have contributed expertise in media relations. The LSU College of Education and the LSU Foundation are actively working to identify sustainable funding sources to expand the program to additional schools and sustain it into the future.

The Louisiana Office of State Parks has offered its parks, some of which were severely damaged by the 2005 hurricanes, as long-term planting sites for our schools. Besides providing access to students and teachers on the restoration planting trips, their education staff will work with their partner schools to help students understand how their good work will help the park recover. This partnership will provide schools with an opportunity to track survival rates of previous planting years and opens a whole new area of investigation for participating schools.

Summary

The *LSU Coastal Roots Program* integrates science in a meaningful way with current issues of living on a fragile coast. The program offers an avenue to help make students aware of the issues affecting our coastal zone, builds scientific knowledge about some of the ways these issues are understood and addressed, and provides a meaningful way for students to take responsible action based on that awareness and knowledge. The most successful school nurseries are those in which the principal and teachers understand these connections and are willing to provide watchful oversight of the program and plant nursery. *Coastal Roots* staff provide scientific and pedagogical expertise in support of the students and teachers in the program. The program helps he students will make a real difference by "planting one seedling at a time".

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The Green World: Plants for Now and the Future

Teaching plant biology in a research university, particularly one with a strong emphasis on biomedical research, is a tremendous challenge because plants often get short shrift in non-agriculturally orientated universities. This was the challenge that the late Phillip Thornber and I decided to undertake in 1991 when we debuted a general education (G.E.) course (MCDB80) for non-majors entitled "The Green World: Plants for Now and the Future". The course structure entailed two lectures of 75 minutes each and a 2-hour laboratory course per week, and hence no more than 45 students could enroll per offering. We taught the course every year and it was always enrolled to capacity. Over the years, a wide variety of students ranging from engineering majors to art students took the course, and each year we incorporated new concepts and ideas into our lectures. We covered biochemistry in terms of cooking (denaturation of protein by whisking or frying eggs, etcl), talked about the principles of genetic engineering as well as the promise and controversy of genetically modified organisms, and described the origins of agriculture and use of plants in medicine. All of this was presented in a basic botany framework (the text was Brian Capon's "Botany for Gardeners") with a bit of emphasis on molecular biology because the course was offered by the Molecular, Cell and Development Biology department. The students took the usual exams and we required a final paper, which could be on any topic the student chose, as long as it had something to do with plants. The papers were as variable as the different student majors. There were the usual papers on marijuana, chocolate, and various fruits and vegetables. However, to this day, I particularly remember several student papers. Some of the most memorable included a paper on the perfect martini (after all, the components come from plants!), traditional Mexican plants used in the treatment of diabetes, a tree that produced 5 different kinds of citrus as a consequence of grafting, and the language of flowers in poetry.

From the beginning, Phillip and I envisioned that the students in the laboratory section would plant a garden at the start of the 10-week quarter session and then harvest the "fruits" of their labor (mostly radishes and lettuce) during the last laboratory period. We reasoned that the vast majority of Southern California young people, particularly those that were city- or suburban-raised, did not have the experience of planting a garden and producing their own food. In addition to the gardening project, we organized "classical" laboratories in which the students elicited tumors on carrot pieces to demonstrate that *Agrobacterium tumefaciens* transformation (a.k.a. genetic engineering) was a natural phenomenon and a lab where they studied the details of environmental effects on transpiration. We also taught the students how to graft scion to stock and how to air-layer plants as well as how to make cuttings using commercial rooting preparations. In addition, organized labs on seedling and plant anatomy, responses to plant hormones, and flowers and fruits were scheduled. Phillip and I wrote our own laboratory manual. In 1996, Phillip passed away and I took over the course myself, and more or less kept the same lecture and lab structure that we established in 1991. However, I taught it every other year because of increased teaching responsibilities in courses directly related to the MCDB major.

Everything changed when our small MCDB80 garden plot was slated to become engulfed by a new Biomedical Sciences Building. We not only lost our garden space, but also our 50-year old greenhouse, where the students learned basic plant propagation and grafting methods. Luckily, funding was obtained for a new Plant Growth Center, which opened in 2004, but the surrounding land was a war zone due to the construction of the PGC. Sadly, some of this land, which had been used as an outdoor growing space for research plants, was part of the Mildred E. Mathias Botanical Garden. Being a long-time member of the BSA (since graduate school in the 1970s), I am an avid reader of the Plant Sciences Bulletin, and one day I came upon a notice about the Stanley Smith Horticultural Trust regarding funds for helping Botanical Gardens. Fortunately, we were successful in obtaining these funds and thus developed the damaged land into a student garden consisting of raised beds, fertile soil, and a drip watering system. From this moment on, gardening became an even bigger event in the life of MCDB80.

I knew that course was a success because students contacted me months in advance before the quarter began. From the grapevine, they heard about a class where they could learn not only theory but also practical aspects of plant biology. However, a big reason the course has been successful is because of the teaching assistants involved with it. MCDB80 has been extremely fortunate because of the dedication of its teaching assistants. Two in particular, Nancy Fujishige, who won a teaching award from the MCDB Department because of the rave reviews from the MCDB80 students, and Peter De Hoff, a current Ph.D. student in my lab, especially stand out because of their enthusiasm and dedication. This year, Peter introduced into the laboratory section a comparison of non-genetically modified versus transgenic corn to show the students the effects of insect predation on the two varieties. The students also planted teosinte in their garden to see how the "mother of maize" differs from current corn varieties. All in all, Peter is very much the organic gardener, and as part of his approach to gardening, he waged a war against the UCLA squirrels by planting catnip in hopes of attracting the UCLA feral cats to deal with the resident population of rodents. Unfortunately, UCLA feral cats have other fish to fry and hence we have relied on such traditional methods as adding chili peppers to the plant beddings to repel the voracious squirrels. The battle lines are still drawn—humans versus squirrels—but with the end of the quarter drawing near, it looks as though the students will have a pretty good harvest although the corn and teosinte are a long way from maturing. The squirrels may win in the end.

This past year, I changed the course one more time because it was becoming more and more difficult to justify teaching a G.E. class of only 45 students. Most MCDB G.E. classes at UCLA have hundreds if not thousands of students. The only way it would be possible to increase the enrollment was to eliminate the laboratory section and change it into a one-hour discussion section. This meant that twice as many students could enroll because instead of 3 two-hour labs, there would be 6 one-hour discussion sections. Hence, as a transition, we eliminated all but the grafting laboratory and dedicated one hour of the 2-hour laboratory period each week to gardening. The other hour was used to read and discuss Michael Pollan's book "The Omnivore's Dilemma". Fortunately, many of the topics I covered in my lecture are addressed in the book, so the students were able to get many lecture concepts reinforced. The students were divided into groups and presented two, at the most three, chapters from the book per week in a PowerPoint presentation. They also had to expand on some of the concepts, for example, on mycorrhizae for the gathering of fungi chapter, on the Haber-Bosch process for discussions of fertilizer. I attended all but two of the student presentations and was impressed not only by their sophistication, but also by their enthusiasm. I was also impressed by the differences in the three lab sections, with reference to the discussion of the chapters and their impressions of the book. We are not all alike in LA-LA land.

The idea for the future offering of this course was to eliminate the gardening aspect of the laboratory and use the one-hour time period for discussion of topical books. However, it became clearer to me over the last several months that majors in MCDB also have a need for courses, and I had to choose whether to teach a laboratory course in Plant Biology for our majors or continue with teaching the non-majors G.E. I opted for the former. Part of my decision rested on the fact that fewer and fewer graduate students at UCLA have either the training or desire to serve as teaching assistants for MCDB80, a non-majors course. Currently, I am thinking of ways to utilize the garden space for the majors' course employing it from more of a research perspective. This too will be a challenge especially with the current emphasis on more "-omics" type of science. Nevertheless, I regret the end of MCDB80. Teaching almost 500 non-biology majors over the last 16 years the marvels of plant biology from a variety of perspectives has been an incredible experience. I hope that the students had as much enjoyment and learned as much from this course as I have.

Acknowledgements
In addition to the numerous students and teaching assistants who have been involved in MCDB80, I am especially grateful to the Stanley Smith Horticulture Trust for funds to establish the student garden.

Ann M. Hirsh. Professor of Molecular, Cell, and Developmental Biology and the Molecular Biology Institute, University of California, Los Angeles.

News from the Society

From the Office

If you haven't done so yet, please take a few minutes and renew your membership and contact information online at https://payments.botany.org/joinbsa/. I'm pleased to note we did not increase fees for 2008. Emeritus/Emerita members, remember, membership fees in the Society have been waived. We encourage you to maintain your sectional affiliations.

We are asking all members to run through the renewal process. We'd like to ensure your contact information is up-to-date. Over the coming year we will be asking you to vote and/or comment on developments within the BSA.

Invest $10 in the future – give a gift with meaning, BSA student and associate memberships - https://payments.scientific-conference.net/giftmemberships.php.

Bylaws

With the introduction of the office in St. Louis in 2002 and the move to a professional staff supporting the efforts of the Society, we have moved beyond what we currently have in place for governance in our bylaws. This is compounded by changes in non-

profit law and the introduction of the Sarbanes Oxley Act during the same year. In 2006 the Executive Committee opened discussions regarding an update of our bylaws in an effort to become compliant with the Act. In Chicago, Pam Soltis appointed a committee including Past Presidents Ed Schneider, Judy Jernstedt and Scott Russell plus student representative Andrew Schwendemann and Bill Dahl to complete the task. During the coming year you will be asked to ratify the changes.

Strategic Planning

In 2001 we undertook a strategic planning exercise that led to the formation of the BSA office and staff team. Other outcomes include continued development of our educational outreach (PlantingScience & web updates), additional support for our scientific meetings & award structure and relationship building with like-minded organizations. In Chicago, Pam also appointed a committee to re-engage the membership in strategic planning over the coming year. The committee includes: Pam Soltis; Karl J. Niklas; Christopher Haufler; Brent Mishler; Gregory Anderson; Simon Malcomber; Mackenzie Taylor; Gordon Uno; Janice Coons; Kent Holsinger; Muriel Poston; Theresa Culley.

Mentor recruitment, training, and compensation efforts will step up as a result. The award will support critical new program elements of teacher preparation during summer workshops and research on classroom implementation conducted by Co-PI Carol Stuessy at Texas A&M University. Over the last couple of years, BSA-member contributions have made PlantingScience a program that NSF considers a promising, innovative approach to improving science literacy. Thank you for your efforts thus far. The fun is only yet begun!

The 3-year Information Technology Experiences for Students and Teachers (ITEST) project ($900,000.00) is a collaboration among the BSA, BioQUEST Curriculum Consortium, and Texas A&M University. The PlantIT Careers, Cases, and Collaborations project will leverage the strengths of BioQUEST and PlantingScience to provide secondary teachers and students with collaborative learning experiences in plant biology. The project will offer two phases of engagement. Plant IT Cases will offer investigative cases integrating technologies used in the study of plant biology and in 21st Century workplace applications. Plant IT Collaborations will offer capstone opportunities for online classroom collaborations. Texas A&M will also host the ITEST summer teacher institutes and student camps beginning this summer.

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.

PlantingScience—BSA-led student research and science mentoring program

National Science Foundation supports two BSA-led projects — The BSA is lead organization on two National Science Foundation grants awarded through the Division of Research on Learning in Formal and Informal Settings (DRL). Through these projects the Society will address a core objective of providing improved education about plants.

The 5-year Discovery Research K-12 (DRK12) project ($1,600,000.00) supports overall development and delivery of PlantingScience to secondary teachers and students across the nation.

August Inquiry Retreat Sponsored by Monsanto Fund — August in St. Louis: the air is heavy and thoughts run deep. It is a great time of year for a PlantingScience writing retreat. Thanks to the Monsanto Fund ($80,000.00) we brought together plant scientists (**Larry Griffing**, **Marshall Sundberg**, **Gordon Uno**, **Paul Williams**), high school teachers (**Valdine McLean**, **Toni Lafferty**, and **Jane Metty**), and science education specialists (**Ethel Stanley** and **Carol Stuessy**) to develop new plant investigations. Materials on genetics, respiration, and growth are in the works now, with alpha classroom testing this winter.

Next year we will host another writing retreat. We invite you to contribute!

Introducing the 2007-2008 Master Plant Science Team — Members of the Master Plant Science Team (MPST) are compensated for their commitment to mentor 4-5 student teams in both the fall and spring PlantingScience sessions. The 2006 inaugural team was a rousing success. Many thanks to BSA members **Rebecca Anderson**, **Kandres Halbrook**, **Donna Hazelwood**, **Kate Hertweck**, **Sonja Maki**, **Mark Mort**, **Ely Huerta-Ortiz**, **Mackenzie Taylor**, **Teresa Woods**! Their mentoring insights and extra efforts took

PlantingScience to new heights, showing the value of a trained and compensated mentoring team comprised primarily of young scientists.

The 2007 MPST expanded to members sponsored by both the Botanical Society of America and the American Society of Plant Biologists. This joint sponsorship represents a new level of partnership among plant organizations, which we hope to see expand as the program grows. I am delighted to introduce the 2007 Master Plant Science Team, who are proving their weight in gold:

BSA-sponsored MPST members: **Dr. Jenny Archibald** of University of Kansas, **Rob Barker** of University of Colorado, **Nick DeBoer** of University of Hawaii-Hilo, **Jenny Dechaine** of University of Minnesota, **Kathy Gerst** of University of Arizona, **Kandres Halbrook** of University of Arizona, **Dr. Carey Hord** formerly of Pennsylvania State University, **Meredith Mertz** of Truman State University, **Abby Moore** of University of California, Berkeley, **Julia Nowak** of University of Guelph, **Amber Robertson** of University of Wisconsin-Madison, and **Teresa Woods** of Kansas State University.

ASPB-sponsored MPST members: **Ed Gilding** of University of Minnesota, **Kelly Gillespie** of University of Illinois, **Emily Indriolo** of Purdue University, and **Chika Nwugo** of Miami University, and **Aurea Siemens** of University of Alberta.

Mentoring, writing and reviewing new plant inquiries, contributing to summer workshops.
If you are looking for ways to make major contributions to improved science education without building a program from scratch, please email chemingway@botany.org.

Spotlight on BSA Member Contributions to Science Education

Congratulations to Tom Rost and Jim Wandersee — Winners of the 2007 **Charles Edwin Bessy Teaching Awards**!

Dr. Thomas Rost, Assistant to the Director of International Programs, Professor Emeritus of Plant Biology, and Botanist Emeritus in the Agricultural Experiment Station at the University of California, Davis. He is recognized for his innovative and outstanding teaching in plant anatomy, including early and experimental adoption of technology in his classes. Tom has been active in the BSA Education Committee and in the Structural and Developmental Section. He has published over 140 scientific papers on root growth and development and other anatomical topics, and co-authored four books, including two general botany textbooks. Dr. Rost received the Davis Division Academic Senate Distinguished Teaching Award, which is the highest teaching award make by each UC campus.

Dr. James Wandersee, LeBlanc Alumni Association professor in the College of Education at LSU, focusing on biological and botanical science education. He is currently the Chair of the Teaching Section of the BSA and has presented many papers and workshops in this section and in the BSA Educational Forum. He helped coin the phrase "plant blindness" which was part of a campaign to help teachers, students, and the general public overcome their inability to notice plants in their own environment, which leads to the inability to recognize the importance of plants in the biosphere and in human affairs. He is a prolific author, with over 100 publications and several books that have been translated into six languages. He was elected a fellow of AAAS, was an officer in the National Association of Biology Teachers, and is the director of the 15 Degree Laboratory, A Visual Cognition Research and Development Laboratory for Improving Biological and Botanical Learning.

Botany 2007 Education and Outreach Highlights
Here are final highlights on education and outreach activities at the Chicago meetings.

BioQUEST Curriculum Consortium 2007 Symposium at the Joint Congress — If you participated in the BioQUEST sessions at the 2002 Inaugural Education and Outreach Forum, you knew you were in for an engaging opportunity to see the power of using case-based and problem-based learning. The six sessions of the 2007 BioQUEST symposium introduced datasets, simulations, and resources to support student investigations of plant pathology, ecology, phylogeography, physiology, and form. **Ethel Stanley** and **Stacy Kiser** kicked off the sessions with an introduction to case-based learning. **Sam Donovan**, **Tony Weisstein** and **Kristin Jenkins** explored phylogeography of the invasive species *Tamarix*. **Ethel Stanley** and **Stacy Kiser** shared modeling and simulation resources. **Claudia Neuhauser** explored integrating statistics in undergraduate biology courses. **Yaff Grossman** shared Excel simlulations of photosynthesis, respiration, and growth. **Kristin Jenkins** shared a new problem space with gene expression data for desiccation sensitive and tolerant plants. **Maura Flannery** and **Ethel Stanley** raised often overlooked issues of visual learning and shared insights from the 2007 Gordon Conference on "Visualization in Science and Education: Seeing the Data … and Beyond!"

Visit the BioQUEST website to access PowerPoint slides of the talks and links to related resources. In case you haven't found it yet, there is a link to BioQUEST on the BSA website (BSA Suggested Websites) too. http://bioquest.org/BSA2007/

Joint ASPB-BSA Education Workshop — Over hors d'oeuvres Monday evening, there were lively discussions about how to get involved and make an impact in education and outreach activities. Six discussion topics were select to cover a range of the wide breadth of possible activities that fall within the scope of the National Science Foundation's broader impacts criterion. NSF representatives Judy Skog, Terry Woodin, and Diane Jofuku Okamuro circulated among the roundtables.

Individuals active in both BSA and ASPB with experience taking ideas to impact served as thought leaders. **Gordon Uno**, who has infused inquiry teaching and learning in botany courses at University of Oklahoma and co-authored inquiry-bases botany texts, led a discussion targeting undergraduate education. **Phil Gibson**, who with his wife is currently writing their third scientific book for youth, shared his experiences working with publishers and presenting science to a young audience. **Paul Williams**, creative genius behind Rapid Cycling Brassicas (a.k.a. Wisconsin Fast Plants), posed provocative questions about working with K-12 teachers and creating cultural shifts in science and education partnerships. **Erin Dolan** and I drew on the Partnership for Research and Education in Plants and PlantingScience programs to focus a broad discussion on scientist-student-teacher partnerships. **David Salt** used his experience creating plant-related museum displays as a springboard to collaborations between scientists and museums, botanic gardens, and other public institutions. **Eve Wurtele**, developing the Meta!Blast video game of Cell and Metabolic Biology, led a discussion on computer and web-mediated learning environments.

An exit survey indicated that participants enjoyed the informal opportunities to talk about a diversity of educational efforts that meaningfully address Broader Impacts and enhance connections between scientists and the community.

One immediate outcome of this workshop is an introductory set of resources to assist faculty in starting broader educational and outreach endeavors. You'll find a pdf of these on the BSA website under Outreach.

What kinds of Education and Outreach sessions you would like to see at future Botany meetings? Please send your ideas!

Education Bits and Bobs

How will US high school students rank in advanced math and science tests across nations? — We will not know the answer to that question. The US has decided to opt out of the 2008 international testing of advanced math and science students. Read more about the issues underlying this decision in an article by Jeffery Mervis. *Science* 317: 1851.

Learn more about the TIMMS and TIMMS-A at http://nces.ed.gov/timss/

What does it take to build a lunar growth chamber? — As NASA plans to return to the moon, plant growth will be an important part of space exploration. NASA scientists anticipate that astronauts may be able to grow plants on the moon in specialized plant growth chambers. Through the 2007-2008 NASA Engineering Design Challenge, elementary, middle and high school students are invited to:
(1) Design, build, and evaluate lunar plant growth chambers;
(2) Receive cinnamon basils seeds flown on STS-118;
(3) Test lunar growth chambers by growing and comparing both space-flown and earth-based control seeds.
http://www.nasa.gov/audience/foreducators/plantgrowth/home/index.html

Editor's Choice

Nicholson, Barbara J. and Sylvia C. Halkins. 2007. Temperature relationships in Eastern skunk cabbage. *Bioscene: Journal of College Biology Teaching* 33(2) 6-14.

In these activities the color, shape, and orientation of spathes and stage of flower maturation are examined for their possible roles in metabolic heat production. Activities are also presented for comparing the role of metabolic heat vs solar heat in heat retention of the inflorescence and a final activity examines the potential correlation between heat and odor production. The activities can be modified for use at all levels from middle school through upper-level college courses. For each activity, sample student data is presented and discussed. The data was generated over several years, but the timing of publication is perfect for use this spring!

Wilson, Christopher D., Charles W. Anderson, Merle Heidemann, John E. Merrill, Brett W. Merritt, Gail Richmod, Duncan F. Sibley, and Joyce M. Parker. 2006. Assessing Student' Ability to Trace Matter in Dynamic Systems in Cell Biology. *CBE-*

Life Sciences Education 5(4):323-331.
http://www.lifescied.org/cgi/reprint/5/4/323

Three batches of radish seeds started with the same dry weight. After 1 week, the seeds that were watered but grown in the dark had a lower dry weight than when they started. "Where did the mass go that was lost by the seedlings…?" This is one of several questions dealing with common misconceptions about photosynthesis and respiration that are addressed in this article. The discussion of the qualitative assessments used by the authors provide many intriguing ideas about how to improve your instruction of these basic concepts.

Douglas L. Wendell and Dawn Pickard. Teaching Human Genetics with Mustard: Rapid Cycling *Brassica rapa* (Fast Plants Type) as a Model for Human Genetics in the Classroom Laboratory
CBE Life Sci Educ 2007: 179–185
http://www.lifescied.org/cg

This activity presents a paternity problem using Fast Plants ™and DNA microsatellite markers. The authors provide complete protocols for obtaining meaningful results in a teaching laboratory geared to a semester-long, upper division undergraduate laboratory in genetics (3-hr, once a week). Although the exercise was developed and presented as a model for teaching human genetics, it has the added benefit of emphasizing that plants have sex too!

A Call to Student Members

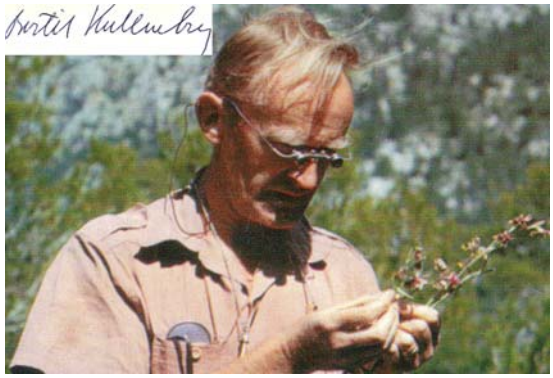
At the Missouri Botanical Garden's Annual Systematics Symposium few weeks ago I was talking with Mary Barkworth about students' requests for on-line identification keys to help them identify local specimens. We realized that while both of us rely on printed keys, there are probably on-line resources out there that would be appropriate to recommend but that we just don't know about. She suggested that the best way to get this information would be to ask students what resources they find useful,

SO--
Here's a call to the student membership of BSA! Send the URL's and a brief critique of your favorite on-line botanical resources to the Plant Science Bulletin (psb@botany.org) and we will make this information available - - to your peers AND YOUR MENTORS!
(Be sure to include your name and school.)

Announcements

In Memoriam:

Bertil Kullenberg (1913-2007)



A French magistrate in Algeria, A. Pouyanne and the British student of orchids, M. J. Godfery wrote about the pollination of *Ophrys* between 1917 and 1930 and described a form of entomogamy which is now called pseudocopulation. Similar observations with *Cryptostylis* in Australia were published by Mrs. E. Coleman between 1928 and 1938. These phenomena were intriguing and became known relatively quickly, but the reasons for the insects' behavior remained relatively obscure until Professor Kullenberg studied them between 1945 and 1979 using methods which were very advanced for the time. These include: 1) a custom made ultraviolet light transmitting quartz lens which made possible UV reflection photography and images that approximated what the pollinators may be seeing, 2) gas chromatographs, 3) mass spectrometers, and 4) concern with chemically active odors like pheromones. What he found was that the flowers produce volatile substances which act as female sexual stimuli and lead the males to attempt copulation. Pollination of *Ophrys* depends on this because the flowers do not produce nectar.

Bertil Kullenberg was born in 1913 in Gothenburg, Sweden and first became associated with Uppsala University in 1933. He defended his thesis in 1944 and became an associate professor in the same year. Four years later he was appointed research professor of Entomology and served in that capacity until 1968 when he became a full professor. Professor Kullenberg retired in 1979. Between these activities he found time to marry Anna-Lis Apelgårdh in 1940 who functioned as his unpaid secretary, field assistant and driver during his entire career. She also bore their three children, Barbro (1941), Gunnar (1945) and Gunhild (1947).

During his career Kullenberg studied (in Sweden as well as in the Mediterranian area and in Africa) capsids, bird migration and communications between organisms. The latter lead him to *Ophrys* pollination through pseudocopulation and to what in my view are some of the most important contributions ever to our understanding of orchid biology (for a summary see Kullenberg, 1961, 1984). One of his students, Prof. Lennart Ågren wrote that Dr. Kullenberg's research in this area was facilitated by "his well trained nose, curiosity, and patience in almost innumerable excursions."

Professor Kullenberg was not a plant scientist as such and I doubt that he would have called himself an orchid specialist. Still, he made highly significant contributions to orchid science. My own recollections of him go back the International Botanical Congress in Leningrad in 1974. On that occasion he showed what can be described as an orchid blue movie which showed wasps copulating with *Ophrys* flowers. I, an aspiring orchid biologist at the time, introduced myself and found Dr. Kullenberg to be a very knowledgeable, nice, kind and considerate person who did not talk down to a beginner. I tried to follow his example during my career.

–Joseph Arditti, Professor Emeritus of Biology, University of California, Irvine.

Literature Cited
Kullenberg, B. 1961. Studies in *Ophrys* pollination. Reprinted from Zoologiska Bidrag Fran Uppsala, Band 34. Almqvist & Wiksells Boktryckeri AB, Uppsala, Sweden.
Kullenberg, B 1984. The Ecological Station of Uppsala University on Öland: A summarizing presentation of its history and research programmes. Nova Acta Regiae Societatis Scientiarium Upsaliensis, Ser. V:C, 3, 7-14.

Robert R. Nakamura (1954-2006)

Many BSA members mourn the passing of Dr. Robert Nakamura, who died of natural causes at the age of 52 in September 2006. Bob was an associate professor of Biology at California State University/Los Angeles, where he was highly regarded as a teacher, mentor, and scholar. Bob grew up in a Japanese-American family with deep roots in California. He is survived by his father, his brother, sister-in-law, and a large extended family.

Bob graduated from Stanford University in 1976 after majoring in Biology, and went on to complete his M.Phil. (1979) and Ph.D. (1983) at Yale University. After several years of postdoctoral research at the University of California at Davis, the Weyerhauser

Company, and the University of Washington, he joined the faculty at Cal State L.A. in 1991. Returning to Los Angeles and living near his parents was rewarding to him. On his faculty website, he wrote, ""When I took up my faculty position at Cal State L.A., I returned to the city of my birth. Here I first discovered nature in backyard gardens and fish ponds, in wondrous museum displays and in fascinating ocean tide pools."

Throughout his career, Bob studied novel and interesting questions in plant evolutionary ecology. His papers on mate choice and plant reproductive biology appeared in journals such as the American Journal of Botany, Evolution, Ecology, and Heredity. At Cal State L.A., Bob was a leader in developing an integrated curriculum in environmental science. He taught courses in plant biology, ecology, natural history, and writing for biologists. He also studied the assessment of student learning and the needs of under-represented minority students. Philip LaPolt, chair of the Department of Biological Sciences at Cal State L.A., noted that "Bob contributed in countless ways to his Department, College, and University. His gentle warmth, sincerity, and sense of humor endeared him to students, staff, and colleagues alike."

Bob's colleague at Cal State L.A., Dr. John Gamon, made the following comments at his memorial service:

I had the privilege of knowing Bob for most of my adult life. I first met him as my TA when I was an undergraduate at Yale in the late 1970s. In 1991, when I was hired as an Assistant Professor in Plant Biology at Cal State L.A., I learned that the one other hire the department made that year was another Plant Biologist named Bob Nakamura. So it was with considerable delight that I started teaching that fall with someone who, by that time, had become a good friend. On campus, we shared a lab space for about five years, and I was always amazed by how tolerant Bob was of whatever happened in our shared workspace. For four additional years, we worked together on a student training grant sponsored by NSF. Remembering Bob, one faculty member spoke of "Bob's kindness, his even demeanor, and the quiet way he went about accomplishing so much." Another put it this way: "Bob was one of the most gentle people I have ever known." He will clearly be remembered as someone who made a difference in the many lives he touched along the way.

These comments reinforce my own memories of Bob's friendship and collegiality. I first met Bob in 1984, when he joined Maureen Stanton's lab group at UC/Davis, and we remained in touch ever since. Over the years, I could always count on Bob for helpful professional advice, enlightening conversations, and good cheer. He was a very generous person who lived his life simply and thoughtfully, with a great deal of empathy for others.

Donations to the Robert R. Nakamura Memorial Scholarship may be made by sending a check to the California State University Los Angeles Foundation, 5151 State University Dr., Admin. 809, Los Angeles, CA 90032. Checks should be made payable to the CSULA Foundation and in the memo section of the check it should list the Robert R. Nakamura Memorial Scholarship.

Respectfully submitted by:

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Judith D. Zuk (1952-2007) Horticulturist, Educator, and Botanic Garden Executive

Judy Zuk, President Emeritus of Brooklyn Botanic Garden, one of America's preeminent botanic gardens, died in Brooklyn on Saturday, September 1, 2007 after a long illness.

Ms. Zuk led the Botanic Garden for more than 15 years and was only the fifth president in its nearly 100-year history. Prior to coming to Brooklyn in 1990, she was the director of the Scott Arboretum of Swarthmore College in Pennsylvania.

"Judy was an extraordinary and adored leader, who guided the Garden through the planning and execution of major capital projects, the expansion of its horticultural, scientific and education programs

and the creation of its master plan for the future," said Brooklyn Botanic Garden board chairman Earl Weiner. "Her death represents an enormous personal loss to all of us who loved and admired her, as well as to the worldwide horticultural community. I am consoled by the knowledge that her extraordinary contributions to the Garden will be enjoyed by visitors for many years to come."

Ms. Zuk studied botany at Rutgers University, graduating *summa cum laude* in 1973. She then

received a Master's in Public Garden Administration from the University of Delaware, and was awarded a Garden Club of America fellowship to study landscape design in England. Ms. Zuk was co-editor-in-chief of *The American Horticultural Society A-Z Encyclopedia of Garden Plants*. She served on the boards of many professional and cultural organizations, including Botanic Gardens Conservation International, and as chair of the Cultural Institutions Group in New York City.

Ms. Zuk was widely recognized for her leadership in American horticulture and received many prestigious awards including the Medal of Honor from the Garden Club of America. In 2004, the American Association of Botanical Gardens and Arboreta chose Zuk, its former Board president, to receive its Honorary Life Member Award, the Association's most prestigious award. On her retirement in 2005, Brooklyn Botanic Garden celebrated Ms. Zuk by the naming of the Judith D. Zuk Magnolia Plaza at the Garden and of a magnolia cultivar developed by the Garden, *Magnolia* x 'Judy Zuk.'

Ms. Zuk is survived by her sister, Patricia Campbell, of China Grove, North Carolina, and nephew Ian. A celebration of her life is planned for September 23 at the Botanic Garden.

Personalia

Dr. Peter Raven Receives Verrill Medal From Peabody Museum

Dr. Peter Raven, president of the Missouri Botanical Garden, has received the Addison Emery Verrill Medal from the Peabody Museum of Natural History at Yale University. Raven and noted Harvard environmentalist Edward O. Wilson each received the award for outstanding achievement in the natural sciences.

Raven is a world-renowned botanist and authority on plant evolution. Described by TIME Magazine as a "Hero for the Planet," he is an advocate for biodiversity and a sustainable environment. He is the recipient of numerous awards and honorary university degrees, including the National Medal of Science and an honorary Doctor of Science degree from Yale University.

The Verrill Award is the Peabody Museum's highest honor and has been awarded only 15 times. It was established in 1959 in honor of Addison Emery Verrill (1839-1926), Yale's first professor of zoology. Raven and Wilson received their awards on Oct. 17 during a program they jointly presented at Yale entitled "The Future of Life on Earth."

Robert Allerton Award for Excellence in Tropical Botany or Horticulture to Dr. William R. Anderson

The National Tropical Botanical Garden (NTBG) has announced that **Dr. William R. Anderson** will

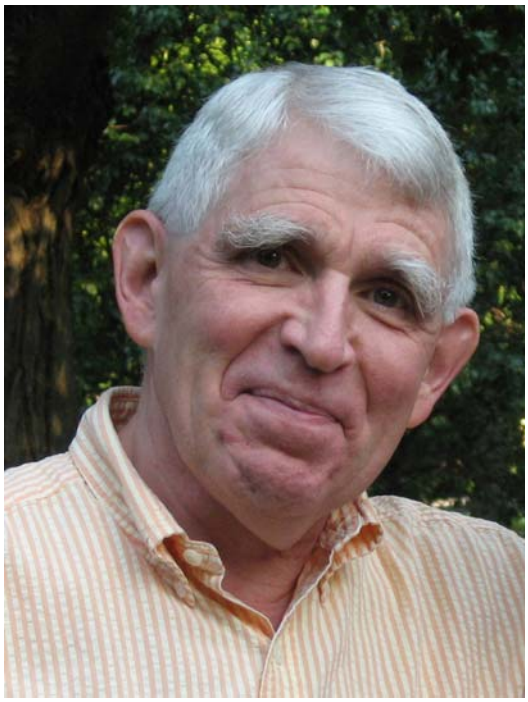

Photo by Christiane Anderson, 2007

receive the Robert Allerton Award for Excellence in Tropical Botany or Horticulture for 2007. The award will be presented October 8 during the institution's semi-annual Board of Trustees meeting. The Allerton Award is given bi-annually to recognize specific achievements or a lifetime of achievements in tropical plant science. The award was initiated in October 1975 and is named to honor one of NTBG's founding trustees and its principal initial benefactor.

"Bill Anderson has been a major influence in the world of tropical botany, from his decades of research to his devotion in teaching generations of future botanists," stated NTBG CEO and Director Chipper Wichman. "His passion to spend his life studying

and sharing his knowledge about tropical plants is truly admirable. It is our honor to present this award to Bill."

Colleagues credit Anderson with anticipating by 25 years the links between plant systematics and ecology that are now widely in evidence. During his lifetime of selfless dedication to the discipline of plant taxonomy, he served as director of the University of Michigan (UM) herbarium, one of the largest university herbaria in the world, and currently holds the title of Curator Emeritus of Vascular Plants. He has taken the lead in understanding the complexities of the large tropical plant family Malpighiaceae, commonly known as the Barbados Cherry family, and continues this research to this day. Now Professor Emeritus of Botany at the University, Anderson devoted many years to training an extraordinary number of undergraduate and doctoral students, many of which have gone on to prominent positions in plant science. His success as a mentor is evidenced by the fact that nearly all of his doctoral students have been awarded dissertation grants from the National Science Foundation.

His own research has received some 25 grants from the Foundation, including early in his career as an NSF Graduate Fellow, throughout his career for fieldwork in Brazil, Mexico, Venezuela, Bolivia, Argentina, and Costa Rica, and for his current collaborative research with his wife and fellow botanist, Christiane, and a researcher from Harvard University. Anderson has published over 70 scientific papers and served as general editor for eight volumes of the monumental Flora Novo-Galiciana. He is a past president of the American Society of Plant Taxonomists and served for 15 years on a committee for the International Association for Plant Taxonomy.

Anderson says he will speak on the "Highs and lows of tropical fieldwork" at the awards ceremony. "Research in plant systematics is fun and fascinating, but it can also be lonely and frustrating," commented Anderson. "It took me years of solitary study to learn enough about the Malpighiaceae that I could start to add to what was already known, and unraveling evolutionary history is the most intellectually challenging work imaginable. Learning that I was to receive the Allerton Award from the National Tropical Botanical Garden was therefore not only deeply gratifying; it was also a validation of 40 years of arduous and joyous scholarship."

It consists of a bronze medal and a $1,000 honorarium. The National Tropical Botanical Garden is a not-for-profit institution headquartered in the only tropical zone in the United States. Its mission is to enrich life through discovery, scientific research, conservation, and education by perpetuating the survival of plants, ecosystems, and cultural knowledge of tropical regions. NTBG has over 1,800 acres in gardens and preserves in the Hawaiian Islands and in South Florida. It is the only tropical botanical garden chartered by the U.S. Congress.

A Limerick by Robert Mager

There once was a teacher
Whose principle feature
Was hidden in quite an odd way.

Students by millions
Or possibly zillions
Surrounded him all of the day

When finally seen
By his scholarly dean
And asked how he managed the deed,

He lifted three fingers
And said, "All you swingers
Need only to follow my lead.

To rise from a zero
To Big Campus Hero
To answer these questions you'll strive:

Where am I going
How shall I get there and
How will I know I've arrived?

Rachel Carson Envionmental Award to Michael J. Balick

Michael J. Balick, Ph.D., Vice President and Director of The New York Botanical Garden's Institute of Economic Botany, is this year's recipient of the Natural Products Association's Rachel Carson Environmental Award. This award was created to recognize individuals who have made outstanding contributions to the environmental community.

In presenting Dr. Balick the award at their national annual convention on July 20-22, 2007, the Natural Products Association cited the breadth of his accomplishments in the field of ethnobotany. Of particular
interest was his extensive work involving ethnopharmacological studies-the search for plants with medicinal properties-particularly his fieldwork in Belize that lead to the formation of the world's first ethno-biomedical forest reserve. Together with Drs. Rosita Arvigo and Gregory Shropshire, he co-founded the Ix Chel Tropical Research Foundation, a center in Belize devoted to traditional healing and cultural preservation. From 1986-1996 he helped lead a collaboration between The New York Botanical Garden and the US National Cancer Institute to survey Central and South America and the Caribbean for plants with potential applications against cancer and AIDS.

For nearly three decades, Dr. Balick has studied the relationship between plants and people, working with traditional cultures in tropical, subtropical, and desert environments. He specializes in ethnobotany, working with indigenous cultures to document their plant knowledge, understand the environmental effects of their traditional management systems, and develop sustainable utilization systems-while ensuring that the benefits of such work are always shared with local communities. Dr. Balick is an expert on the palm family, an economically important family of plants in the tropics. In 1981 he co-founded The New York Botanical Garden's Institute of Economic Botany with Sir Ghillean Prance. The largest and most active program of its kind in the nation, the Institute is devoted to furthering knowledge of the relationship between plants and people. As part of his work, Dr. Balick has established numerous collaborations between communities, governmental and non-governmental organizations, and institutions in the United States and Europe all working towards the common theme of discovering plants with potential therapeutic uses.

Kenneth G. Karol joins Staff at New York Botanical Garden

In September 2007, **Kenneth G. Karol**, Ph.D., joined the Science staff of The New York Botanical Garden as Assistant Curator in the Lewis B. and Dorothy Cullman Program for Molecular Systematics Studies. His scientific research is focused primarily on evolutionary studies among freshwater green algae (specifically the "charophytes" or "stoneworts"), which are thought to be the closest living relatives of all land plants. During recent years, Dr. Karol has been investigating differences in the chloroplast genome structure among species of algae, mosses, and ferns to better understand the origin and evolution of plants. He earned his Ph.D. degree in Plant Biology at the University of Maryland and a Bachelor of Science in Botany from the University of Wisconsin, Madison. Dr. Karol comes to the Botanical Garden from a postdoctoral fellowship at the University of Washington in Seattle.

State Department Names Dr. Nina V. Federoff New Science Adviser

United States Secretary of State Condoleezza Rice has named **Dr. Nina V. Federoff** to be her new Science and Technology Adviser. Federoff, a plant molecular biologist, is the Willaman Professor of Life Sciences and Evan Pugh Professor in the Department of Biology and the Huck Institutes of the Life Sciences at Pennsylvania State University.

Established in 2000, the Secretary's Science and Technology Adviser serves as the State Department's chief scientist and principal liaison to the national and international scientific communities. Federoff is the third person to hold the post.

Among the chief responsibilities of the S&T Adviser are: enhancing the scientific literacy at the Department of State; increasing the number of scientists working for the Department of State, both domestically and overseas; building bridges to the scientific community; and, providing timely information on emerging S&T issues with implications for foreign policy. Federoff's research has centered on the molecular biology of plant genes and transposons, as well as plant adaptations to stressful environments.

Symposia, Conferences, Meetings

The Fourth International Conference on The Comparative Biology of the Monocotyledons

The Fifth International Symposium on Grass Systematics and Evolution

Copenhagen, Denmark
11-15 August 2008

General Information

The Fourth International Conference of The Comparative Biology of the Monocotyledons & The Fifth International Symposium of Grass Systematics and Evolution will take place in 2008 in Copenhagen, Denmark. The organizing committee consists of members from The Natural History Museum of Denmark and the biological departments of the Universities of Aarhus and Copenhagen.

Purpose
To bring leading scientists from all over the world together to Copenhagen to present and discuss the latest developments in the field of monocot and grass evolution.

Registration
Registration is open to anyone interested in the evolution of the monocotyledons and grasses. Payment of the registration fee allows access to all sessions. Reduced fees will apply to students.

Congress Site
The conference site is in the northern campus area of the University of Copenhagen close to the Zoological Museum.

Language
The official language is English.

Highlights
The congress will convene at the opening session on Monday, 11 August 2008 with welcoming ceremonies and plenary lectures, starting with the Rolf Dahlgren lecture. The scientific program will take place from Monday through Friday. Scientific events will end daily at 17:00. A reception hosted by the City of Copenhagen will take place at the Town Hall. The conference dinner will be held in the Tivoli Gardens.

The Scientific Program

The program will – in the tradition of previous meetings – consist of plenary lectures, invited, and contributed papers. There will also be a poster session. The scientific program will have parallel sessions.

Planned scientific program
• Evolution and phylogeny of the Monocotyledons
• Evolution and phylogeny of the major orders (APG II) of the Monocotyledons (e.g., Acorales plus Alismatales, Asparagales, Dioscoreales, Liliales, Pandanales, Commelinales, Poales, and Zingiberales)
• Special sessions on Poaceae, Arecaceae, and Orchidaceae

All authors (oral contributions and posters) will have to supply abstracts.

Ode to Johnson Grass

Some years ago it came to pass
A bright guy sowed some Johnson Grass.

Great claims were made for this new hay,
"Twould make our Southern farmin'pay."

Today when neighbors cuss and shout
It's Johnson Grass they rave about.

It seems unjust to so defame
A grass that's lived up to its claim.

It's easy spread and easy sowed,
It's easy grazed and easy mowed:

It's only fault most folks agree,
Is runnin' on eternally.

The praise this honest grass once got,
Has turned to epithets that's hot.

Our editors to educate,
Head columns up: "Eradicate!"

It seems to me quite out of place
To damn a grass that's fell from grace.

This grass, sez I, don't mean no harm
It just runs loafers off the farm.

The best of farmers cuss and shout,
But after all, they clean it out,

It holds the soil in firm embrace,
Until a real man gets the place.

A crop of hay as smart as that,
Just makes me bow and lift my hat.

-W.H. Darrow

Positions Available

Seed Bank Technician at Chicago Botanic Garden

The Chicago Botanic Garden seeks a technician to assist with the collecting, processing, and seed banking of 1500 native plant species of the Midwestern United States as part of the U.S. "Seeds of Success" project and the international Millennium Seed Bank Project at Royal Botanic Gardens, Kew. Under the supervision of the Seed Bank Coordinator, the Seed Bank Technician will assist with all activities associated with managing the seed bank. S/he will assist with collecting seed and herbarium specimens, scouting natural areas for plant populations for collections and ensuring collecting permits are up to date. S/he will also process and store collected seed, assist in the periodic testing of seed viability, and enter herbarium and seed collection data into an Access database. The seed bank technician will prepare periodic shipments of seeds and herbarium specimens, help manage our volunteer staff (typically 5-10 volunteers), and conduct regular volunteer seed cleaning days. For more information, see the project Web site (http://www.cbgseedbank.org/).

Position requirements: Bachelor's degree in biology, botany, ecology, or a related major and a keen interest in the conservation and restoration of native plants. The Seed Bank Technician must be able to work independently and as part of a team. S/he must be organized and detail oriented. The Technician must be willing to work outside (sometimes in remote locations and under harsh conditions), must be willing to travel (occasionally overnight and on weekends) and hold a valid driver's license. Candidates should have skills in plant identification and herbarium techniques, familiarity with Midwestern flora, and previous experience conducting fieldwork. Computer skills, especially with Microsoft Access, are preferred. Review of applications will begin on November 1 and continue until a suitable candidate is hired.

Application procedure:
Send a resume and three letters of reference to:
Human Resources Department
Re. Seed Bank Technician Position
Chicago Botanic Garden
1000 Lake Cook Rd.
Glencoe, Illinois 60022
Or E-mail employment@chicagobotanic.org

Senior Plant Scientist

The Chicago Botanic Garden (CBG), in collaboration with Northwestern University, invites applications for a **SENIOR PLANT SCIENTIST** position. Applicants should be broadly trained in plant biology or ecology in a subfield that will complement some aspect of our current research expertise in restoration ecology, conservation biology, soil ecology, population genetics, plant systematics and economic botany. Particular specialties of interest include global change biology, invasion biology, spatial ecology, seed physiology, or conservation policy. Duties include conducting an active research program with external funding, collaborating with a wide range of academic and stewardship organizations, and oversight of some of the Garden's plant biology research staff. The new Senior Plant Scientist will join a team of eleven Ph.D. researchers and participate in teaching in an innovative joint Master's program in Plant Biology and Conservation with Northwestern University, and will help contribute to the development of a joint doctoral program with NU.

Candidates must have a Ph.D. in plant biology, ecology, or a related discipline, a strong record of scholarship, an excellent extramural funding record for research, experience advising students at the doctoral level, and a commitment to undergraduate and graduate education. Please send a curriculum vitae, statements of research plans and teaching interests, examples of scholarly writing and three letters of reference (mailed directly from referees) to the address below. Review of applications will begin October 15, 2007 and continue until a suitable candidate is found.

Senior Plant Scientist Search Committee
Attn: Dr. Larry DeBuhr
Chicago Botanic Garden
1000 Lake Cook Road
Glencoe, IL 60022
or
ldebuhr@chicagobotanic.org
(electronic correspondence preferred)

CBG is situated on a 385-acre campus north of Chicago and showcases 23 different demonstration gardens as well as native areas that include woodlands, prairies and aquatic habitats, each featuring native and endangered Illinois flora (http://www.chicagobotanic.org).

The Chicago Botanic Garden and Northwestern University are Equal Opportunity/Affirmative Action Employers. Applications from women and minority candidates are encouraged.

CURATOR OF BOTANY, John T. Howell Curatorial Chair of Western North American Botany at the California Academy of Sciences

The California Academy of Sciences invites applications for the John T. Howell Curatorial Chair of Western North American Botany. Applications for this full-time position at the Assistant Curator level are solicited from individuals with a primary interest in, and commitment to, active field- and collection-oriented research in the systematics and evolution of plants in western North America, including California. We seek an individual who will participate in the diversity of research, educational, and administrative activities at the Academy; contribute to the maintenance and development of a major herbarium; and bring complementary or new research techniques to the Department of Botany. Opportunities for mentoring students are available.

The Academy's Department of Botany houses a worldwide herbarium of 1.9 million specimens of vascular plants, bryophytes, and lichens. The collection of flowering plants from California is the largest in existence. Current collection growth is focused on plants from Latin America, eastern Asia, Madagascar, and western North America. Major research projects are currently underway in China, Madagascar, and parts of Central and South America. Other institutional research resources and facilities include an SEM laboratory, the Center for Comparative Genomics, and a comprehensive library of systematic and evolutionary biology. For additional information about the California Academy of Sciences and its Department of Botany, please visit http://www.calacademy.org and http://www.calacademy.org/research/botany.

Candidates must have a Ph.D. and an active research program (or a willingness to begin such) in plants of western North America. Preference will be given to candidates who combine traditional, collections-oriented research with molecular phylogenetic techniques. Salary is negotiable and a generous benefits package is provided.

Applicants should forward a letter of interest, a curriculum vitae, description of research goals, copies of pertinent publications, and the names (along with contact information) of three references by 15 January 2008 to California Academy of Sciences, Human Resources Department #HOWELLcurator, 875 Howard St., San Francisco, California 94103, U.S.A. The California Academy of Sciences is a natural history museum, aquarium, planetarium, and research institution located in San Francisco. It is an Equal Opportunity Employer committed to diversity.

John J. Rose Postdoctoral Fellowship in Botany.

The California Academy of Sciences invites applications for the John J. Rose Postdoctoral Fellowship in Botany. Applications for this full-time position are solicited from individuals with a primary interest in, and commitment to, active field- and collection-oriented research in the systematics and phylogenics of vascular plants using contemporary techniques. We seek an individual who will participate in our research programs in diverse geographic areas and contribute to the development of a major world-wide herbarium.

The Academy's Department of Botany houses an herbarium of nearly 1.9 million specimens of vascular plants, bryophytes, and lichens. Current collection growth is focused on plants from Latin America, eastern Asia, (particularly China), Madagascar, and western North America (especially California, Nevada, and Arizona). We currently have active research programs in China, Madagascar, and parts of Central and South America. Other institutional research resources and facilities include a SEM unit, the Center for Comparative Genomics, and a comprehensive library of systematic and evolutionary biology. For additional information about the California Academy of Sciences and its Department of Botany, please visit http://www.calacademy.org and http://www.calacademy.org/research/botany.

Candidates must have their Ph.D. prior to beginning the position. This is a one year position with possible extension to two years based on performance.

To apply, send a letter of interest, a curriculum vitae, a general description of research goals, and a proposed project to be conducted during the fellowship period. Please also include the names, addresses, e-mails, and telephone numbers of three references. Send applications to: Human Resources Department #ROSEpostdoc, 875 Howard Street, San Francisco, CA 94103. Applications will be considered beginning Nov. 15, 2007 for a starting date in 2008. The California Academy of Sciences is a Natural History Museum, Aquarium, Planetarium, and Research Institution located in San Francisco. The Academy is an Equal Opportunity Employer and welcomes applications from individuals who will contribute to its diversity.

Manager, Conservation Training Programs at the Chicago Botanic Garden

The Chicago Botanic Garden seeks a Conservation Scientist and Manager for its award-winning Conservation and Land Management Intern Program for its Plant Science and Conservation Division. Duties include management of the intern program, including recruitment, hiring, training and placing approximately 100 interns per year for several land management agencies (approximately 60% time) and conducting an active conservation-oriented research program (40% time). The successful candidate will have the opportunity to work with graduate students from several Chicago region universities if desired.

Requirements include a Ph.D. in ecology, botany, biology or a related field, expertise in restoration ecology or land management practices/policy, and a desire to work in a non-profit environment. Must have excellent organizational and communication skills and maintain strong working relationships with several federal agencies. The position supervises a financial administrative assistant and a research assistant and maintains oversight of the program's $1.5 million budget. For further information about the position, contact Kayri Havens at khavens@chicagobotanic.org. To apply, send cover letter with statement of research and teaching interests, curriculum vitae, and contact information for three references to: Human Resources Department, Chicago Botanic Garden, 1000 Lake Cook Road, Glencoe, IL 60022. Review of applications will begin November 1, 2007 and continue until a suitable candidate is found.

Courses/Workshops

Experience in Tropical Botany

Harvard University Summer School, in collaboration with The National Tropical Botanical Garden announces the following course in 2008.

Dates: June 2 to June 28 2008

Location: The Kampong Garden of the National Tropical Botanical Garden, 4013 Douglas Road, Coconut Grove, Miami FL 33133

The Class will use the newly constructed teaching Kenan Laboratory at The Kampong (wet bench and microscope facilities) and be accommodated in comfortable dormitory style housing in the same location (Scarborough House).

Course title: "Biodiversity of Tropical Plants"
Instructor: Professor P. Barry Tomlinson
Professor of Biology *Emeritus*, Harvard University & Crum Professor of Tropical Botany, National Tropical Botanical Garden.

The course is intensive and intended to present an overview of the rich diversity of tropical plants in natural environments (e.g. The Everglades National Park, Biscayne Bay National Park) and especially rich collections of introduced tropical plants at collaborating Institutions, notably Fairchild Tropical Botanic Garden and The Montgomery Botanical Center, Coral Gables. This tropical resource is unmatched elsewhere in the Continental United States.

Emphasis is on morphology and anatomy in a systematic but also functional context and involves both field and laboratory study. The course structure is extensively enquiry- based and is intended to develop skills in investigative techniques and philosophical approaches which can be applied subsequently in Graduate Study. Students are introduced to many tropical plant families (especially the iconic Arecaceae) and such topics as, e.g., tree architecture, pollination biology, the morphology of vines and epiphytes as well as distinctive tropical ecosystems like seagrass meadows and mangroves. Laboratory work emphasizes anatomy and dissection of fresh material, using implements ranging from chain saws to scalpels.

Admission to the course depends on some demonstrated previous familiarity with at least elementary Botany and is intended to cater for students who are already enrolled in a graduate program in Botany or Biology or plan to do so in the near future.

Students will be required to register with The Harvard Summer School and will receive 4 credits.

Estimated Cost.: Harvard Summer School tuition; travel to and from Miami; Kampong accommodation at $25 per day. Tuition and Travel scholarships may be available for qualifying students.

For further information:-
P.B. Tomlinson at the above Miami address, or
Harvard Forest, Harvard University, 324 N.Main St. Petersham MA 01366
e-mail: pbtomlin@fas.harvard.edu
And Harvard Summer School on-line in 2008

National Tropical Botanical Garden Fellowship for College Biology Professors

Program Operation: May19-31, 2008
Deadline to Apply: March 14, 2008
Notification of Acceptance: March 21, 2008

COURSE DESCRIPTION

The National Tropical Botanical Garden (NTBG) will conduct another exciting Fellowship for College Professors of Introductory Biology at The Kampong, Coconut Grove, Florida.

The goal of the Fellowship is to improve the quality of teaching in introductory biology classes at the undergraduate level. Facilitated by Professor P. Barry Tomlinson of Harvard University and Dr. Paul Alan Cox, CEO/Director of the Institute for Ethnomedicine, the course is designed to show instructors how to use examples from tropical plants in discussing issues of form and function, evolution, and conservation. Fellows will develop teaching modules to be shared and implemented in the introductory biology classroom. Basically, we are looking for the very best biology faculty, those who can fire the imagination of major and non-major biology students. Although botanists will be considered, we also welcome applications from faculty who lack previous botanical experiences, as well as those who have not previously worked in the tropics. The Fellowship will be limited to 12 Professors.

Applications must include:

- Two letters of recommendation.
- Complete curriculum vitae.
- Copy of the most recent teacher evaluation.

A non-refundable $30 USD application fee in the form of a check or money order made payable to the National Tropical Botanical Garden.

The Fellowship will cover the most economical roundtrip airfare to The Kampong, Florida, accommodation and meals, tuition and fees, texts, equipment, and ground transportation.
Requests regarding the Fellowship for College Biology Professors must be directed to:

Director of Education
National Tropical Botanical Garden
3530 Papalina Road
Kalaheo, HI 96741 USA
Tel: (808) 332-7324, ext. 225 or 251
Fax: (808) 332-9765
Email: education@ntbg.org
Website: www.ntbg.org

THE KAMPONG: An Excellent Site for Academic Conferences, Workshops and Courses in Tropical Botany and Conservation

The Kampong, in the village of Coconut Grove in Miami, is the former home of the plant explorer and founder of the Plant Introduction Service of the U.S. Department of Agriculture, Dr. David Fairchild. Fairchild and his wife Marion (a daughter of Alexander Graham Bell) purchased the land in 1916, began establishing a grove of tropical trees, and built their retirement home there in 1927. During his retirement, 1927-1954, the Kampong was the venue for many meetings of prominent scientists and other intellectuals. The formative meeting to establish Everglades National Park was convened there in 1938. After the deaths of the Fairchilds, the Kampong was purchased by Catherine and Edward Sweeney in 1963. Kay Sweeney maintained and improved the plant collections and the buildings, all of historical significance and placed on the National List of Historic Places in 1984. In the 14 acres of gardens there is a rich collection of tropical plants, ideal for instruction in all aspects of tropical plant biology. Kay Sweeney deeded the entire property to the present National Tropical Botanical Garden in 1988. Since that time, the educational facilities at the Kampong have steadily improved. The plant collection has become more diverse. Classrooms and meeting venues have been added; we can now hold meetings for groups of 6 to over 200. A small dormitory, a LEEDS certified building, accommodates up to 12 visitors, supplementing additional accommodations in two cottages. There is also a well-equipped teaching laboratory, accommodating 16 students. The entire property is accessible to dozens of restaurants in Coconut Grove, within easy walking distance. The Kampong has been the site of courses from Harvard University (Barry Tomlinson's course in tropical plant biology), the University of Florida (Walter Judd's course in the systematics of tropical plants), and various courses offered by Florida International University. In addition to the rich plant collections at the Kampong, students also have access to additional collections at Fairchild Tropical Botanic Garden, The Montgomery Botanical Center, and Chapman Field of the USDA/ARS. In addition, Everglades National Park and other natural areas are located very close to Miami. The Kampong has a price structure that makes meetings and courses affordable for academic users. For inquiries about having a group of students visit, teaching a course, running a workshop, or coordinating a conference, contact David Lee, Director of the Kampong, at 305 442-7169 or dlee@ntbg.org.

Other News

Rare Maps on Display at the Chicago Botanic Garden
Maps from the Rare Book Collection of the Lenhardt Library

An exhibition featuring maps revealing the global travels of plant explorers will be on display in the Lenhardt Library located in the Regenstein Center at the Chicago Botanic Garden from Friday, November 2 through Sunday, February 10, 2008. The Chicago Botanic Garden is one of 25 Chicago area cultural institutions participating in the first citywide Festival of Maps.

"These exquisitely detailed maps allow you to create a vivid image of the significant discoveries made by various plant explorers,²"says Leora Siegel, manager of the Lenhardt Library.

This exhibition allows visitors to enter the age of plant exploration through the pages of beautiful maps found in the Library¹s Rare Book Collection, which holds approximately 3,000 titles from the 15th to the 19th centuries.

One of the books featured is by Adolph Eschelskroon (1736-1793), an explorer who studied the natural history of several tropical locales in the 18th century, including Sumatra, now Indonesia. The island of Sumatra featured a variety of unique plants, such as *Rafflesia*, known for its unusually large flower and unpleasant odor. In the book, *Beschryving van heteiland Sumatra*, there is a remarkably beautiful hand-colored map, which features topographical details of the island.

French author, J. Hector St. John de Crèvecoeur (1735-1813) wrote, letters from an American Farmer, a collection of essays on agronomic life in colonial America. This is considered one of the most influential accounts of a foreigner trying to understand what makes someone ³American.² It contains a beautifully engraved black and white map entitled Island of Martha¹s Vineyard with its Dependencies.

Jean-Baptiste Lamarck (1744-1829), a French biologist, published the three-volume set of *Flore Francaise*, which he intended to be an identification manual of French flora. *Flore Francaise* contains an extraordinary color map titled Carte Botanique de France (Botanical Maps of France). This is the first biogeographical map ever published which represents a shift in focus from maps representing distributional pathways to floristic provinces. All three maps will be on display in the Lenhardt library.

The Festival of Maps Chicago is an array of exhibits honoring some of the most significant discoveries and boldest explorations. This collaboration will feature maps, globes, artifacts and artworks from the city¹s finest cultural and scientific institutions.

Admission to the Maps exhibit is free. Hours are Monday through Saturday 9 a.m. to 4 p.m., Tuesdays until 7 p.m. and Sundays from noon to 4 p.m. Parking is $15; free for members. For more information and to search the library collections, visit www.chicagobotanic.org. To view other institutions participating in the Festival of Maps Chicago, visit www.festivalofmaps.com.

Try Chia!

Chia is a desert plant related to basil that is grown in the arid regions of Arizona, Mexico, Argentina, Bolivia and Peru. Seeds of chia (*Salvia hispanica*) germinate quickly and tolerate a wide variety of experimental treatments in k-12 classrooms. Results are visible within 90 minutes. Chia seeds, though small, are fun to work with, easy to grow, and, as a bonus, they are not only edible but are the highest known dietary source of omega-3 fatty acids. They were the second most important crop of the Aztecs and are still consumed in parts of Mexico. For more information contact:: Dr. Margaret Conover, PO Box 1415, Stony Brook, NY 11790 (631) 357-3065 Margaret.Conover@gmail.com Website: www.chiativity.org

The Vascular Plant Atlas of Georgia On-Line

The Vascular Plant Atlas of Georgia, ferns through monocots, was completed by Patrick W. Sweeney & David E. Giannasi in 2000 and is now available at the University of Georgia Herbarium [GA] Website http://www.plantbio.uga.edu/herbarium/index.html or directly at http://www.plantbio.uga.edu/herbarium/GeorgiaAtlas/index.html. These records are based on the collections at GA which has the largest holdings of Georgia plants.

The current faculty and staff of the GA Herbarium are updating and completing *The Vascular Plant Atlas of Georgia* with funding from the National Science Foundation (DBI-0345226 and DBI-0450818; Wendy B. Zomlefer, PI; David E. Giannasi, coPI), and we anticipate a comprehensive posting in the near future. The present project participants are making these data available in the interim while acknowledging that many strides have been made in the systematics of these taxa since this project was initiated in 1997.

—Wendy B. Zomlefer, University of Georgia Herbarium [GA]

DNA Inventory of The New York Botanical Garden's Forest Demonstrates Effectiveness of DNA Barcoding as Identification Tool

With the support of the Alfred P. Sloan Foundation, The New York Botanical Garden has created a DNA-based inventory of all species of vascular plants in its 50-acre native forest. This pilot project, carried out in conjunction with the efforts of the Plant Working Group of the International Consortium for the Barcode of Life (CBOL), employed gene sequences to identify each species of plant in a defined area. The project took the idea of DNA barcoding out of the research laboratory and tested it in the field.

Results from DNA barcoding in the Garden's forest were presented at an intensive working session of 30 international scientists associated with CBOL at The New York Botanical Garden in January, 2007. The results attested to the viability of the barcoding concept as an effective tool for identification. They also contributed to the Consortium's ongoing efforts to determine which segment of genomic code – or , as may be more likely, a set of two or three different segments – might operate as a unique identifier of species across the plant kingdom.

Dr. Kenneth Cameron, Cullman Curator and Director of the Botanical Garden's Lewis B. and Dorothy Cullman Program for Molecular Systematics Studies, led the year-long project. Dr. Cameron comments, "The exciting part of this research was to test the effectiveness of applying a universal plant DNA barcode across a wide range of species in one habitat. Our results provided optimism that DNA barcoding can indeed work as a tool for identification, especially in floristic studies."

Tests showed that identification based solely on DNA barcoding worked with a good degree of reliability. For example, 12 random plant samples were collected by third parties and tested "blind" by DNA barcoding, using two different methods of analysis on five sequences per sample. The results were able to identify accurately all of the flowering plants tested, although there was limited success with ferns and conifers.

CBOL's Plant Working Group is in the midst of a project to identify a universal DNA barcode for plants. The New York Botanical Garden's Forest DNA Barcoding project tested the same gene segments for sequencing as those being tested by the Plant Working Group: in this application, all five gene segments were successful. The CBOL project focuses on specific lineages within the plant kingdom, regardless of where they grow; the Botanical Garden's project, in contrast, looked at a specific geographic region, encompassing many unrelated species.

The familiar black-and-white "barcode" label that is present on virtually all commercial products was developed as the "universal product code" system. This pattern of varying black lines on a white background, with several possible line widths at each position, allows of billions of alternative products to be uniquely identified and tracked. In the same manner, a short segment of DNA sequence composed of varying patterns of A, C., G, T nucleotides should be able to identify different species of organisms from one another.

Potential applications of DNA barcodes are numerous, from unmasking look-alike species and tracking alien invasive plants to identifying plant species just from small fragments of tissue for forensic applications. DNA barcodes could simplify a customs inspector's job, making it possible to sample a few cells of virtually any plant or plant fragment that came thorough the inspections station,. With the use of a handheld DNA barcode scanner, the barcode could be submitted to a universal online database and assigned the correct name. This would help monitor trade in endangered or threatened species, providing a way to identify imports and exports even when they are stripped of obvious identifying characteristics such as leaves of flowers. DNA barcodes could also provide a genetic test of the identity of food extracts or medicinal plants such as herbal supplements. And they could make it possible for more people to identify species; they could extend the reach of expertise, accelerate species identification, and make biological knowledge more accessible to everyone.

The species of vascular plants recorded from the Botanical Garden's forest represent eight percent of all species in the northeastern U.S., as recorded in the *Manual of Vascular Plants of Northeastern United States and Adjacent Canada* by Henry A. Gleason and Arthur Cronquist. As such, this project represents a first step toward creating a DNA library and barcode database of the entire flora of the region,. It also opens the way for a handheld molecular "Life Barcoder" that could be carried into the field in the future.

Results from the Forest DNA Barcoding project at The New York Botanical Garden, including data collection and analysis, are being posted at http://www.nybg.org/science/Ken_C/title%20page.htm.

Books Reviewed

The Biology of Peatlands. Håkan Rydin and John Jeglum. 2006. ISBN13: 978-0-19-852871-5; ISBN10: 0-19-852871-X (hardcover, US $109.50). 360 pp.; ISBN13: 978-0-19-85872-2; ISBN10: 0-19-852872-8 (paper, US $49.50). 360 pp. Oxford University Press, Inc., New York, New York.

This work represents another installment of Oxford's "Biology of Habitats" series, which "… is intended for naturalists, students studying biological or environmental science, those beginning independent research, and professional biologists embarking on research in a new habitat." Consequently, this series provides a potential source of instant textbooks suitable for teaching more specialized ecology courses that focus on specific habitats.

Before commenting on content, I will summarize a few technical items. Although this book was released in both hardcover and paperback formats, a note on the publisher's website indicates that the hardcover format is "no longer available." If you are puzzled by the multiple ISBN numbers listed above, then note that as of January, 2007, a 13-digit system has been incorporated to replace the former 10-digit system as a means of accommodating a larger volume of … ah, volumes, I guess.

Despite my preference for hardcover books, the binding on my softbound review copy was very good, with all of the pages tightly secured. The cover is laminated with plastic, just in case you happen to get it a bit wet – a good idea for a book of this nature. I accidentally dropped my copy off the table onto a hard floor and it landed on a corner of the spine. Although the plastic coating tore a bit, neither the cover nor the binding was affected in the least. The printing also is of good quality, being crisp and uniformly dark throughout the book. Most of the black and white figures are reproduced fairly well, although a number of them tend to be somewhat overexposed and washed out.

The authors contributed 12 chapters in their entirety and about one-third of Chapter 11 ("Peatlands around the world"). The remainder of that chapter includes three sections written by several specialists on peatlands in geographical regions less familiar to the authors. This is a nice addition and lends credibility to the information summarized in the text.

The cited literature includes an impressive list of 756 references, with about 42% representing papers that have appeared within 10 years of the publication date. These figures indicate that the authors used a good balance of historical and recent literature in preparing their text. Several of the references cited actually appeared in the same year of publication (2006).

As would be expected, there are chapters on peatland habitats (Ch. 1), diversity (Ch. 2), succession (Ch.7) and hydrology (Ch. 8). I liked the fact that the authors focused on a fundamental ecosystem classification (marsh, swamp, fen, bog) and expanded these to include examples of finer scale divisions from systems used in Sweden, Finland and Canada. There is only a brief reference to phytosociological classification, which is appropriate for a book of this scope. The discussion of diversity included not only plants, but also microorganisms, protozoa, fungi, as well as invertebrate and vertebrate animals. The chapter on succession was amazingly succinct, and provided a nice overview of the related processes and interactions. The section on hydrology included only a few fundamental equations (e.g., for water balance), and these were explained well. All of these chapters provided thorough but concise overviews of the topics that were easy to read and free of burdensome jargon, so as not to "mire" you down. The text is embellished with clear and informative figures and graphs, which appear at least every few pages and clarify the main issues discussed in each chapter. This combination of features is exactly what one likes to see in a volume under consideration as a textbook.

Other useful and highly appropriate chapters specifically focus on sphagnum and its role in peatland genesis (Ch. 4), the physicochemical characteristics of peat and organic soils (Ch. 5), and the associated fossils or peat archives (Ch. 6). Again, these chapters were well-organized with an efficient presentation of pertinent information. Most of the text flows logically and the transitions from chapter to chapter were fluid. Ironically, I never felt as though I was getting "bogged down" as I read through the book. However, I thought that Chapter 12 ("Productivity and carbon balance") should have been moved up with the chapters on succession and hydrology. It seemed a bit out of place sandwiched between the more general chapters on "Peatlands around the world" (Ch. 11) and "Uses, functions, and management of peatlands" (Ch. 13). Chapter 12 also includes brief discussions on timely subjects such as the impacts of global warming, drainage, forestry and peat harvesting on peatland habitats.

Chapter 11 on "Peatlands around the world" provides an interesting perspective and is the only chapter that includes contributed sections by specialists other than the authors. I was surprised to learn that Indonesia ranks 4th worldwide in terms of total peatland area, behind Russia, Canada and the United States, but ahead of Brazil, Finland, and Sweden. There also are useful tables that summarize losses of peatlands in different countries due to agriculture and forestry. The data, which show disproportionately high historical losses in Europe, emphasize the tremendous impact that humans have had on these habitats.

My biggest surprise was a chapter (Ch. 3) devoted to a discussion on adaptations to the peatland habitat. Although relatively short (only 13 pages), this chapter provided some very interesting life-history information regarding the difficulties and survival strategies associated with life in the peat for plants, animals and fungi. It was a nice addition to the book.

The glossary includes only 55 entries, but these are uniformly well-defined and represent the most important terms necessary for a full comprehension of the text, especially given that the subject matter included in the book should attract an international audience. Here one learns the definitions of such terms as "dy", "flark", "gyttja" and "lagg, which might not yet be commonplace in every reader's vocabulary. Although most of us have felt stuck in a "quagmire" at one time or another, I was a bit surprised to learn that the term actually refers specifically to a quaking/floating mat and not simply to marshy ground as I had thought. From my limited examination, I found the index to be quite comprehensive and helpful for locating discussions of various topics, especially those that were treated in different chapters.

Overall, I found this to be a very satisfying book that is accurate, easy to read, and easy to use. Although I do not presently teach a course on peatland ecology, I would be very comfortable using this book as a textbook for an undergraduate/graduate student level course in this discipline. If you are considering a text for such a course, then by all means I urge you to give this one serious consideration – for "peat's" sake!

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Measuring Plant Diversity: Lessons from the Field. Stohlgren, T. J. 2007. ISBN 0-19-517233-1. (Hardback) 390pp. Oxford University Press, 198 Madison Ave., New York, New York 10016

Measurement of species diversity has been a focus of ecology since its inception and the literature on the subject is voluminous and sometime contentious. In Measuring Plant Diversity, Tom Stohlgren champions nested-plot multiscale vegetation sampling to examine plant diversity patterns at multiple scales. Much of the book is taken from his 20 years of research documenting species richness in western US landscapes and addressing important ecological questions.

The book is divided into five sections: 1) past and present, 2) an experimental approach to sampling, 3) scaling to landscapes, 4) modeling patterns of plant diversity, 5) monitoring plant diversity and 6) research needs. While the introductory chapter explains that monitoring diversity is difficult because most species are rare and are not randomly distributed, the second and third chapters provide the solid foundation for the rest of the book. Chapter 2 provides a lengthy and fascinating look at the history and champions of plant diversity science and plant community sampling in the context of contrasting paradigms of vegetation organization: the holistic plant community concept versus individualism. Much of the chapter is devoted to Rexford Daubenmire who had much to say about vegetation sampling and patterns that is relevant to plant diversity sampling. Stohlgren shows how the development of plant diversity sampling designs has been influenced, biased, and hindered by concepts of community and vegetation homogeneity. In Chapter 3, we learn the details of sampling design, including plot size and shape, sample size, pseudoreplication, sampling pattern, in quantifying plant richness in space and time. In Chapter 4 the reader explores the pros and cons of sampling plant diversity at single scales and finally in the next chapter, multiscale sampling plots are explored.

As the book progresses, we learn the evolution of Stohlgren's modified Robert Whittaker plot design. The final design is a 20 by 50 m, 0.1 ha, plot having one central 5 by 20 m plot, two 2 by 5 m corner plots, and ten 0.5 by 2 m cover plots distributed systematically throughout. Species are enumerated for each scale plot. Inconsistent in his design is the central 100 m^2 plot that does not have side lengths in the ratio of 2 to 5 as the other plot sizes (6.33 by 15.81 m instead of 5 by 20 m). I suspect this change would not have a tremendous effect on the results. Most helpful is the application of his methods to situations where vegetation types are rare or found in small patches. Nevertheless, the sampling designs advocated are important because they allow the examination of plant diversity across many scales and permit examination of what environmental factors correlate with these patterns. From such correlations and additional experimental research pattern causation can be understood.

Case studies are central to the book (Chapters 7 to 12 and 16 and 17) where Stohlgren advocates an experimental approach in applying various designs. Topics covered include technique comparisons, multiphase and scale sampling, modifying forest health sampling designs for groundlayer diversity sampling, patterns of plant invasions across landscapes, impact of grazing and soil on plant diversity, assessment of plant diversity in arid landscapes, sampling plant diversity in response to climate change, and testing nested intensity sampling across landscapes. In each case study, the rationale, hypotheses, methods, results, sampling implications are discussed. The reader is continually reminded of the tradeoffs in sampling intensity, time of acquisition, and funding available. While not a manual on how to do statistical analyses (MANOVA, CANOCO, tree analysis, path analysis, etc.), the application and discussion of statistical and modeling methods used to analyze the data provides a useful introduction to these topics which are covered in more detail in Chapters 13 and 14. The last chapter documents the need for plot arrays that allow plant ecologists to document spatio-termporal dynamics of vegetation across landscapes.

The literature cited is current and relevant, representing the developments in vegetation science in the last two decades. No mention is made of the sampling design of Peet et al (1998) that has been used in the eastern US and which is slightly different from the Keeley design Stohlgren illustrates. This design, developed from the early work of Peter White and Michael Palmer, incorporates many of the features of the modified multiscale Whittaker plots, but differing by having sequentially nested square plots in a basic 10 by 10 m modules which can be replicated into a Whittaker sized plot. Stohlgren would reject this design on the basis of square plots being less efficient in detecting species richness than rectangular plots and the sequentially nested plots lacking independence compared to the small-scale plots in his modified Whittaker design.

The figures were good quality, except figure 3.1 could have been larger to better show the detail. Duplicating figure 4.5 in chapter 4 was unnecessary. Errors in the book were few. In two instances the figure number referred to in the text was incorrect. The tips scattered through the text in boxes were empirical, practical, and helpful, but were few in the

middle sections, were tips were embedded in the text. I found the glossary so general and short that it was almost superfluous. Addition of statistical and modeling terms to the glossary would have aided the student reader, especially when reading the case studies and the statistical analysis and modeling chapters.

I really liked this book because it goes beyond the classic vegetation sampling texts and presents the current state of plant diversity sampling design and vegetation science. I believe it should be required reading for students studying vegetation science because it provides a solid foundation on which future advances in field will be based.

Reference cited:
Peet, R. K., T. R. Wentworth, and P. S. White. 1998. A flexible, multipurpose method for recording vegetation composition and structure. Castanea **63**:262-274.

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Structure and Function of a Chihuahuan Desert Ecosystem: The Jornada Basin Long-Term Ecological Research Site edited by Kris M. Havstad, Laura F. Huenneke, and William H. Schlesinger (2007) Oxford University Press in conjunction with the LTER Network. xv + 465 pp.

This edited volume of 18 chapters provides a wealth of information about the Jornada LTER and Experimental Range, located in south-central New Mexico, in the northern Chihuahuan Desert. Jornada is the short form of the place name Jornada del Muerto, which translates into "journey of the dead," a name reflecting that this desolate region, part of the famed Camino Real, was an extraordinarily difficult place for 16th and 17th century Spanish colonizers to traverse – due to lack of water – on their way from current-day Chihuahua, Mexico to northern New Mexico.

Virtually all chapters are superb. Many of them are encyclopaedic, sometimes with mind-numbing detail, such as precise map locations of data collection sites within the Jornada. There are also a few broad review chapters, such as on desert NPP (net primary productivity) by Huenneke and Schlesinger and temporal transitions between ecological communities by Peters and Gibbens, both of which are extraordinarily eloquent. With its richness of detail, interleaved with broad overviews, this volume would be perfect for any new researcher at the Jornada, including incoming graduate students. It would also be great, albeit possibly too detailed, for congressional staffers who need to understand the importance of this long-term research.

My two primary criticisms of this volume are political. First, the preference for grasslands over shrublands seems driven by cattle grazing, and not ecology. Second, the favouring of abiotic (vice biotic) factors in ecology seems driven by a single influential researcher.

The notion of the Jornada only being useful as rangeland for cattle is pervasive throughout this volume. Historically this view was sensible insofar as the original purpose of this land was to study beef production and was why this study area was first set aside for rigorous scientific study in 1912. Several contributors to this volume discuss restoration and remediation of creosote-mesquite shrublands to black grama grasslands and discuss that shrublands are one step beyond degraded grasslands, implying that something is wrong with shrublands. This makes sense to a rancher, but should sound peculiar to a contemporary ecologist, especially since shrublands are repeatedly referred to in this volume as being more spatially heterogeneous than grasslands. The desire for spatially homogenous grasslands, with much finer-scale patchiness, is a normative goal, one that is here undoubtedly driven by politics. In a similar vein, two of the editors, who also happen to be former Jornada LTER PIs, repeatedly in one chapter talk about "desertification as degradation." My naïve impression is that deserts have greater biodiversity than any other ecosystem type in North America, including grasslands, an impression that is somewhat supported by Whitford and Bestelmeyer's chapter on animals of the Jornada ecosystem. In fact, the chapter by Bestelmeyer, Brown, Havstad and Fredrickson acknowledges that, on average, during the transition from grasslands to shrublands in the Jornada Basin, alpha-diversity remains unchanged, while beta-diversity seems to increase. This refreshing chapter also acknowledges the political bias that the Jornada's mission is largely to support ranchers, primarily of beef cattle. Desertification is a problem if you graze cattle, but should not necessarily be viewed negatively for maximizing biodiversity.

This volume contains a huge amount of geology, geography, and geochemistry. The preface states, "Much of that research effort, evident in the chapters of this book, has been creating an abiotic-based understanding of this ecosystem given the overwhelming importance of these bottom-up processes in the Jornada Basin." I appreciate the editors' candour insofar as the abiotic, bottom-up approach truly comprises most of this volume. However, it is debatable whether an abiotic view is somehow more important in the Chihuahuan Desert

than in other ecosystems or whether an abiotic view should dominate the study of structure and function of any ecosystem. Although justification for such an abiotic bias may exist, none is presented. The abiotic perspective seems striking given that many of the contributors acknowledge that humans and their cattle are of overwhelming importance in shaping the modern Jornada Basin. An abiotic view may not appeal to most botanists, who usually take a more organismal view of ecosystems. In fact, this volume contains surprisingly little about plants. My guess is that this volume's abiotic emphasis reflects that a biogeochemist, Bill Schlesinger, was PI of the Jornada LTER for most of its history and that he co-authored over one-quarter of the chapters. Tellingly, the one organismal botany chapter in this volume was co-authored by the current and relatively new PI of the Jornada LTER, Debra Peters.

Despite the detailed nature of most chapters, not quite enough attention was paid to details. Several of the chapters contain figures that are unreadable or barely readable. This was probably due to lifting figures that were originally in colour and printing them here in black-and-white. Several equations are gibberish for lack of a decent equation editor. Automatic spelling correction was relied on to its detriment, e.g. creosote being labelled *Larrea tridentate*. The abbreviation ANPP is used in two different ways, aboveground versus annual NPP. None of the chapters contain abstracts. The chapters are seemingly not arranged by themes. These are minor issues, but distracting nonetheless.

This volume not only introduces lots of interesting data and ideas, but also broaches many interesting questions for future research. For example, several authors in this volume state that plant growth is co-limited by availability of water and nitrogen. We also learn that heavy rains wash away available nitrogen. Hence, it seems to be impossible to simultaneously increase availability of these two limiting factors. I anxiously await someone figuring out the elaborate dynamics between water and nitrogen. As another example, is the Jornada really a unique ecosystem in terms of its creosote-mesquite islands of fertility and idiosyncratic nitrogen cycling? Do similar phenomena occur in other semi-arid regions, such as Argentina? How do we estimate NPP in shrublands dominated by mesquite (*Prosopis* spp.), when most of this nitrogen-fixing plant's biomass is below-ground, but traditionally all of our sampling is above-ground? I anxiously await more papers from this great and interdisciplinary assemblage of researchers who call the Jornada home. Despite some foibles, this is a valuable collection of chapters.

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Edible Medicines: An Ethnopharmacology of Food. Etkin, Nina L. 2006. ISBN 0-8165-2093-3 (hardcover: alk. paper, US $50.00). 304 pp. University of Arizona Press. Tucson, Arizona, USA.

In her book *Edible Medicines: An Ethnopharmacology of Food*, Nina Etkin provides us with a rich resource for addressing "non-nutritive" qualities of food, specifically, the medicinal qualities. She states that we use about 3% of the world's plants (~7000 species) as food plants, but half of those food plants derive from only three genera. Many of the other species have limited nutritive roles, but may have pharmacological uses. In her own research with the Hausa of Nigeria, of the 264 local plants that are used medicinally, only 11% are cultivated.

Etkin starts out with an excellent primer of phytochemistry and a brief history of the "food-getting systems" used throughout history. She reminds us that food plants serve many roles besides cuisine components – they may have ritual uses, medicinal value, power as metaphors – and these roles sum to our "sense" of foods.

The author presents a well-written history of the attitudes and philosophies toward food-medicines and their roles in health and healing. Prior to the nineteenth century, healing was a holistic, systemic process that involved generalist approaches to therapy related to balancing our "bodily humors". Most of the burden of health and healing rested on the shoulders of women and the food-medicines they prepared for the family. The advent of the germ theory and advances in technology resulted in a realignment of the responsibility for family health to "professionals", physicians that had a more in-depth knowledge of human anatomy and physiology. By the mid-to-late 1800s, attitudes had shifted from a generalist philosophy to "an articulated doctrine of specific etiology and its corollary, specific therapy" and medicinal foods did not fit well into this new framework.

In subsequent chapters, Etkin discusses specific food groups: spices, fermented foods and beverages, "social plants", and zoologically derived medicines. Spices, with volatile essential oils, are used for flavoring, coloring, and preserving food. Etkin provides a case study of the use of chile pepper (*Capsicum* spp.). Though a New World plant, chile has been incorporated as a signature flavor in the national cuisines of India, China, and Pakistan. Its arrival is more recent in West Africa, but the Hausa people also favor it in their cooking and use it as medicine for treating intestinal parasites, fevers, wounds and other ailments. Modern studies into its pharmacology and phytochemistry have supported its antimicrobial properties.

Treating foods and beverages with heat, leaching, maceration, and/or fermentation has been part of human activities for millennia. These treatments reduce the effects of volatiles (after those chemicals have protected the plant in cultivation) and have the benefit of lowering toxicity, while potentially increasing palatability, digestibility, vitamin content, and antioxidant, antimicrobial and anti-cancer activity.

"Social plants", those that are used outside of meals as "items of reciprocity and communal consumption" often take on ritualistic roles. Etkin highlights nearly a dozen examples of social plants, from alcohol, coffee and tea to chocolate and chewing gum. For each plant, she discusses its social usage as well as its health-related effects.

Lastly, Etkin provides good coverage of medicines derived from animals or animal organs. She starts with a very interesting summary of the ways that animals self-medicate, primarily for pest and pathogen avoidance or treatment. Examples of animals or animal parts used as medicines are followed by an examination of the historical and present role of leeches in healing. The chapter finishes with an extensive discussion of insects, their presence in world cuisines, their uses as medicine, and their nutritional value. Despite Etkin's reassurance that 80% of the world's population regularly eats insects, it is doubtful that Americans and Europeans will be moving much beyond honey anytime soon! However, the same premise applies to plants and animals: if toxins are useful to the organism in warding off disease or predators, then those same toxins may have therapeutic applications for humans as well.

The final chapter summarizes the present state of food-medicines in the US and Europe. With an increasing global economy, consumers are becoming more aware of complementary and alternative medicines (CAM) used in other cultures, and interest in food-medicines is increasing. Etkin addresses genetically-modified foods, the health food industry, extractions of phytochemicals for supplements, and provides two more detailed analyses of adjustments in foods for lactose-intolerance and the emergence of *noni* production as a commercial industry.

Edible Medicines is a well-researched, well-written book that would serve as an excellent reference for classes in ethnobotany, economic botany, human ecology, and pharmacology. While clearly written for an audience with specialized interests, the text is accessible to most readers. Etkin occasionally leans on the jargon of the discipline when simpler terminology would probably suffice, but her writing style pulls the reader through the denser passages. The literature cited serves as an extensive, current and multidisciplinary resource. *Edible Medicines* reveals the history, culture, usage and economics of medicinal foods in an interesting and appealing manner.

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Genetically engineered crops: Interim policies, uncertain legislation, Iain E.P. Taylor Editor, 2007, ISBN: 978-1-56022-989-6 (Paper US$29.95) 430 pp. Haworth Press, 10 Alice Street, Binghamton, NY 13904-1580.

This edited volume presents 17 chapters with 23 authors, none of whom appear to have any connection with the Land Grant Universities of the U.S., or any agrobiotechnology company. Overall, the emphasis is on viewpoints not routinely heard in the U.S. This is both a strength and a weakness of this book. Iain Taylor, who edited this volume, has had a long career studying plant cell walls, and more recently scientific ethics, in addition to extensive work as an editor of the Canadian Journal of Botany and the whole stable of NRC journals. He brings a broad perspective to the subject matter, and has connections to a wide range of authors from diverse backgrounds.

In my opinion the most interesting chapter is the final one, by Brian Wynne, a professor of Science Studies at Lancaster University, UK. He argues, I think rightly, that the way in which "risk" is defined in the debate over deployment of genetically engineered (GE) crops, carries a large baggage of assumptions, perhaps delusions, about what the "public" is and what it "thinks" about scientific matters. Thus, effective dialogue between scientists and technocrats, with their presumed public, frequently is totally ineffectual. This, Wynne would suggest, is because the basic issues "are repeatedly misdefined as if they were purely closed epistemic issues-' How to get *them* (the ignorant public) to understand what *we* know is true?'- when these confrontations are fundamentally issues of different cultures coming into confrontation with one another." His critique of the scientific-technocratic culture is devastating, suggesting that many within its sphere of influence cannot even recognize questions as questions, because the questions are not framed in strictly scientific terms

of "risk". A careful reading of this chapter might serve as a beneficial antidote to our hubris.

The UK and EU have a much stronger tradition of civil society organizations ready to challenge underlying assumptions about GE products than does the U.S. Simon Joss provides an excellent overview of how some such organizations became involved in governance and decision-making, particularly in the European setting. While Joss discusses GE materials in terms of governance and the broader issue of technology assessment, Armin Spoek tackles the biotechnology policy of the EU. He successfully covers a lot of issues and history in under 30 pages. One might say he covers a lot of ground, but in fact, the small area of ground covered by all of Europe is one of the major issues in regulation of GE organisms- different countries with quite divergent needs and views are in very close proximity, making regulatory heterogeneity problematic. For instance the most recent proposed regulations on GE organisms in Germany, which depend on "safe zones" several hundred meters extent, are nearly unworkable where traditional farms are quite small patchwork quilts. In such circumstances, GE organisms are basically regulated out, even as they are formally being permitted.

Four chapters address governance in Canada, the U.S., Africa and Brazil. These are all well written and informative. Unfortunately, some of their statistics are becoming dated already, because this is a rapidly developing area and the book had a long gestation period. Kathleen Merrigan has provided an important historical piece because she was hired as a congressional staff aide in 1987 to manage emerging issues of agbiotech for the Senate Agriculture and Judiciary Committees. Her description of the "principles driving U.S. governance of agbiotech" shows the great contrast between how GE materials are treated in the U.S. and elsewhere. One such principle is the notion of "substantial equivalence", namely, that the issue is not whether an organism is GE or not, but whether it is substantially equivalent to what might be derived by previously developed genetic means.

A contrasting viewpoint is represented by those who invoke a precautionary principle or framework for biotechnology. Kathleen Barrett and Conrad Brunk (University of Victoria) address the principle from a Canadian perspective, while Carolyn Raffensperger is based in the U.S. but writes in more global terms. The chapter by Barrett and Brunk originally was commissioned by Environment Canada as a consideration of the precautionary principle. Raffensperger has written extensively on the precautionary principle and its application to biotechnology, in some instances in collaboration with Barrett. Thus their chapters are complementary in coverage and philosophical basis.

In Canada, all plants with novel traits, not just those developed using genetic engineering, are subject to review prior to release. Thus, plants with herbicide resistance from spontaneous mutants in the aromatic amino acid biosynthetic pathway are reviewed using the same procedures and criteria as those engineered to be resistant to glyphosate. This is the converse of substantial equivalence and more precautionary than the strategy being used in the U.S. E.A. Abergel reviews how this affects regulations and trade from Canada to other parts of the world, particularly the EU. She suggests that underneath the wide acceptance of GE organisms in agriculture, there is significant discontent amongst the product-consuming public. The basis of her argument is that the rapid adoption of GE plants outstripped the pace of essential dialogue on ethical issues including risks and benefits. Various opinion polls, at least in Canada suggest that she may well be right.

Michiel Korthals provides some interesting thoughts on the relationships of seven ethical problems and four major constituents of biotechnology including "governments, markets, civil societies and (bio)science". His chapter is only a starting point and it would really take another book to work through a complete discussion. He specifically is looking at the "technology divide", the stark contrast between how government and the private sector resources differ between developed and developing world. Iain Taylor looks to "next challenges for crop GE: maturing of governance and moves beyond food issues". His review would serve as a good stand-alone discussion of where the field ought to be heading.

I found the first few chapters of the book much less satisfying. In part this is because much of what the authors say has been said before, by the same authors in different venues, and some of it has a recycled flavor. Also these authors are laboring under a disadvantage in trying to keep up with a rapidly changing field. For instance, in June of 2007, a meta-analysis was published in Science magazine, dealing with the impacts of insect resistance on non-target organisms. In that analysis more than thirty detailed studies of Bt (Bacillus thuringiensis) genes in crop plants were considered. Thus many concerns expressed by authors of the early chapters which are quite critical of the scientific underpinnings of risk assessment for GE crops, have in fact been addressed in a very extensive way. Having myself written a recent chapter in a book specifically dealing with cotton, I know that there is in fact is an even more extensive literature than cited in the Science article. Because

most of it finds little or no effect, and certainly no significant injury beyond the anticipated impact on caterpillers, it is not published in high profile articles. Only negative news tends to get wide press play. Meanwhile, thoroughly discredited, but widely disseminated pieces continue to circulate and truth never quite catches up with them.

I really would have liked to see stronger and more balanced discussions in the first five chapters, to provide a better basis for the more useful chapters that follow. One question only tangentially addressed in this book, though perhaps pointed toward by Wynne is "if not GE crops, then what?" We will have crops and agriculture for as long as we have a civilization. Would we rather have the status quo ante, with high pesticide and herbicide use, massive erosion and dwindling genetic gains? Or do we have a different viable vision?

On balance, this book provides a significant, useful contribution to the discussion of GE crops. It will be essential for GE proponents to understand the arguments presented here. Otherwise, the concept of GE crops will never become a reality for more than a half dozen major crops in highly industrialized agriculture, which is where it is stuck now and for the foreseeable future.

-Lawrence C. Davis, Professor of Biochemistry, Kansas State University, Manhattan, KS 66506.

Introduction to Fungi 3rd ed. Webster, John, and Roland W. S. Weber. 2007
ISBN 978-0-521-01483-0 (Paperback). 841 pp. Cambridge University Press.

The authors' stated purpose is "to place an organism in its taxonomic context while discussing as many relevant aspects of its biology as possible in a holistic manner." Here we consider what that goal might mean and whether the book meets it.

This is an updated third edition of a traditional British mycology text from 1970 and 1979. As such it includes all the groups that once belonged to the Fungi: slime molds of all types that are now classified as Protozoa, the Oomycota and other groups now classified in the Straminopila, as well as the Eumycota. The book addresses taxonomy in the sense that the chapters follow phyla, orders, families and in some cases genera. Taxonomic characters are primarily those of life cycles along with cell structure and some natural history. Molecular data is mentioned, but not evaluated or compared with morphological characters.

The approach is basically one of life cycle drawings and diagrams. The aim of the first edition was "to produce original illustrations of the kind that a student could make for himself (sic)… and to illuminate things which he can verify for himself (sic)." This goal is maintained throughout the third edition. "Original line drawings…can readily portray an understanding of structure and that drawing as a record of interpretation is a good discipline." Clearly an arguable point. In an era of digital images and search engines, why is this a good idea?

One reason is that the material is assembled in an orderly manner and the drawings catch ones attention in a way that words fail to do. The line illustrations range from careful renderings to stylized diagrams to line drawings of transmission electron micrographs. Some are adequately labeled, e.g., Fig. 11.9 *Gymnoascus*, with labels of antheridium, peridial hypha, ascogonium, and ascogenous hypha. However, most figures, e.g., Fig 15.11 *Trichoglossum* are completely unlabeled. So line drawings have various curlicues and shadings, but no explanation of what these are. Indeed one way to use the book in a class would be to have students decide how to label the drawings. These drawings are not realistically the kinds that a student would make. The effort to stipple or to include all the coils of a *Helicon richonis* spore (Fig. 25.21) would exceed the time allotted for this work in a laboratory session. And what are those dots anyway?

Micrographs are of various kinds. Numerous scanning electron micrographs and a few transmission electron micrographs are suitable and helpful. Scattered compound microscope images taken with differential interference contrast illumination add valuable information. Twelve plates of color photographs illustrate the range of visual appearances of fungi. Again most photograph lack detailed labels; the reader is left to interpret how the labels in a figure legend apply to the image.

Does the book discuss "as many relevant aspects of its biology as possible in a holistic manner"? I do not know what a "holistic manner" is so I'll skip that.

"As many…as possible" has no meaning, but "relevant aspects" does. I looked up "sudden oak death", one of the top public concerns regarding fungi in California. No entry. But there was an entry on "sudden infant death syndrome" linking it to *Pneumocystis*, an Archiascomycete, but with no supporting reference. This is spurious at best. Under *Phytophthora* in the Oomycota, there was reference to *P. ramorum*, "a serious pathogen of oak trees" and one cited reference. There is useful information about chemical compounds in fungi, e.g., secondary metabolites and mycotoxins with molecular diagrams of penicillin, griseofulvin and aflatoxin. Other "relevant aspects" include fermentations, biological clocks, wood rot, Dutch elm disease, and the price of white truffles, all definitely interesting.

I believe that a textbook should also point to the online literature, e.g., at a minimum, AFTOL and Index Fungorum. Many wonderful websites address aspects of fungal life histories and include remarkable images. At least include that in an introduction or put up a website with useful links. Just for fun, I surfed up "Laboulbeniales". Wow! What wonderful images and information are on line. Compare that to the one-page entry in the index of Webster and Weber referring to one sentence in the Introduction to the Ascomycota.

In contrast to Bryce Kendrick's, *The Fifth Kingdom*, which might be called "mycology lite", Webster and Weber's, *Introduction to Fungi*, is definitely "mycology heavy" at 1.9 kg for the paperback version. Clearly it carries the weight of mycological history and its own prior editions.

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Induced Resistance for Plant Defence: A Sustainable Approach to Crop Production. 2007. Walters, Dale, Adrian Newton and Gary Lyon (eds) ISBN 9-781-40513447-7 (Clogh US$199.99) 258 pages, Blackwell Publishing Ltd., Oxford, U.K.,

To appreciate the timeliness of this book, one need only know that about 12 % of global crop production, valued at about 84 billion U.S. dollars, is lost to disease annually. The thirteen chapters, each written by a specialist, review virtually all aspects of the mechanisms plants employ to limit damage from predatory agents, from viruses, bacteria and fungi to chewing and sucking arthropods and nematodes. The writing is predominantly at an advanced level, although beginners and neophytes in plant pathology can certainly profit by picking their way through almost any chapter. Most of the 21 authors are from the U.K. (especially Scotland), Europe, Australia or New Zealand; only 2 are from the U.S. Thus, American readers have to get used to "defence" with a "c" and "labour" with an added "u"; they are also apt to get a somewhat different point of view from that found in similar surveys of U.S. origin.

In facing attack by predators, plants are neither defenseless nor do they have a sophisticated animal-type system responding specifically to each invader with an antibody or similar molecule. Rather, they have mechanisms for inducing local or systemic responses to broad classes of invader-induced stresses. Early observations of induced resistance were made in the 19th century, but the phenomenon was not systematically explored until the 1950's and 1960's. We now know that Systemic Acquired Resistance (SAR) is frequently dependent on the induced synthesis of salicylic acid and may also involve the synthesis of phenols, isoflavonoids and lignin, leading to cellular necrosis, producing pockets of dead cells that effectively wall off and limit the spread of the disease. Induced Systemic Resistance (ISR), on the other hand, is frequently associated with root pathogens and the induced synthesis of ethylene and jasmonate. Both types may be triggered by a wide variety of elicitors, including antibiotics, chitin, sterols, glucans, peptides and yet uncharacterized components of plant cell extracts. The genomic background of the plant may determine whether infection can occur and the nature and strength of the plant defensive response, including "gene for gene" responses to avirulence (Avr) genes of the pathogen.. Clearly, it behooves us to gain more information about the subsequent proteomics of these reactions, as well as the metabolic pathways activated to yield the ultimate defense mechanism. Recent programs to sequence the entire genomes of important crop plants make it more likely that we will be able to gain greater understanding and ability to design effective countermeasures. In so doing, we will have to consider ecological matters as well, because mutualisms of various kinds occur. For example, accompanying non-pathogenic organisms may affect the pathogenicity of the invader, and endophytic mycorrhizae and even compost can affect responses, while light regimes, temperature and other environmental variables may modulate them. Fortunately, all of these subjects are at least alluded to in various chapters, and some are exhaustively discussed. All chapters have extensive bibliographies, and thus provide a basis for further investigation by advanced workers.

Presently available knowledge has permitted the synthesis and application of commercially available agents for inducing resistance, such as beta-aminobutyric acid (BABA), benzthiodiazole (probenazole) and acibenzolar-S-methyl ("Bion"). The effective use of these compounds and their incorporation into effective and sustainable protective regimes for crops is discussed at length. In the future, such studies may well be fortified by our increasing genetic knowledge of crops to produce programs of breeding crops to respond to specific agents. This is a dynamic field, and this book provides a basis for understanding it.

-Arthur W. Galston, Department of Molecular, Cellular and Developmental Biology, Yale University,New Haven, Connecticut.

Senescence Processes in Plants: Annual Plant Reviews Volume 26. Gan, Susheng (ed). 2007. ISBN 978-1-4051-3984-7. (Cloth US$199.99) 332 pp. Blackwell Publishing, 2121 State Avenue, Ames, IA, 50014-8300.

Mid October, while admiring luminous leaf colors and raking fall's first-fallen leaves, seems an especially apt time to read a series of new review articles devoted to understanding Senescence Processes in Plants. A collection of researchers working primarily in Canada, Europe and the USA, contribute physiological, cellular, biochemical and molecular mechanisms underlying leaf senescence. There has been considerable progress in this field, especially in genetic and genomic aspects. Beginning with a chapter on senescence-related terminology and current knowledge of mitotic senescence in plants, a little-studied subject written by Editor Gan, the book focuses on post-mitotic senescence, and includes chapters addressing the senescence of leaves, flowers and fruits. Later chapters examine the development of various new biotechnologies for manipulating the senescence processes of fruit and leaves, some of which are approaching commercial application. The review format of this book seems to have necessitated summaries supplemented with long bibliographies to assist readers who wish to pursue specific details more thoroughly.

The biological function of leaf coloration is poorly understood. Hörtensteiner and Lee, in Chlorophyll catabolism and leaf coloration, trace chlorophyll catabolism and the dynamics of accessory pigments. Virtually all orange and red color change is due to *de novo* synthesis of anthocyanins, which are not present in leaves as carotenoids are. In the past decade, evidence of photoinhibitory protection by anthocyanins has accumulated. Simultaneously, increased interest in antioxidant components of foods led researchers to demonstrate potent antioxidant activity of anthocyanins. The challenge in understanding the function of accessory pigments that are synthesized *de novo* is to justify the metabolic expense of producing pigments at the end of the leaf life span. Two separate and competing hypotheses based on physiological and ecological studies, are reconciled.

"Loss of membrane structural integrity is a seminal feature of senescence that is initiated early in the cell death cascade." This exemplifies the well-written expressions in Membrane dynamics and regulation of subcellular changes during senescence, by Hopkins et al, that investigates dismantling of membranes, autophagy and nutrient recycling, metabolism of membrane fatty acids and conversion to phloem-mobile sucrose for transport to developing seeds, and translational regulation of senescence.

In Oxidative stress and leaf senescence, Zentgraf highlights the ongoing debate as to whether senescence is a form of programmed cell death or a developmental process with unique features. Under the collective acronym ROS, respiratory oxidative molecules and singlets such as the superoxide radical, hydroperoxyl radical, hydrogen peroxide and the hydroxyl radical are extremely reactive and able to oxidize biological molecules such as DNA, proteins or lipids. They may lead to massive impairments of all cellular components, often resulting in irreparable metabolic misfunction and cell death. Superoxide radicals can oxidize specific amino acids such as histidine, methionine and tryptophane. Chloroplasts are the main source of ROS in plants. Oxidative stress arises from an imbalance between generation and elimination of ROS, often leading to cell death.

Nutrient remobilization during leaf senescence by Fischer opens with a helpful overview that categorizes types of senescence: annual crops, monocarpic, i.e. fruit set and maturation directly associated with whole-plant senescence and death, top senescence in species with bulbs, tubers, tap roots and rhizomes, deciduous senescence in trees and shrubs of temperate zones, and progressive senescence in evergreen trees. In contrast to annuals, leaf or whole shoot senescence is not directly associated with seed filling in perennial

plants. Loading of photoassimilates and other compounds into the phloem is probably the best investigated step in higher plant transport processes. The availability of genomic and proteomic methods has added a substantial amount of information to our knowledge of senescence processes, including nutrient remobilization from senescing leaves. Peptidases of senescing leaves may help understand nutrient remobilization at the cellular level.

Lers tackles the relationship between senescence and environmental stress, capturing the profound impacts of global changes to endanger our future environment, such as increasing temperatures, changes in precipitation, and altered atmospheric gas composition and radiation. This topic implicates involvement of three primary plant hormonal pathways: ethylene, jasmonic acid and salicylic acid. Each component of the environment: light intensity, photoperiod, wavelength, ozone, temperature, drought, flooding, salinity, pollution/ toxic materials, oxidative stress involvement in environmental regulation, nutrient and mineral shortage, carbon dioxide, biotic stress, is addressed.

What controls the length of life is a fundamental biological question that has puzzled scientists for centuries. Developmental and hormonal processes that control leaf senescence, by Schippers et al, reviews the prominent roles that hormones play during developmental ageing and the initiation and progression of senescence from a molecular view. Responses to hormones that delay leaf senescence: GA, auxin and cytokinins, which have the strongest effect, are contrasted with hormones that induce leaf senescence: ABA, brassinosteroids, ethylene, jasmonic acid, and salicylic acid. They conclude that senescence is an extremely complex phenomenon, due to the involvement of multiple components that exhibit overlapping effects.

The genetic manipulation of senescence in agriculture features in two chapters. Genetic control of senescence revealed by mapping quantitative trait loci [QTL], by Ougham et al refers readers to rice, the subject of a number of QTL studies of leaf senescence that demonstrate many of the challenges of the approach. The genetics of leaf senescence has been scrutinized extensively in sorghum, because delayed leaf senescence is considered a valuable agronomic trait. Water limitation during the grain development stage can cause premature leaf death and poor yield of seed and stover. With maize, too, delayed foliar senescence has been associated with enhanced yield or drought resistance. QTL, which can influence grain protein content, occurs on all chromosomes in barley and *Triticum* spp. Nevertheless, rice, by virtue of its small genome and diploid nature, is the model for genome research in grasses. Genomics and proteomics of leaf senescence by Carp and Gepstein, and Molecular regulation of leaf senescence by Kim, Lim and Nam seek to elucidate the roles of potential regulatory genes in senescence.

"The wilting of flower petals is perhaps the most deliberate and precisely controlled senescence event in plants" introduces an examination of Flower senescence, by Reid and Chen. Hormonal regulation, remobilization of resources, petal senescence as programmed cell death, and molecular biology of petal senescence are the headings included. Fruit ripening and its manipulation by Giovannoni, describes physiologies of ripening fruit processes and their manipulation, aimed to control ripening to achieve best nutritional quality, detoxify potentially damaging free radicals, or adjust antioxidant levels.

Genetic manipulation of leaf senescence, by Guo and Editor Gan, offers strategies of manipulating leaf senescence such as transgenic techniques for manipulation of cytokinin production. Their closing remarks state that current molecular genetic approaches used in delaying senescence derive from plant hormone biology: either blocking ethylene production, or enhancing cytokinin production. The former strategy primarily prevents fruit senescence. The latter strategy encounters some difficulties with developmental abnormality. The cloning and use of the highly specific SAG12 promoter from *Arabidopsis* to direct IPT in transgenic plants has made it possible to use the cytokinin-based strategy to manipulate senescence. Recently, senescence-specific genes were identified in other species. It is likely that the promoters of the new genes will be used to fuse with IPT to form the autoregulatory senescence inhibition systems similar to SAG12-IPT.

This volume documents well that significant progress has been achieved unraveling molecular regulatory mechanisms underlying leaf senescence, and some important regulators of leaf senescence are accepted. English is not the first language of a number of contributors, and there are places where their colloquial speech crept in and remains. There are understandably, overlaps in content, but specialists will benefit from the reappearance of themes by several experts addressing a single subject from the point of view of their distinct spheres.

-Dorothea Bedigian, Research Associate, Missouri Botanical Garden, St. Louis, MO

Growing Carnivorous Plants. Rice, Barry A. 2006. ISBN 0-88192-807-0. (Cloth US$39.95) 224 pp. Timber Press, 133 S.W. Second Avenue, Suite 450, Portland, OR 97204-3527 and **Pitcher Plants of the Americas.** McPherson, Stewart. 2007. ISBN 0-939923-74-2 (Paper US$34.95) 320 pp. The McDonald & Woodward Publishing Co. 421-B E. College Street, Granville, OH 43023.

Two truly excellent books on carnivorous plants have been published recently, one with a narrower, more scientific focus on pitcherplants and the other with a broad view of the cultivation of all carnivorous plants. Growing Carnivorous Plants, by Barry Rice of the University of California at Davis and the Nature Conservancy, arrives from Timber Press while Stewart McPherson's Pitcher Plants of the Americas is published by McDonald & Woodward. [Disclaimer: The reviewer is the current President of the International Carnivorous Plant Society, for which Barry Rice is one of two journal editors, and provided one photograph for a chapter of Rice's book.]

Barry Rice is a well-known expert in the cultivation of a wide range of carnivorous plants, including the cobra lily (*Darlingtonia californica*; Sarraceniaceae), and the notoriously difficult-to-cultivate corkscrew plants (*Genlisea* spp.; Lentbulariaceae). His websites at www.sarracenia.com and the Galleria Carnivora found there, are fonts of images and information renowned among carnivorous plant enthusiasts. Thus, he was a highly appropriate choice to write such a book, and he succeeds admirably in covering all major groups of carnivorous plants, such as bladderworts, in separate chapters, along with a catch-all chapter for minor groups of carnivores such as South Africa's *Roridula* (Roridulaceae) and non-carnivores often mistaken for carnivorous plants. Along the way, Rice merges a very clear text with occasional eccentric humor, for which he is known, as on p. 174 when he writes of a cultivar of tropical pitcherplant named for a nursery owner in California, and friend of Rice's, "The grotesque 'Peter D'Amato' is best kept in a greenhouse..."

The two most outstanding things about this book are the marvelous pictures—always crisp and informative and often showing very tiny but important details—and the wealth of information on their cultivation. So many people have as the story of their first attempt at horticulture something like: "When I was 8, I was given a Venus Flytrap, which died 2 weeks later. I can't grow plants." The information in this book can help many people avoid those kinds of problems.

From lighting conditions to soil mixes to watering (amount, water hardness, etc.), all of the information is there which a reader would need to cultivate many different carnivorous plants. He even provides tables which are useful for both taxonomists and horticulturalists—there are few, if any, other places where one can quickly and easily find out which members of *Utricularia* are rheophytes or which members of *Drosera* are tuber-forming species.

Throughout, Rice reminds readers frequently about how badly endangered many carnivorous plants are in their native habitats, the importance of buying only cultivated plants. He also urges them not to release carnivorous plants into habitats where they do not belong, since a bog overrun by non-native carnivores is not much more good to the natives than a bog drained by ditching. This is as would be expected in a book written by a specialist on weedy plants from the Nature Conservancy.

McPherson also emphasizes shrinking natural habitats and the importance of conservation in his clearly written book, but his is aimed at a more technical audience and deals just with the carnivorous pitcher plants of the Americas—the three genera, *Sarracenia*, *Darlingtonia*, and *Heliamphora*, of the Sarraceniaceae. McPherson, like Rice, provides stunning photographs. Since his brief is more oriented towards field work than Rice's, McPherson actually takes the reader's breath away more often, as when he shows an oblique aerial view of the tepui, or table mountain, called Mt. Roraima (pp. 104-105). Unfortunately, his line drawings are pleasant but could be more detailed, and the finer lines often disappear with whatever reproduction process was used with this work.

He provides much more scientific detail than Rice. For example, he digresses into a discussion on infraspecific diversity in the various genera of the Sarraceniaceae, both what is easy to reason out and that which deserves further study.

McPherson also is more forgiving than Rice in how he defines carnivorous pitcher plants, including chapters on two genera of bromeliads, Catopsis and Brocchinia, which are suspected of containing some carnivorous species. However, there is still active debate about this, and most books on carnivorous plants place these genera in a catch-all chapter. In the author's defense, these plants are often accepted on the list of carnivorous plants, and some of them occur in a region where *Heliamphora* is endemic. McPherson does discuss the controversy, but he clearly, in his mind, places these genera on the list of carnivorous plants.

In spite of his more technical focus, McPherson does consider finely divided groups within species of American pitcher plants, some of which are best

known as cultivated forms, as well as providing a chapter on cultivation which includes some sources of these plants in English-speaking countries, though the list is short and incomplete. A Yahoo! search would provide the names of more sources of American pitcher plants. Especially notable for their absence are the various regional, national, and international societies devoted to carnivorous plants, each of which usually maintains a seed bank for members with seeds of *Sarracenia* and *Darlingtonia*.

Both of these books, Rice's Cultivating Carnivorous Plants and McPherson's Pitcher Plants of the Americas, are outstanding and belong in all college and university libraries. The photographs alone should be able to excite students' interest in botany. Most botanists would find them useful in their personal libraries, for answering both the "Martha Stewart had these plants that catch bugs, how do I grow them..." type of questions as well as the "my kid got this plant that eats bugs, and I don't know how to keep it alive..." type that all botanists face at some point. Buy them today.

-Douglas Darnowski, Department of Biology, Indiana University Southeast

Wild Orchids of the Prairies and Great Plains Region of North America. Paul Martin Brown with watercolors by Stan Folsom. University Press of Florida, Gainesville. ISBN 0-8130-2975-9. $29.95.

Extending for more that 1500 miles, south to north, the prairies and Great Plans of North America include plains, river valleys, hills, mountain ranges and the Black Hills of South Dakota and Wyoming. A map in this book shows that they extend from parts of Texas and Louisiana to Saskatchewan and Manitoba (south to north) and Wisconsin and Illinois to Montana, Wyoming, Colorado and New Mexico (east to west). This vast expanse contains a large number of plants and not a few orchids (from a low of 5 species in Colorado to a high of 50 in Illinois with a fair number occurring in more than one state).

A number of publications which deal with the flora or the orchids of North America in general and those of specific states cover the orchids of this area. However, this is the first field guide which brings this information together in a form which can be used by those who may wish to enjoy treasures such as *Spiranthes* (15 species plus three natural hybrids) the flowers of which resupinate as they open while the entire inflorescence twists to form a spiral; *Corallorhiza* (five species, three with two varieties each) a mycotrophic genus in the area covered by the book (the authors must be congratulated for not using the old, tired, and incorrect "saprophytic orchid") which has managed to reverse the usual order in nature in that the orchid is parasitic on a fungus rather than vice versa; and fascinating lady slippers, *Cypripedium* (five species, one with three varieties plus three natural hybrids).

The book has an illustrated key to genera and keys to every genus. These keys should prove to be very helpful to those who take the book outdoors to look for and identify orchids. And, once the used/reader is lead to a particular species the many excellent drawings, maps, drawings and color photographs will help in making the final determination.

Part 3 of the book, "References and Resources" is a marvelous collection of additional information (it covers 100 pages and the list of goodies is too long to include here) which is not only invaluable, but should also serve as an example for others who write such books.

If this book has any shortcomings we could not find them. Hence, this short review. This is an excellent book. We only hope that the authors will similar books about other parts of North America, starting with the West Coast, of course.

-Tim Wing Yam, Senior Researcher Officer, Singapore Botanic Gardens (YAM_Tim_Wing@nparks.gov.sg) and Joseph Arditti, Professor of Biology Emeritus, University of California, Irvine, CA 92604 (jarditti@uci.edu).

Orchids of the Singapore Botanic Gardens, 3rd edition. Text and pictures by Tim Wing Yam. National Parks Board (www.nparks.gov.sg, NPARKS_Mailbox@nparks.gov.sg), Singapore Botanic Gardens, Cluny Road, Singapore 259569. ISBN 978-981-05-7752-0. Singapore $23.00 (ca. US$15).

In the late 1920s Prof. Hans Burgeff, the German orchid mycorrhiza expert visited Singapore on his way to the Bogor Botanical Gardens. He introduced Prof. Eric Holttum (his photograph is on page 19 of the book), the legendary director of the Singapore Botanic Gardens (SBG) to asymbiotic orchid seed germination. Holttum initiated an orchid hybridization program immediately (pictures of the building where the laboratory was situated and of the seedling room can be seen on pages 19 and 23) and in 1931 flowered *Spathoglottis* Primrose, the first hybrid: a) made by a human in Singapore, b) in the genus, and 3) created in the Singapore Botanic Gardens. Despite its age (76 years) and this hybrid remains popular and easily holds its own against modern hybrids. It started a tradition of orchid breeding at SBG which continues at present.

The hybrids are displayed in the garden and/or named after dignitaries, local (for example, *Trichocentrum* Christine Dhanabalan, *Parachnis* Eric Holtuum and *Pecteilis* Kiat Tan), foreign (*Aranda* Barbara Bush, *Dendrobium* Jackie Chan, *Mokara* Laura Bush, and *Paravanda* Nelson Mandela, for instance), and unusual (*Vanda* Hong Kong and Shanghai Bank). Several excellent breeders produced these hybrids over the years. This book is by the latest of these breeders (photograph on page 116).

The book is multifaceted in that in includes sections on orchids in general, orchids in the Singapore context and local species, a brief and interestingly illustrated history of the orchid program at SBG, orchid species of Asia-Pacific and the Americas grown in SBG, and hybrids produced at SBG. All sections are well written and magnificently illustrated with photographs and historical color paintings.

I have spent a considerable amount of time in Singapore during the last 40 years (and consider it to be my second home), much of it at SBG and its orchid collection, but I still found in this book gems that escaped my attention. Those who have not been there will find this book to be excellent and very enjoyable even if they have no special interest in orchids.

Singapore is sometimes called the Lion City (because that is the translation of its name into English and there is an orchid by that name). It is also known as the Garden City (because that is what it has been made into). This book presents a convincing argument that another name for Singapore should be the Orchid City.

-Joseph Arditti, Professor of Biology Emeritus, University of California, Irvine, CA 92604.

Books Received

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12th international Exhibition of Botanical Art & Illustration. White, James J. and Lugene B. Bruno. 2007. ISBN 0-913196-82-7. (Paper US$25.00) 190 pp. Hunt Institute for Botanical Documentation, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213.

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