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

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Editor: Marshall D. Sundberg
Department of Biological Sciences
Emporia State University
1200 Commercial Street, Emporia, KS 66801-5707
Telephone: 620-341-5605 Fax: 620-341-5607
Email: psb@botany.org

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This is the last issue of Plant Science Bulletin before we begin the Botanical Society's Centennial Year. What better way is there to prepared for the celebration than to highlight the career of one of our most distinguished former members, especially if she happened to be President of the Botanical Society of America during our 50th year? I originally invited Dr. Lee Kass to write a shorter piece about Harriet Creighton to give us a sense her personality as well as her scholarship. Lee, who is chairperson of the BSA Historical Section, has presented us with a piece of her own scholarship that goes well beyond my original request. I am proud to be affiliated with the organization to which Creighton was so dedicated. I'm sure you'll feel the same way!

-Editor

100th Anniversary Series

HARRIET B. CREIGHTON: PROUD BOTANIST

Harriet Creighton (1909-2004) was the third woman elected to the presidency (1956) and the first woman secretary (1950-54) of the Botanical Society of America (BSA). Creighton's many contributions to the BSA and to botanical education are often overshadowed by her most cited work, the first demonstration of cytological and genetical crossing-over in *Zea mays* (McClintock 1931, Creighton and McClintock 1931, Coe and Kass 2005a). The investigation was part of Creighton's dissertation research project (Creighton 1933) at Cornell University (1929-1934), under the guidance of her collaborator, Dr. Barbara McClintock, who had suggested the problem. Their study provided additional confirmation of the chromosome theory of inheritance for which Thomas Hunt Morgan would win a Nobel Prize in 1933.

While a graduate student in 1973, I was first introduced to Creighton during the Thirteenth International Congress of Genetics in Berkeley, CA. Years later, in the context of interviewing Creighton about her work with McClintock, I experienced her outgoing and generous nature (Kass 1994, 1996). In long, beautifully printed, hand-written letters, she carefully answered my many questions about early investigations in maize cytogenetics, and about students and faculty in Cornell's Departments of Botany and Plant Breeding, including insights on policies and procedures for gaining academic jobs and rank in the early 20th century (Kass 2001, Kass 2003, Kass *et al*. 2005, Kass 2005). She also gave me her own cherished copies of celebrated works by Lester W. Sharp (Fotheringham 1928) and Alan C. Fraser (Emerson *et al.* 1935), members of her Ph.D. committee.

Creighton recalled that Margaret Clay Ferguson (1863-1951), her undergraduate Professor of Cytology at Wellesley College, encouraged her to study at Cornell University. Ferguson had received her B.S. (1899) and Ph.D. from Cornell (Ferguson 1901), and was the first woman president of the BSA (1929). Creighton returned to Wellesley as a member of their faculty, where she enthusiastically continued Ferguson's commitment to the botanical sciences, endeavored to expand her programs in botany, and encouraged the Department and Trustees to name the Wellesley greenhouse complex in her honor (Creighton 1947).

Although she was pleased and proud to discuss McClintock's early contributions to science, recognized much later by her 1983 Nobel Prize winning research, Creighton denied that she had made much of a scientific contribution herself. As early as 1938, Creighton is listed in *American Men of Science* (Cattell and Cattell 1938:307). She was not starred, however, among the top ranking 1,000 scientists in the United States, as were her mentors, Ferguson (starred in Botany, 1910) and McClintock (starred in Botany, 1944) (Rossiter 1982:293). It was only after her death that I gained access to her *CV* and Publications List, which were generously

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Address Editorial Matters (only) to:
Marsh Sundberg, Editor
Dept. Biol. Sci., Emporia State Univ.
1200 Commercial St.
Emporia, KS 66801-5057
Phone 620-341-5605
E-mail: psb@botany.org

provided by the Wellesley College archives (WCA). Creighton's publications and early contributions to maize genetics may be found in issues of *Proceedings of the National Academy of Sciences (PNAS)*, *Maize Genetics Cooperation News Letter*, *Records of the Genetics Society of America*, and citations to her works appear in many books and journals, whose authors also acknowledge her for sharing data.

Her major contributions to our field, however, are her behind-the-scenes participation on many national science education committees for the BSA, the American Institute of Biological Sciences (AIBS), and the National Science Foundation's National Research Council (NSF/NRC) (Faculty File, WCA). Much of her involvement on these committees has been described in the pages of the *Plant Science Bulletin* (*PSB*[1]), of which she was a founding member. Additionally, Creighton served on the *PSB* editorial board (1955-1959), was acting editor (1956), and had graciously accepted editorial responsibilities in May 1958, when founding editor Harry J. Fuller took ill. She wrote articles encouraging innovation in teaching (Creighton 1956, 1958), and in her retiring presidential address, she encouraged her fellow botanists to be as proud as she was of their botanical roots, and challenged them with the call "Botanists of the World, Unite! and Get Going" (Creighton 1957).

Early Achievements, 1929-1940

The Cornell Years*:* Creighton was born in Delavan, Illinois on June 29, 1909. At age 20 she graduated from Wellesley College (A.B. 1929), and accepted an assistantship (1929-1932) in General Botany with Loren C. Petry, Professor of Paleobotany in the Department of Botany, College of Agriculture, at Cornell University. Creighton's mother accompanied her to Ithaca, where Barbara McClintock took the young graduate student under her wing (Figure 1). It was McClintock, Creighton told me, who suggested that she pursue a Doctorate in Cytology with L.W. Sharp and to bypass the Masters degree, which she had considered doing initially. McClintock, an Instructor and Sharp's teaching assistant, introduced Creighton to Sharp at his home, where he was recovering from a broken toe.

Creighton was familiar with Sharp's recently published textbook, *Introduction to Cytology* (Sharp 1926), and expected to meet a stodgy grey-haired professor. Instead, she was pleasantly surprised to find a young man with a crew cut, who loved music and had a wonderful sense of humor. His hoax of the woofen-poof bird, *Eoörnis pterovelox gobiensis*, published the previous year under the pseudonym A. C. Fotheringham (1928), was the talk of the department. She was present when Sharp read with disbelief its review published in *The Quarterly Review of Biology* (Pearl 1930). He truly believed that the reviewer had been taken-in, she recalled laughingly, until he reached the end of the summary, where it was made clear that the so called serious review was a spoof in itself.

Sharp was Vice-president of the BSA when Creighton arrived at Cornell in 1929, and he was elected President the following year. L.H. Bailey, Dean of the College of Agriculture, had been President in 1926, and Karl M. Wiegand, Chair of the Department, would be elected President in 1938. George F. Atkinson, first President of the BSA (1907), was a Cornellian, and other Botany Department faculty members were affiliated and would become officers of the Society (BSA 2005:234); most faculty members in the Plant Breeding Department had also joined.

McClintock suggested Creighton's minor subject areas, Plant Physiology and Genetics, and the Professors whom she should include on her committee, Otis F. Curtis, a member of the Botany

Department, and Alan C. Fraser, in the Plant Breeding Department. In 1929, Creighton learned many new plant cytological techniques from McClintock, and met Charles Burnham, a National Research Council (NRC) Fellow who had arrived that summer at Cornell from Wisconsin to work with Rollins A. Emerson, the head of the Plant Breeding Department. They worked together in close quarters in Sharp's Cytology Laboratory in Stone Hall, where Creighton shared a desk with future Nobel Laureate, George W. Beadle (Creighton 1992, Burnham 1992, Kass and Bonneuil 2004).

Emerson and Beadle, his student, had initiated the *Maize Genetics Cooperation News Letter* in April 1929 (Kass *et al.* 2005; Coe and Kass 2005b), where students of maize genetics shared their unpublished data. Cooperation among students was fostered in Sharp's laboratory and encouraged by Emerson, who also established the Maize Genetics Cooperation at Cornell (Kass *et al*. 2005). This cooperative spirit shaped Creighton's view of joint efforts and ethical practice in science (Letter, Creighton to Kass, 27 Feb. 1995; Kass 2001).

Emerson also encouraged faculty and graduate students in the Departments of Botany and Plant Breeding to attend Synapsis Club meetings. Creighton went regularly with her major professor and graduate student colleagues. The club sponsored weekly dinners with speakers, held special social gatherings, and organized a bowling league on which Creighton was a star performer (Synapsis Club Records, Cornell University Archives). Creighton was quite athletic. She played tennis regularly with her graduate student colleagues, and was renowned for climbing the buildings at Cornell. When I asked her about a story I had heard regarding McClintock climbing up the Plant Science Building to get into her office when she had forgotten her key, Creighton said emphatically that it was she who had climbed to the second floor of the building, entered through the window, and unlocked the door. She added: "That building was just meant to be climbed."

In their study of the cytological basis of crossing-over, Creighton used a semisterile corn stock with a prominent knob at the tip of the short arm of chromosome 9, and having a piece of chromosome 8 attached (a translocation). Burnham had brought the stock with him from Wisconsin and generously shared it with them (McClintock 1930, McClintock 1931, Creighton and McClintock 1931, Kass and Bonneuil 2004, Coe and Kass 2005a). McClintock had applied Belling's chromosome squash technique to the anthers in this strain of corn, and first clearly observed corn chromosomes at the pachytene stage (McClintock 1930, Kass 2003). Creighton took advantage of this new technique and by April 1931, had limited data to support a claim for a correlation of "genetical and cytological crossing over." Morgan, who had learned of their results during a spring lecture tour at Cornell, encouraged them to publish immediately (Coe and Kass 2005a, see also Keller 1983).

FIGURE 1. Barbara McClintock and Harriet Creighton at Cornell University, June 1930 (reprinted with permission from Kass 2003, *Genetics*).

Creighton became Sharp's assistant in Cytology when McClintock left Cornell to begin her NRC Fellowship at Missouri in June of 1931. They corresponded regularly regarding their upcoming publications (McClintock 1931, Creighton and McClintock 1931), which were submitted by Emerson in July and published in the August PNAS (Coe and Kass 2005a). Unfortunately, none of their letters about these critical papers have been saved (Postcard, Creighton to Kass, 8 Dec. 1996), but Emerson's correspondence is in the Cornell University Archives. Creighton granted permission to reprint their article in a number of collected readings in Biology, and a diagram from their paper was reproduced in many biology and genetics textbooks (Coe and Kass 2005a; Faculty File, WCA).

At the 6th International Congress of Genetics, at Cornell in 1932, they collaboratively presented evidence for 4-strand crossing over in corn (Creighton and McClintock 1932). Creighton continued to contribute unpublished data to the *Maize Genetics Cooperation News Letter*, and published new findings on deficiencies on chromosome 9 of corn (Creighton 1934).

As a graduate student, Creighton was elected to the Women's Scientific Fraternity, *Sigma Delta Epsilon* (Graduate Women in Science) in 1930. Their motto was "United in Friendship through Science," and their goal was to promote interest in science and to advance the participation and recognition of women in science. The Alpha Chapter had been established at Cornell in 1921, and Creighton later became an officer of the National organization (Second Vice-president, 1948-49; First Vice-president 1949-50; National President 1950) and also chaired their Research Awards Committee (1968-1969). In 1931, she was elected to the Cornell Chapter of the honorary scientific society, *Sigma Xi*, which had been founded at Cornell in 1886; and to *Phi Kappa Phi*, in 1932, whose mission is "To recognize and promote academic excellence in all fields of higher education and to engage the community of scholars in service to others."

Creighton completed her thesis in 1933 (Creighton 1933) and remained in the Botany Department at Cornell as an Instructor of cytology and microtechnique (1932-1934), until accepting a job at Connecticut College for Women (CCW) in 1934 (Cattell 1944:383; Letter, Creighton to P. Davies, 6 May 1993).

***CCW Botanist, 1934-1940*:** Creighton was an Instructor in Botany at CCW from 1934 to 1938. She was promoted to Assistant Professor in 1938 (Barnhart 1965:394), on the basis of years of service both at Cornell and CCW. She explained that the rules for promotion and tenure were different at that time (Letter, Creighton to Kass 27 Feb. 1995), and I subsequently learned that not all academic institutions followed AAUP guidelines for tenure and promotion, which were in flux during this era (Kass 2003, Kass 2005).

With McClintock, she published (1935) a corroboration of their investigations of cytological crossing over, and gave papers at meetings of the Genetics Society of America (see their *Records* for abstracts of her papers). Creighton worked collaboratively with G.S. Avery, P.R. Burkholder, and others at Connecticut College, on a translation and revision of Peter Boysen-Jensen's (1883-1959) *Growth Hormones in Plants*, which was expanded to include 188 new contributions to the literature and 40 additional illustrations (Avery *et al*. 1936). With Avery, Burkholder, and others at Connecticut College, she also conducted a series of plant physiology experiments that were mainly published in the *American Journal of Botany* (*AJB*) between 1936 and 1941. Creighton called these her ABC papers, because the 11 papers published with Avery, Burkholder, and others had the authors' names listed in alphabetical order (at Avery's insistence, she recalled).

Contributions 1940-1974

Wellesley College, Associate Professor to Department Chair: Creighton jumped at the chance to return to her alma mater as a member of their faculty. In 1940, she was appointed Associate Professor of Botany at Wellesley, elected a Fellow of the AAAS, and reviewed manuscripts for the *AJB*. In addition to teaching, she continued to conduct research on corn, and in 1941, she was invited to spend the summer at Cold Spring Harbor with McClintock and other guest investigators who studied plant genetics (Kass 2005).

Soon after the U.S. entered World War II, Mildred McAfee, President of Wellesley College, recruited Creighton for the WAVES (Women Accepted for Volunteer Emergency Service). According to Naval history (http://www.history.navy.mil), McAfee was sworn in as a Naval Reserve Lieutenant Commander, the first female commissioned officer in the U.S. Navy history, and the first Director of the WAVES, the women's branch of the Navy. The Navy had accepted a large number of enlisted women and needed Commissioned Officers to supervise them. The WAVES performed previously atypical duties such as communications, intelligence, science and technology. Creighton was granted a leave of absence for war service (1943-May 1946) and rose to the final rank of Lieutenant Commander.

Creighton loved to travel. At the conclusion of the war, she and Gertrude Dever, a friend she had met in the WAVES, embarked on a cross-country adventure in an old multi-colored jalopy, making stops along the way in New Orleans and Mexico (Wellesley Club News 2005). Upon returning to Wellesley, she was appointed Chair of her Department. After recommending that the Wellesley Greenhouses be named for Ferguson, she followed in the footsteps of her mentor, and enthusiastically supported Wellesley's Arboretum, Botanic Gardens and The Ferguson Greenhouses as "premier educational sites" and was committed to maintaining them as such (Biographical File, WCA). In 1946, she initiated Garden Day, where local garden clubs were invited to Wellesley to view the greenhouse and gardens. This eventually led to the founding of the Wellesley College Friends of Horticulture (WCFH) in 1982, whose members raised funds for the renovation of the Ferguson Greenhouses, completed ten years later. The Harriet B. Creighton Room at the Visitor Center of the Margaret C. Ferguson Greenhouses was dedicated to honor her years of service to the Botany

Department and her ongoing support for the College's Botanic Gardens. It was in this room where I first interviewed Creighton, and photographed her outside of the building (Figures 2 & 3).

While carrying a full teaching load and guiding the department at Wellesley, she also served as Secretary of the BSA Teaching Section (1948-1951), was a member of the AAAS Council (1949-1951), and was elected Secretary of the BSA in 1950. The latter office had previously been filled by Petry and A. J. Eames, her former Cornell teachers, and Avery and Burkholder, former colleagues at Connecticut College (BSA 2005:235).

FIGURE 2. Harriet Creighton outside the Margaret C. Ferguson Greenhouses, Wellesley College, 1994 (Photograph by author).

She was promoted to Professor of Botany in 1952. That year she was a Fulbright Lecturer in Genetics and Plant Physiology (with 4 months of research), at the University of Western Australia, Perth, and at Adelaide University, which fulfilled her desire for travel abroad. This experience was so rewarding that seven years later she again went abroad as a Fulbright Lecturer in Genetics (with 3 months for research) at the National University of Cuzco, Peru.

In 1955, Creighton was named the Ruby F.H. Farwell Professor of Botany, in acknowledgement of her outstanding success at Wellesley. In that year she was also elected Vice-president of the BSA, served on the *PSB* editorial board (through 1959) and participated (through 1958) in an NSF Panel for the selection of Predoctoral Fellows. She also served as a Member-at Large for the 14th -16th (1955-1957) Symposium of the Society for Developmental Biology.

As BSA President, Creighton had the honor of presenting Certificates of Merit to 50 distinguished scientists for their contributions to botany, at the 50th anniversary Golden Jubilee Merit Citations award banquet, held on August 29, 1956, at the University of Connecticut, Storrs (*PSB*, Oct. 1956, pgs.1-2). Among those first honored were George W. Beadle, her graduate school colleague; Edgar Anderson, with whom she had cooperated at Cold Spring Harbor in the summer of 1941; and nine BSA past Presidents, including Anderson, and Katherine Esau, the second woman elected President of the society. At that time, the society also announced its plan to present certificates to additional botanists in succeeding years.

The following year, at the BSA annual banquet, held at Stanford University, Creighton's former mentor, Barbara McClintock, received a Certificate of Merit, as a pioneer in the use of chromosomal aberrations for the purpose of genome analysis, important contributions to the theory of gene structure, and "world leader in the broad field of cytogenetics" (*PSB*, Jan. 1958, pp.5-6). Creighton must have felt proud of McClintock, and the other plant geneticists so honored that night, as she delivered the retiring past-President's address (Creighton 1957). "If we would put together all the findings of all kinds of botanist, we would be proud enough of the results that we would not be ashamed of being called botanist," she assured her audience. Some investigators, she emphasized, call themselves "pure botanists," while others work on applied problems, "yet all study plants and are, therefore, botanists." But some, she noted, do not want to be called a "botanist." She suggested that we use the word botany and make clear that botany includes the study of all plants, and "call ourselves botanists with some pride in our voices. ... We have to change the climate of opinion concerning botany," she said. "We have to sell ourselves, and then the educated and intelligent public, that we are students of plants and that plants are important in the modern world. ... Botanists of the World, Unite!" she urged, then added, "and Get Going!"

***Professor Creighton's commitment to Botanical Education*:** "Creighton was an amazing teacher," wrote one of her former students in a note appearing in the *WCFH Spring 2004 News,* devoted to her memory. Clearly she was dedicated to her profession, which is demonstrated by her leadership in the BSA and her active participation on national committees for botanical education. As a member of the Society's Education Committee, she

supported their proposal to the National Science Foundation (NSF) for a Summer Institute for Botany teachers from small colleges to be held at Cornell in 1956. NSF notified President Creighton in December 1955, of the $31,400 Award for their first supported Summer Institute for college teachers. Institute Director H.P. Banks (Cornell University), Past President Ralph Wetmore (1953; Harvard University), and Creighton made the stipend awards to 50 college teachers to acquaint them with current work in the field (*PSB*, Oct. 1956, p.12).

Creighton continued serving on NSF Panels for Summer Institutes for College and High School Teachers of Biology through 1959. She was one of the outstanding lecturers who participated in the NSF-supported Summer Institute for College Botany Teachers, sponsored by the BSA, and sustained at Indiana University in 1959 (*PSB*, Dec. 1958, p. 3). Concurrently, she was a member of the NSF Committee on Teaching Biology (1956-1957), and was invited to join the AIBS Committee on Education and Professional Recruitment's Steering Committee (1956-1966) for the *Secondary School Film Series* (*PSB*, April 1959, pp. 1-3), in which she played a "teacher" in several individual films (Faculty File, WCA). While editor of *PSB*, Creighton (1958) encouraged writers and publishers of Botany and Biology text books to "experiment with texts that are really a third arm of a course, the first two being the teacher and the organisms studied in the field and laboratory."

Creighton was secretary (1960-1963) of Section G (Botanical Sciences) of the AAAS, and concurrently chaired the BSA's Committee on Education for two years (1960-1962). The Committee studied the Role of Botany in America, and she helped to formulate their recommendations concerning High School Biology Courses, Introductory Courses in Biology, and the "Facts and Principles that should be taught" (*PSB*, March 1958, pp. 1-2). They sent an open invitation to BSA members requesting that they prepare a series of articles on botanical subjects, particularly for teachers of biology in secondary schools and colleges, for publication in *Turtox News*. Chair Creighton was responsible for editing all manuscripts contributed by members of the society (*PSB*, May 1961, p 8).

As part of her responsibilities for the BSA Education Committee, Creighton was a botanical consultant (1961-1969) to A. J. Nystrom and Co. (Chicago), who produced 12 teaching charts (with transparencies for overhead projection) and 8 models of plant structure, which she had designed (Faculty File, WCA; *PSB,* Dec. 1963, p4). They anonymously published eight booklets (prepared by Creighton between 1963 through 1968), each comparable to a short chapter of a textbook, to accompany each of the botanical teaching models (Faculty File, WCA).

Rossiter (1995:304) has documented the under-recognition of women scientists, who in the 1950 and 1960s were "practically invisible to the public, to other scientists, and to each other." Creighton's early scientific achievements are well recorded; and her behind-the-scenes efforts towards academic and public education were recognized by her peers, if one considers it an honor to chair committees and to be elected a society officer. These contributions, however, were probably mostly invisible to the public.

Research interests and further responsibilities: Along with her teaching and committee responsibilities, Creighton pursued research on the genetics of *Petunia* flowers, which she presented independently, and with students, at the annual meetings of the Genetics Society of America (GSA) in the 1940s. Later, she became interested in the horticultural aspects of *Begonia*. Those studies were presented at the BSA, and published in *The Begonian* during the 1960 and 1970s. To keep current in her field, she spent a sabbatical year in the Botany Department at the University of California, Berkeley (Sept.-Dec. 1966) and at the Cell Research Institute of the University of Texas in Austin (Jan-June 1967).

In the early 1960s, she was President of the Wellesley Chapter of the Society of *Sigma Xi*. She regularly attended annual meetings of the BSA and the GSA, and when possible, drove to Long Island, NY, for the Cold Spring Harbor Symposium. She traveled to India as a consultant for NSF (1968, 1969) and also accepted committee assignments from the GSA. While an editorial board member (1969-1975) of the *Journal of College Science Teaching*, she reviewed more than 30 manuscripts beginning with Volume 1. Additionally, she refereed book manuscripts and journal articles, and published many book reviews.

A year before retirement, she joined the Historical Section of the BSA (1973) and was its representative to the Executive Committee. In keeping with her principles, she also offered a class on Basic Botany and Horticulture for the Massachusetts Horticultural Society, and gave a National Science Teachers Association workshop for high school teachers on the use of plants for experiments in their classes. Her energy seemed boundless.

The Retirement Years 1974-2004, and beyond

Honors and Recognition: Creighton kept busy after her 1974 retirement as Ruby F.H. Farwell Professor Emerita. Possessing exceptional institutional memory, she was consulted on all aspects of Wellesley College life; wrote the chapter on "The Grounds" for the centennial volume *Wellesley College 1875-1975, A Century of Women*; and as a member of the Wellesley Campus Master Plan Committee (1998), recalled each transformation made since her first day on campus in 1925 (Biographical Files, WCA). The Massachusetts Horticultural Society honored her with the Large Gold Medal of their society in 1985, for her botanical expertise and "horticultural concern in the community." Public recognition had been achieved at last. In 1994, The Wellesley College Alumnae Association recognized her with the Syrina Stackpole Award for "dedicated service and exceptional commitment to Wellesley College."

Posthumous honors: Creighton died at age 94, on January 9, 2004 (The Wellesley Townsman, 22 Jan. 2004, p. 34). That year, the Wellesley College Botanical Greenhouse Fund, established by Creighton in 1955 with an initial modest gift, was renamed the Harriet Creighton Greenhouse Fund for continued support of the Margaret Clay Ferguson Greenhouses.

FIGURE 3. Harriet Creighton and Lee Kass, Wellesley College, 1994 (Photograph by Beverly Rathcke).

Creighton lived a long, happy, and successful life. Her legacy of contributions to Botany in the 20th century has persisted and sustained the broad field of Plant Biology. Let us dedicate this issue of the *Plant Science Bulletin* in honor of Harriet Baldwin Creighton to celebrate with pride the Golden Jubilee Anniversary of the publication she co-founded 50 years ago.

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-Lee Kass

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Lee B. Kass is Visiting Professor in the L. H. Bailey Hortorium, Department of Plant Biology, Cornell University, Ithaca, NY, lbk7@cornell.edu, where she is preparing an intellectual biography of Barbara McClintock. She is Chair of the Historical Section of the BSA, and a member of the Centennial Committee. The second edition of her *Illustrated Guide to Common Plants of San Salvador Island, Bahamas* has recently been published by the Gerace Research Center, San Salvador Island, Bahamas.

[1]Full citations listed only for feature articles published in the Plant Science Bulletin; announcements found therein are cited within parentheses.

News from the Society

From the Annual Meeting

The Power of Plants: Building Collaborations among Educational Institutions, Botanical Gardens and Communities.

(Banquet speech given by Ed Schneider, President-elect, at the 99th meeting of the Botanical Society of America, August 17, 2005, Austin, TX).

The theme for the 99th meeting of the Botanical Society of America – Learning From Plants – inspired the title of my presentation. The 'Power of Plants' presents several interwoven themes: career development from student to faculty member; tribute to those who fostered and inspired us through our professional growth; and an action plan for the future of the Botanical Society of America and the value added benefits of expanding partnerships and collaborations among agencies and organizations that have at the core of their missions improved understanding and promotion of plants. These interwoven themes have a common overarching theme, the power of plants, since plants have inspired and influenced the course of our careers and all aspects of human activity.

As students, we may recall those moments when we first developed an interest in the botanical world. For me, it began when I was an undergraduate and asked by a faculty member to consider becoming a teaching assistant for a course in introductory botany. That was the hook. Graduate school soon followed with thesis work on the amazing Amazon water lily, *Victoria.* Who could not be inspired by those remarkably large, 6'- 8' diameter leaves. I recall clearly the hot day in early August in Tempe, AZ (1974) when I attended my first Botanical Society of America annual meeting to make a scientific presentation on findings about that remarkable plant. Then began the quest to secure the first faculty position, followed by the journey toward tenure, promotion, and assuming the same leadership role in fostering students as faculty members had done for me years earlier.

During my career I felt a particular motivation to study hydrophytes, especially waterlilies. Adaptations to the aquatic life are fascinating, The molecular investigations leading to added confirmation of the long held hypothesis that waterlilies are among the basal-most flowering plants also helped to secure funding and a widening interest in the Nymphaeaceae.

As botanists, we understand the importance of plants for their life sustaining photosynthetic process. Within our classrooms and laboratories we emphasize to hundreds of thousands of students each year, the oxygen generation role of autotrophs, and the carbohydrate (food) production that sustains life through food chains. We marvel at the fact that 74% of the human population is sustained by less than ten crop species. The role of plants in providing fuels, shelter, medicines and drugs, and a vast variety of products used each day in our lives makes me pause and ask – while students may find this intriguing and understandable, can we do more to excite and involve a larger audience that will stand and with a unified voice, pronounce that plants are important, they need more study, and work in concert to raise the conscientiousness of all to the importance of plants.

It is not surprising that gardening is the number one past time in the United States. Aside from the therapeutic benefits, we bask in the beauty of plants, marvel at their form and growth as we harvest homegrown fruits and vegetables. Eco-tourism has also become popular over the past decade or two, and understandably, since natural landscapes offer immense beauty and inspiration.

In contrast to the natural landscape, the built landscape such as found in botanical gardens offers a means, through inspiring, aesthetically developed displays, conservation, research, and a broad spectrum of educational programming, to an end – to promote an enhanced understanding of the botanical world and the importance of plants. Botanic gardens like other cultural organizations in our communities are places that enrich lives; they are places of inspiration, places to refresh the soul, places of beauty and tranquility, and places to commune with and better understand our place in nature. This enrichment process educates the visitor's mind, wins their hearts, and in doing so leads to deeper levels of involvement, higher levels of ownership, and ultimately, to improved philanthropy. If this process is cultivated well, the 200 million visitors to U.S. botanic gardens each year represent more informed voters about our environment and the importance of plants. Just as the Botanical Society of America (BSA) has fostered interactions with educational organizations, so, too, should BSA foster partnerships and collaboration with botanical gardens. The advantages are clear, the linkage is natural. This is why BSA selected the Missouri Botanic Garden as a partner and host. Botanic gardens, like educational organizations, have at their core many similar and overlapping programs. Botanic gardens are institutions that offer more than just inspiring

displays. They hold vast collections of living plants. It is estimated that over 6 million living plants are held in the accessioned collections of botanical gardens world-wide. These *in situ* and *ex situ* collections offer rich collections for taxonomic and systematic research conducted by faculty and students. Botanical gardens also hold enormous herbaria collections, estimated to be over 50 million sheets, not to mention outstanding botanical and horticultural library collections.

Another plant focused non-profit that is housed in partnership and collaboration with the Missouri Botanic Garden, which BSA could build a partnership with is The Center for Plant Conservation (CPC). The mission of CPC is to develop a coordinated response for both *ex situ* and *in situ* conservation of the American flora. Through a consortium of over 30 selected botanical gardens, CPC maintains a National Collection of the most rare and endangered plant species (610 species). CPC also has developed an Access database with information on over 8,000 species and tracks accessions of over 13 million seed. The charter of CPC is also to: strengthen relationships and scientific standards between all agencies involved in plant conservation and research; integrate c onservation efforts without duplication; and to offer public education and public relations programs to inform both the scientific community and the general public. The increasing number of contributed papers and abstracts presented each year at the annual BSA conference that have conservation related themes is exciting. It may well be time to establish a Conservation Section or offer thematically related papers to be group into common sessions. Conservation is a cornerstone to most botanical garden programming. Over 1 billion seeds have been banked in gardens and of the 400,000 different species of plants, of which over 75,000 species are under threat - botanic gardens provide safe haven for over 10,000 of the world's most threatened plants. Botanic gardens have the expertise to propagate and save rare species and are currently building capacity to assess genetic variation in threatened populations. It is clear, therefore, that continued collaboration and partnerships must be established and strengthened among BSA, botanical gardens, and CPC, and that through these partnerships all stakeholders become unified in their collective voices.

So, what can we do to strengthen the future of the Botanical Society of America and its important mission? I offer the following action items: build more partnerships and collaborations - and through our partnerships, increase our voting constituencies if we wish to influence public attitudes toward the environment and the botanical world; share what we know and our discoveries more rapidly in digital format to make information more accessible; tell our stories and articulate our positions widely to the public and to policymakers, and grow in technical excellence, financial capacity, and staff capacity in the home office. To varying degrees each of these actions has begun, but much work lies ahead. Although there is considerable work to be undertaken, we must take pause to have fun on this journey because plants are an enjoyment. Remember, be an active advocate for plants and the botanical world, be active in the Botanical Society of America, and foster a growing relationship with your local botanical garden and plant related organizations.

Educational Forum Keynote

Is it cool to know and do science? Can we create a Scientific Temper? Linking Scientists, College Faculty, K-12 Teachers and their Students in Collaborative Research.

Barbara Schulz
The National Academies, Teacher Advisory Council, Center for Education

Barbara Shulz is currently a Teacher Leader with the National Academy in the Center for Education. She taught AP Biology and other science courses in public and private schools for 35 years and is an active leader in science education innovation. She has extensive experience linking scientists with K-12 educators and developing authentic research opportunities for students and teachers.

Ms. Schulz enumerated several challenges facing science and science education including the need to increase inquiry science in K-12 classrooms, to connect teachers with research and the scientists

who conduct research, to increase the number of students who will pursue careers in science, to increase student motivation to learn, and finally, to help scientists share their research with the public. She proposed that a shortage of science, mathematics and engineering graduates is developing and could become a serious problem. The number of United States students pursuing a career in science is decreasing, while the demand for science and math graduates is increasing. Currently 46% of our science, mathematics and engineering students are from other countries. Student interest in science starts decreasing in 7th grade, and low percentages of students pursue careers in science, mathematics and engineering. Clearly science teaching, as currently practiced in most schools in the United States, is not encouraging students to pursue careers in science.

Ideas about how science would be best taught have been considered for some time. The Committee of 10 in 1897 proposed that science classes should not focus on memorization, but on acquisition of knowledge and intellectual growth based on observation of nature, and that 60% of the class should be used for the lab component (National Education Association 1903). Recently published National Science Education Standards (National Research Council, 1996) stressed that science is an active process with inquiry into student-generated questions at its center. The report asserts that supplementing this approach with teaching and assessment strategies that develop a well-grounded understanding of science will encourage students to continue investigating scientific issues and become lifelong members of the scientific community.

The ways we teach science can also be informed by recent advances in cognitive research. In 2005, the National Research Council published a summary of current research and stressed that effective teaching needs to start with what students think they already know. The report also stated that teachers need to be at the forefront of deciding what is taught, why it is taught, and what successful mastery of the topics looks like. Students need to be encouraged to understand how they are learning and develop metacognitive skills. To reach these goals requires an increase in inquiry science, which means that teachers need to be comfortable with doing science and teaching their students how to do science. A 2000 survey of biology teachers indicated that teachers are not prepared to engage students in the practice of science in any substantial way (Horizon Research, Inc., 2002).

Once teachers and scientists understand that they have common or mutually beneficial goals, possibilities for collaboration become obvious. In fact, there are many similarities between scientists and teachers. Both are passionate about their work, and love analytical thinking. They both suffer from public distrust to some degree yet depend on public funding to continue their work. However, while scientists and academics tend to be critical, K-12 teachers are more likely to take a nurturing approach toward students. Scientists benefit from flexible schedules, have relatively high levels of resources in comparison to K-12 schools, and are judged on their own work. K-12 teachers are faced with rigid schedules, have few resources, and are judged not by their own work, but by their students' achievements. Comparing scientists and teachers as expert learners with students who are novice learners is also informative. Most scientists and teachers are unfamiliar with computer games and may have limited computer skills. Students on the other hand, are well-versed in the use of computers and adapt readily to new technology. Students need to develop a base of knowledge, develop analytical skills, and the ability to learn in depth. They need to help developing a structure for, or ways to organize, new knowledge. Connecting scientists, teachers, and students via the internet may be a very productive approach to engage students in doing science and create a collaborative community involving students, teachers, and scientists.

A new initiative of the Botanical Society is the Scientific Inquiry through Plants (Sip^3) project. This web-based inquiry science project links scientists, teachers, and students from around the country. Teachers design their own inquiry-based curriculum using the theme "The Wonder of Seeds". As students develop research questions, hypotheses, and experimental designs, they post them to the internet. Each team of students is mentored, via the internet, by a scientist. A pilot of this innovative project was completed in the Spring of 2005 with very encouraging results. Students from middle school to college appreciated that experts would spend time helping with their projects. Teachers felt that students were more motivated. The enthusiasm of novice learners was infectious for both teachers and scientists.

Ms. Shulz concluded that programs such as Sip^3 can meet the need for inquiry learning in science classrooms. While students may not be strongly interested in science, we can take advantage of their inclination to use the internet to engage them in the process of doing science. Furthermore, teachers who have weak botanical backgrounds, are encouraged to incorporate plant-based activities in their classrooms, knowing that there are experts who will mentor the student projects. Students who are doing science and have access to experts, are

much more likely to continue on in the sciences which will help meet critical needs for scientists in the future. As the Sip3 project develops additional components, scientists will have a venue to communicate their love of science with the students, including their own research topics. In this situation, everyone can win.

-summary contributed by Beverley Brown

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Summary of Scientific Meeting Keynote speaker: Dr. José Sarukhán, Professor, Instituto de Ecología. National Autonomous University of Mexico

Returning biodiversity knowledge and information to society: the case of Mexico

Issues of biodiversity are not readily understood outside scientific circles and the public has not strongly grasped the importance of preserving significant areas of biodiversity. Dr. Sarukhán discussed a well-established program in Mexico that makes information on biodiversity available to the public (CONABIO: www.conabio.gob.mx). This information can be used by scientists, policy makers, and members of the general public. Developing databases of herbarium specimens and augmenting collections so that they are representative of the flora and fauna in a given area is imperative if this information is to be useful for both scientists and the public. Easy access to information raises the possibility of linking research to societal needs, rather than reserving access to information for only a few botanists. There are many projects which are now possible and in fact, proving very useful to decision makers in Mexico using the information and analysis tools available through CONABIO. Human health programs are using insect data to model insect distribution and target areas that are high risk for specific insect-transmitted diseases. The data base has been used to determine where commercially-grown genetically engineered cotton could be introduced, making sure that introductions were well away from naturally occurring *Gossypium* populations. CONABIO is also used to track and report forest fires and is current within 12 hours which increases the efficiency of fire fighting efforts. The database has been used to draft legislation and study invasive species.

Since public funds are often the primary source of funding for herbaria and scientific work research in general, there is an obligation on the part of scientists to make this information available for use beyond botanists conducting research. We need to continue to make herbaria specimens available on-line. In the last 6 years there has been a 25% growth in the number of specimens in herbaria, but only 5% of the specimens are electronically catalogued. There is a need to continue developing access to information in Mexico, as well as sharing information between Mexico and the United States. We face the challenge of educating the public with regard to the importance of biodiversity. If we can educate the public, we will not face the challenge of educating decision makers alone. Once the public is informed and truly understand the situation, they will work to inform decision makers.

-summary contributed by Beverley Brown

Dear Botanical Society of America Members and *Plant Science Bulletin* Readers

On behalf of the Botanical Society of America and the BSA staff, I'd like to wish you all a very happy and safe holiday season. We've enjoyed serving you throughout a busy and productive 2005.

As a staff team, we are extremely excited to be celebrating the Botanical Society of America's first 100 years. Celebrations will culminate at the Botany 2006 Conference in Chico, California. Please mark Botany 2006, July 28-August 3, in your calendar. We look forward to seeing you all in Chico (make sure you sign up for the centennial BSA banquet). "Looking to the Future – Conserving the Past" will be a memorable conference and botanical gathering - a once in a lifetime event. The Society will bring together, and honor, long-time members and some of the most notable contributions to the plant sciences over the past half-century. Follow developments at www.botany.org.

BSA members, we will also keep you current through the monthly e-newsletter. For us to keep in touch please check and, if need be, update your email address (and other details) on the BSA database at www.botany.org. Let us know if we can assist you in bringing your details up-to-date. If you do not receive the monthly email newsletter, please check with your systems operator and make sure it is not getting thrown out as spam. You can also find a full list of BSA news and announcements at .www.botany.org

BSA members who have yet to renew their 2006 membership, please go to and renew online, or complete and send in the renewal form we mailed out in the fall.

Plant Science Bulletin readers who wish to become BSA members, please go to www.botany.org. We'd be pleased to have you join us.

Again, have a great holiday season!

Sincerely, Bill Dahl

Botanical Society of America's Statement on Evolution

The Botanical Society of America exists to promote botany, the field of basic science dealing with the study and inquiry into the form, function, diversity, reproduction, evolution, and uses of plants and their interactions within the biosphere. Our membership largely consist of professional scientists, scholars, and educators from across the United States and Canada, and from over 50 other countries. Most of us call ourselves botanists, plant biologists, or plant scientists, and members of our profession teach and learn about botanical organisms using well established principles and practices of science. As such, we were asked by the National Center for Science Education (NCSE) if we could provide a statement outlining our view on evolution. On July 27,2003 at the 2003 Annual General Meeting the BSA Council approved the statement to follow for use by the NCSE. For the Complete statement see the Botanical Society website: http://www.botany.org/newsite/announcements/evolution.php

Intelligent Design: It's Not Even Wrong

By Congressman (and Physicist) Rush Holt

As a research scientist and a member of the House Education Committee, I was appalled when President Bush signaled his support for the teaching of "intelligent design" alongside evolution in public K-12 science classes. Though I respect and consistently protect the rights of persons of faith and the curricula of religious schools, public school science classes are not the place to teach concepts that cannot be backed up by evidence and tested experimentally. For complete blog seehttp://www.tpmcafe.com/story/2005/9/8/183216/1039

Centennial Medallion

The Centennial Meeting of BSA will be held at Chico State University, California, 28 July -3 August 2006. Hopefully, you already are making plans to attend this important, once-in-a-century meeting. BSA has selected the design for its Centennial Medallion, and the Centennial Planning Committee (CPC) thought you might enjoy seeing it.

Job (or Art) #: A001239 (obverse)
Designer: Justin Michael Ladd
Sales Person: Marty Colwell
Client: Botanical Society
Description: Looking to the Future
Date: 4-06-05

Actual Size
50 mm

Job (or Art) #:A001240 (reverse) idea 1
Designer: Dennis Arneson
Sales Person: Marty Colwell
Client: Botanical Society
Description: Centennial 1906-2006
Date: 11/12/04

Actual Size
50 mm

The plan is for each registrant at the 2006 meeting to receive a medallion. Also, a limited number of additional medallions will be made, and they can be ordered for a yet-to-be-determined price. The medallion will be a reminder of an important milestone in the history of BSA, but if you receive yours at the Centennial Meeting it will be extra special.

A published history dealing with the one-hundred years of the society will be available also. This history is being written by Betty Smocovitis who is using BSA archival materials, once stored at the University of Texas at Austin Library, and now at the Missouri Botanical Gardens. She is also utilizing materials provided by a number of society members.

The Centennial Meeting program is being jointly developed by the CPC, the Program Director, and the Business Office staff. As in past meetings, the program will include the array of six major symposia, contributed paper and poster sessions, associated society gatherings and dinners, special events, and concluding with the annual BSA banquet. The CPC will be inviting representatives from other affiliated and plant-science societies to join in the celebration. It is hoped that all active and retired members of the society will want to join this historic event. More details will come in future PSB issues.
Sincerely,

Centennial Planning Committee

Letters

Marsh Sundberg's assessment of the content of botany and biology courses is very timely as the botanists in the Department of Biological Sciences of the UW Colleges (Wisconsin's 13 freshman/sophomore liberal arts transfer campuses) are engaged in re-examining our curriculum. Our work is motivated at least in part by the unrelenting attack on evolutionary theory by Creationists, Intelligent Designers, and even the President of the United States. (One has to wonder how the folks at Yale feel about the latter!)

Sundberg's efforts will be useful to us, but the BSA membership needs to pick up where he leaves off. Indeed, Marsh calls for just such action at the end of his article.

I continually wonder where students will learn about the organisms of the natural world if not in our introductory courses. Contemporary students by and large are much less likely to have grown up turning over rocks and building forts in the woods than those of us who have been teaching for 20-30 years. Students know less from the simple childhood observations than we did.

I compare my 1966 freshman botany book (Wilson and Loomis, *Botany*) with Raven, Evert and Eichhorn's *Biology of Plants* and marvel how our knowledge has exploded. My freshman semester was 16 weeks long; each class and lab was filled with work to do. So how do we include not only classical botany, but in-depth treatment of evolution and biotechnology as well, without rushing through with such swiftness that it is nothing more than a cursory glance?

Marsh alludes to the big issue, but it is lost in his final sentence about content. We need to focus not so much on the content, but the manner in which we teach our courses. There are many faculty who are providing students with a much different learning experience than that which Marsh and I experienced, even if the "content" is the same. A sharing of and focus on pedagogy that works, as shown by empirical assessment measures, will be at least as informative as thinking about what topics are covered in any course.

James W. Perry
Campus Dean
Professor of Biology
University of Wisconsin-Fox Valley

Announcements

Personalia

Karla Meza Awarded Timothy Plowman Scholarship

The Botany Department at the Field Museum recently (June-August 2005) hosted this year's Timothy Plowman Scholarship Award recipient, **Karla Meza,** from the Universidad Nacional de la Amazonía Peruana, Iquitos, Peru. Karla studies the Heliconiaceae (or Banana Family) and used her time to examine the extensive herbarium material from the neotropics housed at F. In addition to basic measurements and observations, she made numerous determinations of our unidentified collections and added our holdings in to her database. These data will eventually be part of a monographic style treatment of the genus *Heliconia* for the Peruvian Amazon.

Symposia, Conferences, Meetings

2nd Meeting of the International Society for Phylogenetic Nomenclature

Yale University, New Haven
June 29 – July 2, 2006

We are pleased to announce the 2nd Meeting of the International Society for Phylogenetic Nomenclature (ISPN).

Venue:
The meeting and associated social gatherings will be held on Yale University's beautiful campus in New Haven, Connecticut, USA. Accommodations are being organized both on and off campus.

Scope:
This meeting will follow the format of the 1st and founding meeting of the ISPN that was held in Paris, France in 2004 by providing opportunities for formal oral and poster presentations while leaving ample time for discussions. The annual business meeting of the ISPN will also be held during this conference.

Conference Language:
English

Organizing Committee:
Nico Cellinese, Co-Chair, Yale University
Walter Joyce, Co-Chair, Program Officer, Yale University
Michael Donoghue, Co-Host, Yale University
Jacques Gauthier, Co-Host, Yale University
David Baum, University of Wisconsin
Philip Cantino, Ohio University
Michel Laurin, CNRS, Paris
Kevin de Queiroz, Smithsonian Institution

Registration:
Instructions on how to register will be provided in the second circular.

Important Dates and Deadlines:
Abstract submission deadline:
April 1, 2006

Advance registration:
May 1, 2006

Contact
Nico Cellinese (Logistics and general information)
Walter Joyce (Program)
Yale Peabody Museum
170 Whitney Avenue
POB 208118
New Haven, Connecticut, 06511 USA
Email: nico.cellinese@yale.edu
or walter.joyce@yale.edu

Award Opportunities

Timothy C. Plowman Latin American Research Award

The Botany Department at The Field Museum invites applications for the year 2006 ***Timothy C. Plowman Latin American Research Award***. The award of $2,000.00 is designed to assist students and young professionals to visit the Field Museum and use our extensive economic botany and systematic collections. Individuals from Latin America and projects in the field of ethnobotany or systematics of economically important plant groups will be given priority consideration.

Applicants interested in the award should submit their curriculum vitae and a detailed letter describing the project for which the award is sought. The information should be forwarded to the Timothy C. Plowman Award Committee, Department of Botany, The Field Museum, 1400 South Lake Shore Drive, Chicago, IL 60605-2496 USA and received no later than 15 December 2005. Announcement of the recipient will be made no later than 31 December 2005.

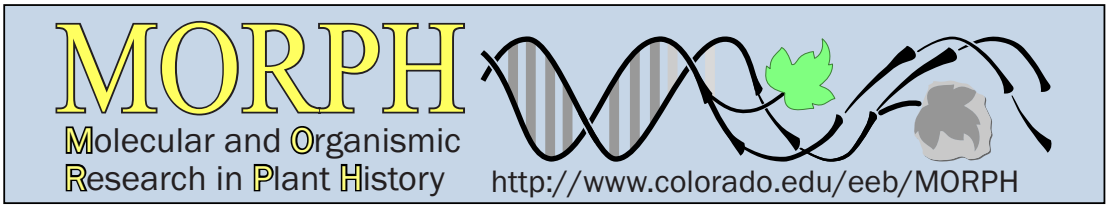
Anyone wishing to contribute to ***The Timothy C. Plowman Latin American Research Fund***, which supports this award, may send their checks, payable to The Field Museum, c/o Department of Botany, The Field Museum, 1400 South Lake Shore Drive, Chicago, IL 60605-2496 USA. Make certain to indicate the intended fund.

Premio de investigación Latinoamericano Timothy C. Plowman

El departamento de Botánica en "The Field Museum" invita aplicaciones para el ***premio de investigación Latinoamericano Timothy C. Plowman*** 2006. Este premio de $2,000.00 fue diseñado para apoyar a estudiantes y profesionales jóvenes en visitas al museo de Field y utilizar sus extensas colecciones de botánica económica y sistemática. Se les dará consideración especial a individuos de Latinoamérica y a proyectos en los campos de etnobotánica ó sistemática de plantas económicamente importantes.

Las personas interesadas en aplicar a este premio deberán proveer su curriculum vitae y una carta detallando el proyecto para el cual el premio se utilizará. Esta información debe ser enviada al Timothy C. Plowman Award Committee, Department of Botany, The Field Museum, 1400 South Lake Shore Drive, Chicago, IL 60605-2496 USA y ser recibida antes del 15 de Diciembre de 2005. El ganador del premio será anunciado antes del 31 de Diciembre de 2005.

Cualquier persona que desee contribuir al ***Fondo de investigación latinoamericano Timothy C. Plowman***, el cual apoya este premio, puede enviar su cheque, pagadero a "The Field Museum, c/o Department of Botany, The Field Museum, 1400 South Lake Shore Drive, Chicago, IL 60605-2496 USA". Asegúrese de indicar el fondo al cual se destina su contribución.



MORPH announces two opportunities for funding in plant evolutionary developmental biology. Evaluation of both grants will begin on November 1, 2005, and applications will continue to be accepted until all annual funds have been committed. These grants are for graduate students, postdoctorals, and early career faculty (assistant professors). The primary goal of the MORPH Research Coordination Network is to support scholars with a desire to bridge the gap between organismic and molecular aspects of plant evo-devo.

Application guidelines: http://www.colorado.edu/eeb/MORPH/grants.html

For more information, contact Professor William (Ned) Friedman: ned@colorado.edu

Plant evo-devo training grants

The MORPH Research Coordination Network provides support for cross-disciplinary training between organismic (neobotanical and paleobotanical) and molecular labs. These visits range from a few weeks (to learn specific techniques) to a semester (to complete the equivalent of a lab rotation and take coursework not available at the home institution).

Botanical garden evo-devo grants

MORPH supports visits to botanical gardens for individuals with an interest in expanding organismic and molecular evolutionary developmental studies to include a broader sampling of plant biodiversity. This will be accomplished through funded visits to MORPH-affiliated botanical gardens, chosen for their broad phylogenetic holdings and research staff that includes morphologists, anatomists, developmental biologists and paleobotanists. Initial participating gardens are: The Royal Botanical Gardens, Kew; Munich Botanical Garden; and The New York Botanical Garden.

http://www.colorado.edu/eeb/MORPH

NATIONAL TROPICAL BOTANICAL GARDEN FELLOWSHIP *for* COLLEGE PROFESSORS

Program Operation: June 12-23, 2006

Deadline to Apply: March 24, 2006

Notification of Acceptance: March 31, 2006

COURSE DESCRIPTION

The National Tropical Botanical Garden (NTBG) will host another exciting Fellowship for College Professors of introductory biology from June 12-23, 2006 at The Kampong, Coconut Grove, Florida. College professors accepted to the Fellowship will become Fellows at the National Tropical Botanical Garden.

The goal of the NTBG 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 Fellows.

Applications must include:

- Two letters of recommendation
- Complete Curriculum Vitae
- Copy of the most recent teacher evaluation
- A non-refundable $USD30 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 about the NTBG Fellowship must be directed to:

Director of Education
National Tropical Botanical Garden
3530 Papalina Road
Kalaheo, HI 96741

Tel: (808) 332-7324 ext. 225 or 251
Fax: (808) 332-9765
Email: education@ntbg.org
Website: www.ntbg.org

Courses/Workshops

Biology S-105 "Biodiversity of tropical plants."

The National Tropical Botanical Garden in collaboration with the Harvard Summer School and Fairchild Tropical Botanic Garden

Instructor: P. Barry Tomlinson, Professor of Biology *Emeritus*, Harvard University and Crum Professor of Tropical Botany, National Tropical Botanical Garden.

Time: June 26 – July 21, 2006.

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

At the Kampong the class will use the living accommodation provided in an air-conditioned dormitory-type facility (Scarborough House) and the newly –constructed teaching laboratory. This is supplemented by the teaching facility at the Center for Plant Conservation of Fairchild Garden.

Prerequisites:
Preferred Introductory Botany at the undergraduate college level.

Selection:
To be based on the prior experience of the student and the suitability of the course for graduate advancement. As in previous years the course will cater for students with broad interests who seek to become more familiar with tropical plants.

Course description:
The course is directed toward students already enrolled or about to be enrolled in a graduate program and will introduce the diversity of tropical plant types within a biological and systematic framework. Study will be based on the living collections of the Kampong, supplemented by those at other South Florida institutions (e.g., Fairchild Tropical Botanical Garden and the Montgomery Botanical Center, Coral Gables, FL) and on plants in natural environments (e.g., Biscayne Bay and the Everglades National park). This is a teaching resource of some 10,000 species representing all tropical groups.

The work involves classroom and laboratory demonstration combined with outdoor presentations and excursions. The final week of the course requires each student to prepare an individual research project leading to a written and graded report.

The course is designed to develop a comparative approach to the study of plants that will broaden general understanding of their structure and function.

Enrollment: Limited to 12

Credits: 4

Estimated tuition: ~$2,300

Application: Students will be regularly enrolled in the 2006 Harvard summer School program, Selection is based on a Supplementary Application Form. Application materials will be available at www.summer.harvard.edu in early 2006.

Further information and enquiries from Professor Tomlinson (pbtomlin@fas.harvard.edu).

Positions Available

Paleobotanist.
East Tennessee State University

The Department of Biological Sciences at East Tennessee State University invites applications for an Assistant Professor tenure-track position beginning August, 2006. The successful candidate will participate in research at an outstanding local Late Miocene fossil site. Responsibilities include classroom and lab instruction and mentoring student research at undergraduate and graduate levels. Ph.D. required at hire date.

The Department of Biological Sciences is currently comprised of fourteen faculty members engaged in a wide range of research programs and serves approximately 250 majors and 20 M.S. students. Further information concerning the department is available at www.etsu.edu/biology.

The Don Sundquist Center for Excellence in Paleontology is under development in Gray, Tennessee, 15 miles from the main ETSU campus. A museum with research facilities and visitor center is planned for this unique Late Miocene forested site. Additional information about the Gray site is available at http://www.etsu.edu/grayfossilsite/.

East Tennessee State University is located in Johnson City, Tennessee, a city of about 55,000 located in the southern Appalachian Mountains. The region has a total population of more than 400,000 and combines a low cost of living with amenities found in larger urban areas. ETSU

enrolls approximately 12,000 students and offers more than thirty master's degree programs and six doctoral degree programs. Submit c.v., transcripts, statements of research and teaching interests, and three letters of reference electronically to paleobotanist@etsu.edu. Application review will begin on 12/1/05. ETSU is an AA/EO employer.

Orchid Taxonomist
Marie Selby Botanical Gardens

Job Title: Curator, Orchid Identification Center (OIC)
Reports To: Head of Systematics
Position: 40 hours. Includes benefits.
Start Date: As soon as possible

The Selby Botanical Gardens Research & Conservation Department seeks an experienced orchid taxonomist to manage its Orchid Identification Center (OIC). The curator must be able to aid department taxonomists in the accurate identification of Orchidaceae to species level, be familiar with relevant botanical literature, and be able to supervise volunteers, students, and interns. The successful candidate will manage and update the OIC species files and the Spirit Collection of 24,000 specimens, as well as write articles and provide lectures for public and scientific audiences, seek funding opportunities, and be willing to participate in international fieldwork.

Minimum education/experience: M.Sc. in orchid taxonomy preferred or B.Sc. in botany with two years practical experience in orchid identification. Experience in a herbarium or museum environment a plus. Excellent communication and computer skills (i.e., Microsoft Word, Outlook, Excel, Access, Adobe PhotoShop) required. Selby Gardens is an equal opportunity employer and a drug free workplace.

Applications will be accepted until the position is filled.

Please send C.V. and the names of three references to:

Wesley E. Higgins, Ph.D.
Head of Systematics
The Marie Selby Botanical Gardens
811 South Palm Avenue
Sarasota, Florida 34236 U.S.A.
Office: (941) 955-7553 ext. 315
Fax: (941) 951-1474
E-mail: whiggins@selby.org
Website: www.selby.org

Systematic and Evolutionary Biology
University of Georgia

The Plant Biology Department at the University of Georgia has an opening for an Assistant or Associate Professor in Systematic and Evolutionary Biology. We seek a systematic biologist who uses innovative approaches to address fundamental questions about plants, algae or fungi in areas such as phylogenetics, molecular evolution, speciation or genome evolution. The successful candidate is expected to develop a vigorous, externally-funded research program and to teach and train undergraduate and graduate students in systematics. Cover letter, curriculum vitae, short statements of research interests and teaching philosophy and no more than five reprints should be assembled into a single pdf file and submitted online at http://www.plantbio.uga.edu/positions.html. Candidates should request four referees to submit letters of recommendation to the same site or by mail to Systematic and Evolutionary Biology Search Committee, Plant Biology Department, University of Georgia, Athens, GA USA 30602-7271. Applications received by November 4, 2005 are assured full consideration. The Franklin College of Arts and Sciences is committed to increasing the diversity of its faculty and strongly encourages applications from individuals in under-represented groups. UGA is an Equal Opportunity Employer.

Dean and Vice President for Science
International Plant Science Center
New York Botanical Garden

The Garden's Dean and Vice President for Science is one of the nation's highest profile spokespersons for the importance of basic research in the plant sciences, with an emphasis on the significance of plant biodiversity and conservation, and will represent The New York Botanical Garden and plant science in international venues, in government relations and to the private foundation community. The Dean and Vice President will lead strategic positioning, planning, and administration for Science at the Botanical Garden and must be a fluent and enthusiastic interpreter of plant sicence to a broad audience. The individual in this position will be expected to assume active leadership roles in international conservation and biodiversity organizations, and to integrate international priorities in related research within Science at the Botanical Garden

Requirements

The successful candidate will possess a Ph.D. and will be fully conversant with modern molecular and genomic approaches as applied to plant biodiversity, systematics, economic botany and related areas. The specific disciplinary specialization is open, but the essential talent required will be the ability to creatively blend the Botanical Garden's unique biodiversity collections assets and deep expertise in plant and fungal diversity with evolving molecular and genomics technologies. S/he will be a dynamic, collaboratively minded individual with proven skills in interdisciplinary research team-building; demonstrated grantsmanship; administrative experience in an academic and/or research institute; publication record in plant molecular biology; excellent written and verbal commu8nication skills for scientific and lay audiences.

Applicants should send curriculum vitae and statement of research interests, and the names and contact informatino for at least three references to:

Dr. Kim E. Tripp, Ph.D.
Director of the Botanical Garden
Attn: Human Resources Department
The New York Botanical Garden
Bronx, NY 10458 USA

Review of applications to commence on January 9, 2006

Director of Research & Chair, Department of Botany Rancho Santa Ana Botanic Garden Claremont, California

RANCHO SANTA ANA BOTANIC GARDEN (RSABG) seeks a successful leader, scholar and administrator to direct its research programs and to serve as Chair of the Graduate Program in Botany, Claremont Graduate University.

RSABG is a 78-year-old non-profit organization dedicated to promoting botany, conservation, and horticulture to inspire, inform, and educate the public and the scientific community about California's native flora. The Garden conducts programs in research, graduate education, public and professional education, and rare plant conservation. Facilities include a one-million specimen herbarium with worldwide representation, a living plant collection of over 3,000 species and varieties on 86 acres, research laboratories, greenhouse, nursery, seed storage facilities, and a 50,000-volume research library. The Garden also publishes the scientific journal *Aliso*.

RSABG has an active, broad-based, internationally recognized research program in systematic and evolutionary botany, and is the Botany Program for Claremont Graduate University by an affiliation agreement, awarding masters and doctorate degrees. Over 90 highly trained students have received Masters of Science or Doctor of Philosophy degrees since inception of the program.

Qualifications: Reporting to the Executive Director, this endowed position will have overall responsibility for management of the Garden's research programs, including oversight of the graduate Botany Program (as Department Chair), as well as supervision of the herbarium and research library. The Director will also participate in teaching graduate-level courses in botany and maintain an active externally-funded research program, with a scientific focus that will complement and strengthen the current research at the institution. The Director of Research will be fully committed to graduate education, a well-regarded researcher, a skilled communicator, and an excellent administrator and manager. Required are a doctorate in botany or a related field, with specialization in some aspect of plant systematics or evolutionary biology preferred, and an excellent and ongoing track record of scientific publication and extramural funding. The Director of Research will be expected to hold an Associate or Full Professorship at Claremont Graduate University, which will be co-terminous with the appointment as Director of Research.

To apply, send a letter of interest and *curriculum vita* to Patrick S. Larkin, Executive Director, Rancho Santa Ana Botanic Garden, 1500 North College Ave., Claremont, CA 91711. Letters of reference will be requested later. For more information contact Mr. Larkin directly at (909) 625-8767, ext. 220 or by e-mail at Patrick.Larkin@cgu.edu.

The search will remain open until the position is filled.

The Botanic Garden values a diverse community and is committed to equal opportunity in employment.

Other News

NEON Progress Report

Planning for the National Ecological Observatory Network is beginning to yield new specifics about NEON science and the deployment of sensors and cyberinfrastructure.

NEON's ultimate goal is to forecast the future state of key ecological systems in the United States. When fully deployed, the observatory will support systematic study of seven US ecological priorities: invasive species, infectious disease, climate change, land-use change, biogeochemical cycles, biodiversity, and aquatic ecosystems. A standardized set of sensor technologies and cyberinfrastructure will enable continuous, long-term data collection, storage, and dissemination within 20 distinct climatic domains across the continental United States (in addition to domains for Alaska/tundra/taiga, Hawaii/Pacific Tropical, and Atlantic Neotropical). (See www.neoninc.org for more on the climatic domains and an interactive tool for exploring the maps.)

Within each domain (or NEON Node), infrastructure will be deployed in three land-use/land-cover types: wild, managed, and urbanized, each of which will contain transition zones between terrestrial and aquatic systems. Every NEON Node will feature a range of standardized instruments deployed at three fixed sites to provide critical data streams related to the ecological priorities, as well as mobile capacity to conduct routine manual sampling and to respond to sudden ecological events, such as the outbreak of an infectious disease. NEON infrastructure will be networked via state-of-the-art communication and computational tools.

NEON will be based on an open architecture that gives scientists access to new and evolving hardware and software technologies. A suite of NEON education programs will explicitly translate NEON science in ways that capture the imagination and attention of the general public, including teachers, students, decision-makers, and citizens from all walks of life. Teachers will have real-time NEON data as a classroom learning resource, students and citizen-scientists will participate in field trips to collect data, and the general public will learn about their environment through daily ecological forecasts.

As NEON planning progresses, updated materials describing the project will be available in print and online.

New Exhibition Showcases Research Projects by New York Botanical Garden Scientists

Plants and Fungi: Ten Current Research Stories opens October 22 and features unusual plant specimens, artifacts from explorations, maps, research tools, and audio visual presentations showcasing Botanical Garden scientists and graduate students. Ten exhibit cases present research stories involving mushrooms, blueberries, lichens, mosses, cycads, rice, Brazil nuts, squashes, vanilla orchids, and ferns. They illustrate how scientists unravel the mysteries of science, including the evolutionary history, ecological roles, and economic uses of plants and fungi.

The Tree of Life

Unraveling the mysteries of plant and fungal evolution is a major theme of the exhibition. It is dramatized by a large-scale diagram of the Tree of Life extending along one of the major walls of the gallery. Portions of the Tree are magnified to show the relationships of plant groups, including those of the plants in the research stories exhibit. Individual research projects presented include DNA fingerprinting, classic plant exploration and collection, and detailed scientific observation and description; for example, compiling a definitive floral of all known ferns in Mexico and documenting the lichens of the Ozark Mountains.

Ecological Roles of Plants

Scientists study the complex interactions of plants and fungi with their environments. Many lichens, for example, are highly sensitive to pollution and serve as environmental indicators of clean air. One research story presents the documentation of the various species of lichens that grow on the grounds of the Botanical Garden itselt.

The ecological role of plants and fungi also includes the many interactions with animals. Plants in the Brazil nut family, for example, have evolved many strategies to attract pollinators and to entice bats and other animals to disperse seeds. Plants and fungi also interact with other plants and fungi in their environment. In the harsh, high-elevation habitats of the Andean mountains, botanists are studying the relationship between a porcini mushroom and a member of the blueberry family that need each other to survive.

Uses of Plants and Fungi

People rely on plants and fungi as resources for medicine, food, fiber, and fuel. One project studies the diversity of rice varieties: how different varieties are created, maintained, and transformed through social networks. Another project tackles the search for the wild ancestors of today's domesticated squashes. Through research on cycads, botanists are studying a nerve toxin in cycads that causes "Guam dementia" and that may provide clues to other human neurological diseases such as Lou Gehrig's, Parkinsons's and Alzheimer's.

Books Reviewed

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Flowering Plant Embryology: With Emphasis on Economic Species, Nels R. Lersten, 2004. ISBN 0-8138-2747-7 (hard back $89.99) 212 pages. Blackwell Publishing Professional, 2121 State Avenue, Ames, Iowa 50014, USA.

This rather short text, only 212 pages to include cited literature at the close of each chapter and an Index, is clearly written and packed with up-to-date information generally of value to any student of botany and essential for those who will advance future research in this field. The author's point that a single author can present a uniform style not usually found in edited texts with many authors is supported by this text. The embryology of economic plants is emphasized, and no other embryology text contains this emphasis. The treatment of *Pollination and Pollen-Stigma Interaction* is especially well

written and offers important information not presented in earlier texts. That pollen tubes do not attain growth in vitro that they attain in situ, i.e., in contact with carpellary tissue, supports the notion of the unique expression of heterospory in seed plants mentioned later in this review. The discussion of *Pollen Germination, Pollen Tube Growth, and Double Fertilization,* also reports features and details of development not included in past treatments, even in the more encyclopedic texts (e.g., Johri, 1984). The events in pollen germination (the final developmental stages for the microgametophyte) are very clearly and thoroughly explained. The behavior and movement of organelles toward the apex of the pollen tube as growth is promoted by factors transferred to it from the surrounding carpellary tissue, is explained clearly and appropriately illustrated. The author presents a very thorough account of studies on dimorphic sperm cells citing the most recent studies. This phenomenon for the first time is clearly documented as a significant feature of development. Sperm of different size and shape from the same microgametophyte were mentioned only briefly by Maheshwari (1950) who regarded reports up to that time as doubtful. Dimorphic sperm are not mentioned either by Maheshwari (1963) or by Johri (1984). The events of pollen tube discharge and double fertilization are accorded better analysis and summarization of variations than have been offered in other treatments. The description of endosperm development is innovative and complete. New terms applied to endosperm types offer logical replacements for the traditional ones. Traditional nuclear type is referred to as coenocytic while cellular type is described more accurately as multicellular. Helobial type is retained for its first discovery and prominence in the monocot Helobiales. Past accounts in passing noted that in many cases the nuclear type in later development becomes cellular. These cases here are treated as a separate type, viz. the coenocytic/multicellular type which, as the author points out, is the most common type, and present in 161 families. The author's brief speculations on endosperm variation are very well stated and make more sense than those offered previously.

There is much more here for which any reviewer could offer genuine praise. However, those who make use of this text should be aware of some errors, which may well be regarded as minor; several omissions, at least one of which is justified in view of the author's intentions for this text; and alternative approaches to some subjects, which might be considered more appropriate for reasons offered in this review.

As to the few errors, flowers with androecia and gynoecia are described as *bisexual* or *perfect* and those with only one group of appendages as *unisexual* or *imperfect*. Flowers belong to the sporophyte generation and, therefore, are *asexual.* The statement that, "Continuous xylem (in the stamen filament) is probably unnecessary..." is an unnecessary conclusion that promotes a very common error in present-day biological writing, viz., teleology. That the xylem is discontinuous need no further comment unless its evolutionary derivation from the primitive stamen is to be discussed. The ovule is not a megasporangium. Only the archesporium in the nucellar hypodermis and tissue derived from it, the parietal and sporogenous tissues, constitute the megasporangium. Where the megasporocyte is derived directly from a single-celled archesporium, the megasporangium has been reduced to one cell.

Ontogeny of the microsporangia is omitted. The sporangial initials in the hypodermal layer of the young anther divide to produce the primary parietal layer and the primary sporogenous layer which produce respectively the secondary parietal layers and the sporogenous tissue. From this common ontogeny four types of microsporangia are produced (Basic type, Dicotyledonous type, Monocotyledonous type, and Reduced type) based on variable patterns in the derivation of the secondary parietal layers and sporogenous tissues. This text accounts for ten different patterns or types of female gametophyte development which are illustrated with a diagram from Maheshwari (1950). Twelve patterns are illustrated by Maheshwari (1963) and thirteen by Johri (1984). No mention is made of a second bisporic type, the Endymion type, or of two Chrysanthemum cinerariaefolium types. Atropous (orthotropous), anatropous, and campylotropous ovules are described but are not illustrated. The nature of these three ovule forms is difficult to visualize from the descriptions alone, and there is no mention of the amphitropous type. Embryo types first defined by Schnarf (1929), better explained by Maheshwari (1950), and greatly elaborated to include numerous morphological variations by Johansen (1950), are excluded from this text. Neither is the rather elaborate system for classifying embryo development formulated by Souéges (see Crété, 1963) presented. This omission is reasonable in view of the author's intent of presenting important principles of development which could, as has occurred in other treatments, be lost in the morass of variation inherent in embryo typology.

The criticisms so far addressed are not, of course, constructive, since the text has already been published. And, indeed, these criticisms may be regarded as not reflective of major error. The final criticism is directed to what is here viewed as errors

in the presentation of two topics marked by a departure from accepted philosophy of the subject. Perhaps these remarks will compel teachers and other users of this text to adopt alternative approaches to these topics, so that the perceived errors will not detract from the many aspects of value in this text. Each of these topics will be treated separately.

The endosporic development of the male and female gametophytes is mentioned briefly, but without any indication that flowering plants share this feature with all other heterosporous plants. However, the unique features of seed plant heterospory are not mentioned. All megaspores, for example, except those of seed plants accumulate nutrients in an amount sufficient to produce a mature female gametophyte. The energy required for endosporic development is endogenous, and none is required from the environment during the process. On the other hand, in seed plants the endosporic female gametophyte develops and matures utilizing energy derived from the nucellus over the entire course of the process. This comment goes to the contention expressed earlier that the complex events of flowering plant embryology should be examined in full view of their natural connection with developmental events in other heterosporous plants.

Discussion of the life cycle of flowering plants does not make clear to the reader with proper emphasis that the alternation of generations is an alternation of two types of plants, an asexual sporophyte and two sexual gametophytes, male and female. The alternation of sporophyte and gametophyte generations in the life cycle is a salient feature of the plant kingdom. Terminology emphasized in the presentation of the flowering plant life cycle is largely the cause for the failure to show the relationship, similarities and differences, with other heterosporous plants and the unique nature of the life cycle in green plants manifested in the alternation of generations. The term, "pollen sac" and most especially the term, "embryo sac" should not receive mention, although they are frequently used in the most prominent texts written in the 20th century (e.g., Schnarf, 1929; Maheshwari, 1950; 1963, and Johri, 1984). If instead, these terms were omitted in favor of "microsporangia" and "female gametophyte"respectively, the student reader would make the proper connection between these structures and their counterparts in other heterosporous plants, especially other seed plants. The term "embryo sac" should never be used, since from its origin it promotes an inaccurate concept propagated by Jacob Schleiden throughout his career and most emphatically in his Principles of Botany text (Schleiden, 1849). Schleiden successfully promoted the concept that the tip of the pollen tube produced the "germ", the embryo which was nourished to maturity by a nutritive fluid encapsulated in an ellipsoid body located within the *"nucleus"* (see Gray, 1845, now the "nucellus") of the ovule. Nourishment for the embryo was the sole function envisioned for the *"sac of Amnios"* or embryo sac The terms "female gametophyte" or "megagametophyte" that here in this text receive only parenthetical mention, connote a sexual plant whose function is identical wherever heterothallism is expressed in the gametophyte generation. This same connotation applies to the male gametophytes or microgametophytes.

As mentioned previously, this major criticism treats matters that can be easily corrected through good pedagogy, and it does not weaken my enthusiastic recommendation of this text for a course in flowering plant embryology offered to advanced undergraduate and first-year graduate students. In addition, it would be of value to those conducting research in the field.

— J. M. Herr, Jr., Department of Biological Sciences, University of South Carolina, Columbia, SC 29208.

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Crété, P. 1963. Embryo. *In* P. Maheshwari [ed], Recent advances in the embryology of angiosperms. International Society of Plant Morphologists, University of Delhi, Delhi, India.

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Schleiden, J. M. 1849. Principles of scientific botany. Longman, Brown, Green, & Longmans. London.

Plant Functional Genomics. Dario Leister (Editor) Publisher: Food Products Press (New York, London, Oxford); 2005 ISBN: 1560229993; List Price: $89.95 (paperback).

The rapidly growing field of genomics can be divided into structural and functional genomics. Structural genomics is the first stage of genome analysis that results in the complete DNA sequence of an organism while functional genomics uses the genome sequence to determine the functions of the genes. The *Arabidopsis* genome was completely sequenced in 2000, and the rice genome has recently been published. Functional genomics will become more important to botanists and all biologists over time since, as of July 2005, there are 1496 genome projects (89 of these are plant genomes) with 276 completed genomic sequences. (http://www.genomesonline.org/).

The 23 articles in this volume are written by leading experts in the field, and the book is organized into five major sections: breakthrough techniques, species examples, organelles, pathways and processes, and protein families. The chapters in the first section introduce many important concepts in functional genomics including microarray technology, annotation of genomes, T-DNA mutagenesis, reverse genetics tools, among others. The many Web-based resources available in functional genomics are indicated, and the limitations of the techniques as well as the importance of statistical analyses are discussed. The chapters in the species section include a cynaobacterium (*Synechocystis*), *Chlamydomonas*, moss (*Physcomitrella*), *Arabidopsis*, rice, and maize. Of course, the organelle section contains a chapter on chloroplast proteomics and one on mitochondrial proteomics.

Section three on pathways and processes provides many interesting applications of functional genomics. These include photosynthesis, nitrogen metabolism, fatty acid biosynthesis, seed development, and plant salinity tolerance. In this section, we can see many fundamental advances, and how these new approaches have made profound changes in research methodologies in these fields. This last comment also applies to the final section of the book which considers protein families such as plant transporters, cytochrome P450, among others.

The editor should be congratulated for bringing together such a wealth of information in one large volume. However, this book would benefit from a glossary covering the most important and basic terms. In general, the chapters are well-illustrated with diagrams and half-tone photographs, but a few of the chapters would have benefitted from increasing the number of figures to help explain complex topics. Functional genomics has a sometimes bewildering list of terminology and acronyms, and in most (but not all) cases, these are defined.

This book will be very useful for graduate students and faculty who plan to use functional genomics in their research. While it would be difficult to implement in an undergraduate class, the book would be useful in a graduate course or seminar. Certainly, all university libraries should order a copy for their collections.

-John Z. Kiss
Dept. Botany, Miami University, Oxford, OH 45056

The Ecology of Seeds. Fenner, Michael and Ken Thompson. 2004. ISBN 0-521-65311-8 (Cloth US $90.00) ISBN 0-521-65368-1 (Paper $US 45.00) 250 pp. Cambridge University Press, 40 West 20th Street, New York, NY 10011-4211.

Readily attracting a reader's eye, this volume's appealing sky-blue cover illustrating dandelion seeds airborne, afloat, invites plant biologists into a substantial examination of seed ecology. The Ecology of Seeds takes up basic problems such as, What determines the number and size of the seeds produced by a plant? How often should a plant produce them? Why and how are seeds dispersed, and what implications do those factors have on the diversity and composition of vegetation?

These data feed concepts connected to ecological aspects of seed biology, starting with a consideration of reproductive strategies in seed plants and progressing through the life cycle, comprising seed maturation, dispersal, storage in the soil, dormancy, germination, seedling establishment, and regeneration in the field. Field botanists will appreciate coverage of central issues such as seed size and persistence in soil, how shade and seed size constrain plant distribution, and the significance of seed banks. The text reflects the central role that seed ecology has played in elucidating many fundamental aspects of plant community function.

Information in this scholarly opus, meticulously documented with 62 pages of literature citations, is organized into the following chapters: Life histories, reproductive strategies and allocation; Pre-dispersal hazards; Seed dispersal; Soil seed banks; Dormancy; Germination; Post-dispersal hazards; Seedling establishment; and Gaps, regeneration and diversity. Searching the volume is made easy with a ten-page index. For the next edition, an additional author index would enhance the reader's ability to search for work recalled by investigator's surname.

Profoundly important, is a discussion of associations between seed longevity and particular habitat types. The severity and predictability of disturbances interact to determine the persistence of seed banks beneath grasslands. Severe disturbance tends to select for persistent seed bank.

Seed dormancy, an adaptation to prevent germination when conditions are suitable for germination but the probability of survival and growth of the seedling is too low to ensure successful seed germination, is addressed in a chapter at the midpoint of the book. Types of dormancy: morphological, physical and physiological are differentiated, with morphological dormancy viewed as the most primitive type.

The study of gaps and their role in promoting seedling recruitment has been an important focus of investigations into regeneration and species diversity in plant communities over the past few decades. The book's final chapter, Gaps, regeneration and diversity, closes with this disclaimer: "Unpredictability of most types of disturbance may create a regeneration lottery that results in the maintenance of species diversity by default."

The authors use a helpful device, not always seen, wherein each chapter begins with a short introductory paragraph providing essential background information and some key questions the authors intend to tackle in the succeeding pages.

Anyone interested in plant seeds, whether recreational gardener, career botanist, plant geographer or environmental scientist, will appreciate this valuable compendium. It updates Seed Ecology, a work the first author published two decades earlier, that contained citations to a mere fourth of the references included here, indicating the exponential growth of research in this field in recent years.

-Dorothea Bedigian, Missouri Botanical Garden, St. Louis.

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Forest Canopies, 2nd Edition. Lowman, M.D. and H.B.Rinker. (Eds.). 2004. Elsevier Academic Press, 525 B Street, Suite 1900, San Diego, California 92101-4495. (ISBN 0-12-457553-6, hardback), $79.95, xxiii+517 pp, 62 color images, 108 b&w figures, 20 tables, 7 ½" X 10 ½".

Why study the forest canopy ecosystem? Like the vastness of outer space and the depths of the oceans, tree canopies represent one of the last frontiers of exploration. Most of the biodiversity on planet Earth, estimated at 30 million species, occurs in the treetops. This beautiful book documents the past 25 years of exciting research in treetops with 62 color images, 108 black and white illustrations, 20 tables, and 30 side bars with references that enliven the 26 chapters written by 59 contributors. Tree canopy research is a relatively new area of science because many of the techniques to reach the treetops such as the single and double rope climbing systems, airships, canopy rafts, sleds, cranes, towers, tram-lines, and walkways are of recent origin. The purpose in this edition is to update the advances in tree canopy research and pass on the knowledge base with all of its challenges and unanswered questions to the next generation of canopy scientists, educators, and students. This book accomplishes this and much more.

This second edition of "Forest Canopies" is an entirely new book. The chapter titles and content are different and the number of contributors has almost doubled. Three general themes: Structures of Forest Canopies, Organisms in Forest Canopies, Ecological Processes in Forest Canopies, are found in both editions with an added section, Conservation and Forest Canopies, in the second edition. An overview begins each thematic section, for example, the section on Structures of Forest Canopies compares the past decade based on ground-based methods of how far a standing human could reach, to how far a human can climb, usually to the treetop. This has enabled more quantification data of the upper canopy, mapping the architecture of the entire tree, exploring vertical stratification of biota, measuring factors such as age, light levels, evolutionary status, and genetics. This goes beyond

individual trees and applies to the three-dimensional structure and development of forest ecosystems. A broader definition of forest canopy is applied: "…denotes community architecture as well as species composition, nutrient cycling, energy transfer, and plant-animal interactions from the ground to the forest-atmosphere interface."

Sidebars are short canopy stories, one to five pages in length, with their own set of references intercalated within the chapters that highlight specific topics. Examples are "Measuring Canopy Structure: The Forest Canopy Database Project", another example, "The Botanical Ghost of Evolution", and still another "Arboreal Stromatolites: a 210 Million Year Record". There are many other fascinating titles highlighting innovative methods and ideas that serve to break up the more technical chapters. These sidebars, set apart by their light green background, will appeal to a more general audience.

This book would have benefited from a brief biosketch about the editors (Margaret D. Lowman and H. Bruce Rinker) because of their long distinguished career in canopy research that began in the late 1970s. The preface alone is not enough. Meg Lowman's book "Life in the Treetops" has won several book awards and serves as an inspiration for other young women to pursue a career in canopy biology. Her delightful prose engages the reader in such a way that broad readership will especially enjoy the chapters "Tarzan or Jane? A Short History of Canopy Biology" or "Ecotourism and the Treetops". Her pioneering research on canopy herbivory using rope climbing systems will lead by example the next generation of women who will follow in her footsteps. Bruce Rinker has wide ranging interests in tree canopy research especially the ecological links between treetops and soils, ethnobotany, entomology, ornithology, resource management, and canopy education and conservation. Some highlighted examples of chapters where he is author or coauthor are "Soil Microarthropods: Below Ground Fauna that Sustain Ecosystems", "Insect Herbivory in Tropical Forests", and "Reintegration of Wonder into the Emerging Science of Canopy Ecology".

A survey of the organisms in the forest canopy includes such diverse groups as lichens, bryophytes, vascular epiphytes, mistletoe, mites, micro-arthropods, tardigrades, vertebrates such as anole lizards, and mammals. A chapter on the vertical organization of canopy biota also includes fungi and bacteria, invertebrates, epiphytes, climbers, amphibians and reptiles, birds, and mammals with each group limited to one or two pages of text. There are gaps in our knowledge of canopy bacteria, fungi, and protists, including groups such as the myxomycetes, dictyostelids, and protostelids that are not even mentioned. Corticolous myxomycetes which grow, develop, and sporulate on the bark of living trees from ground level to the treetops should have been included since references exist dating from the 1970's. Certainly the biodiversity and role of fungi in forest canopies should encourage the next generation of mycologists to vertically explore the bark surface of living trees. More research on the taxonomic communities of micro-organisms, especially bacteria, myxobacteria, cyanobacteria, green alge, fungi, and protists, will be new data for future chapters in the next edition of forest canopies.

Information in tree canopy science is growing by leaps and bounds on a global scale. Many of the references are after the year 2000 so the editors included and updated current references just prior to publication. No glossary is included. Tree canopy science has developed to a point where a set of basic terms would be helpful to standardize a working vocabulary. A user-friendly, alphabetized, 16-page index includes page numbers to topical subjects, figures, tables, and genera which aids in finding a wide array of key terms and thematic areas in the book. Careful attention to detail in this section, for example, cross referencing terminology (water bears, see Tardigrades) or fungi (10 citations) enables the reader to ferret out general and specific information in different chapters.

Careful editing has eliminated most errors. Exceptions are the captions given as scanning electron images on pages 252 and 253 which are actually light photomicrographs without any value for the scale bars to determine relative size. Again, on pages 254 and 255, the beautiful images are not labeled as scanning electron micrographs.

Elsevier Academic Press has produced a book whose design, format, and organization make it an easy and enjoyable read. The chapters are logically arranged. In addition, the reader is effectively guided by topical boldface headings, ample white space, and font size so reading this book is easy on the eyes. Illustrations are tipped in at the appropriate spot in relation to the text narrative instead of grouping the color images as a group of plates at the end of the chapter or at the back of the book. The lead in artwork and quotations add a touch of class to the major sections of the book.

This book is recommended to a general audience interested in the biodiversity, exploration, and conservation of tree canopy ecosystems on a global scale; included in this group are conservationists, environmentalists, naturalists, citizen action groups, educators, ethicists, and politicians at local, state,

and national levels. In addition, professional scientists working as botanists, ecologists, foresters, and zoologists will find useful information related to their fields of study. Finally, educators should consider using "Forest Canopies" as a textbook for seminars or special topics courses offered at colleges and universities.

This book is well worth the price and is a bargain when the many color images are considered. Every library and person who values the importance of trees and forests to the future of our planet should buy this book.

-Harold W. Keller is a Professor of Biology at Central Missouri State University, Warrensburg, Missouri, 64093. Email: haroldkeller@hotmail.com.

Sonoran Desert Plants: An Ecological Atlas. Raymond M. Turner, Janice E. Bowers, and Tony L. Burgess. 1995 [first paperback edition 2005]. ISBN 0-8165-2519-6. $39.95. 501 pages, 332 maps and charts, 81 photos. University of Arizona Press, Tucson.

One of the problems with paperback versions of books is that instead of plastering endorsements on the dust-jacket (fly-leaf), these quotes are printed right on the front cover and cannot be easily ignored. For this book, those words read, "A goldmine of information that represents more than three decades of careful compilation." What a gross understatement. The lead author alone has put in over four decades of such work. Between the three authors and their litany of close colleagues, such as Rod Hastings, Reid Moran and Howard Gentry (to name just a few), there are centuries worth of careful work that have gone into this volume.

Sonoran Desert Plants is an atlas, showing the distributions of 339 species of Sonoran Desert plants in traditional maps. For each species (or occasionally groups of closely related species with muddled taxonomy), three maps are given (1) a thumbnail map showing whether the species occurs or not in each state of the U.S., each state in Mexico, and each country in Central America and the Caribbean, (2) an expanded map of the Sonoran Desert and much of the Mojave Desert, with state boundaries and degrees of longitude and latitude demarcated showing all the documented locations of the species, and (3) a graph with elevation versus latitude, showing the same latitudes and the same documented locations as the previous map. Two types of data are distinguished on these maps: (a) herbarium voucher specimens and (b) sightings by one of the authors or by some other highly trusted authority. Various textual information is given for each species – taxonomy, range, and other items – although the scope of this information varies between taxa.

This book is limited in scope and idiosyncratic in its coverage. It also happens to be one of the best and most beautiful data sources for plant habitat information. Some day in the very distant future, when most herbaria digitize their holding – if they make these data open to the public – maybe such an ecological atlas will exist on-line. But for now, this book is invaluable for any natural historian of the Sonoran Desert. It required a remarkable amount of labor and expertise to compile even a single of these distribution maps, let alone the hundreds of maps produced herein.

The authors have not only put together an atlas showing the distribution of over 300 species in the Sonoran Desert. They have also included data on the biology, biogeography, ethnobotany, and other interesting facts for many species. In many instances, they have speculated as to the most likely cause for range limits, such as temperature, precipitation, fire, shade, salinity, other edaphic conditions, pollinators, grazing by livestock, competition, and introgression. Although these speculations on causes of range limits are just hypotheses, they are based on many years of field experience and are one of the most interesting aspects of the book. I was astounded by how in some genera (e.g. *Agave*), so many different factors appear to influence range limits, depending on the species in question. I was also impressed with how much the authors reported on the packrat midden work (especially by Tom Van Devender) showing historical distribution data over the past 20,000 years.

This book pleasantly surprised me with its reports of plants outside of the ranges that I knew, even for plants that I thought I knew quite well. For example, the elephant tree, *Bursera microphylla*, is well-known from South Mountain in Phoenix, Arizona, but I had never before heard of the Harquahala Mountain population roughly 15 km further to the north and 60 km further to the west.

The biggest idiosyncrasy of this volume is the choice of species. These largely reflect the authors' interests. How else could one hope to compile

such an enormous amount of data without choosing their favorite taxa? And, how else could the first 20% of the book cover plants whose genera start with the letter "A"? This atlas contains entries for many of the most common trees and shrubs of the Sonoran Desert, as well as a preponderance of agaves, cacti, and woody legumes. Walking through the desert in the dry season (i.e. much of the year), this is all you see. So, I find the coverage quite good. Only if your taste lies more with herbaceous plants – grasses, lilies, and little composites come to mind – will you be disappointed.

There are many other quaint idiosyncrasies throughout this volume. The erstwhile family names Leguminosae and Compositae are used instead of the more modern monikers Fabaceae and Asteraceae. Genus epithets are sometimes given two letter abbreviations, e.g. *Aesculus* = *Ae*. I suppose this could help distinguish *Aesculus parryi* from *Agave parryi*, but I could find no obvious places in this volume where such confusion might arise.

The authors provide us with many curious tidbits. They report matched photos/sightings taken roughly a century apart of the same individual of *Ambrosia dumosa*, *Atriplex cansecens*, *Celtis pallida*, *Ephedra aspera*, *Opuntia kunzei* [*Grusonia kunzei*], and *Peucephyllum schottii*! Decent documentation on plant longevity is often hard to find, other than from cores of woody trees. I have always suspected that the Arizona *Grusonia* dog chollas (which the authors refer to as *Opuntia kunzei*, *O. emoryi*, and *O. parishii*) formed ancient clones that covered many square kilometers. At least this atlas provides some evidence for the old age of the smaller fairy rings of *Opuntia kunzei*. The authors report that pollen and nectar of *Aesculus californica* (not a Sonoran Desert native, but rather native to coastal and northern California) are poisonous to the non-native European and African honeybees (both are subspecies of *Apis millifera*), but not to native bees. They report obvious sexual dimorphism in leaves and stems of desert populations of jojoba (*Simmondsia chinensis*). As a final example, they report that cuttings of *Ambrosia deltoidea* tied to other plants will deter herbivory by rabbits (citing Joe McAuliffe at Desert Botanical Garden in Phoenix, a place that is overrun with cottontails and jackrabbits). There is no way to predict when such idiosyncratic gems – and there are many – will be peppered throughout the text. These gems keep you reading, albeit preclude skimming.

The authors have cited an extensive literature. Their reference list is a very useful resource.

Sonoran Desert Plants is a great atlas. I hope that the authors and possibly others continue to update this wonderful resource. On-line documentation exists for all the data that went into the distribution maps (http://wwwpaztcn.wr.usgs.gov/atlas/). This on-line documentation was apparently not designed for external use, so is neither user-friendly nor aesthetic, but is publicly available. I highly recommend *Sonoran Desert Plants* to anybody who is interested in trees or shrubs of the Sonoran Desert, especially if interested in their distributions.

-Root Gorelick School of Life Sciences, Arizona State Uiversity

Waterlilies and Lotuses: Species, Cultivars, and New Hybrids. Slocum, Perry D. 2005. ISBN 0-88192-684-1. (Cloth US$34.95) 328 pp. Timber Press, 133 S.W. Second Avenue, Suite 450, Portland, OR 97204-3527.

In Waterlilies and Lotuses: Species, Cultivars, and New Hybrids by Perry Slocum, the author clearly and effectively presents a review of the cultivated species and hybrids of the genera *Nymphaea* and *Nelumbo*, as well as species of other genera in the Nymphaceae.

Perry Slocum was one of the best known, perhaps the best known, waterlily and lotus breeder in the US. He bred hundreds of new varieties and ran his own nursery, in addition to writing books. He was the first person to be inducted into the Hall of Fame of the International Watergardening Society (now the International Waterlily and Watergardening Society), and he had just finished this work when he died in 2004, having contributed greatly to the renaissance in watergardening in the US.

This volume is really a modification of the earlier Water Gardening: Waterlilies and Lotuses by Perry Slocum and Peter Robinson with Frances Perry, also from Timber Press. In many ways this version is preferable, especially for botanists, since it is taxonomically more tightly focussed. The earlier volume dealt with all sorts of cultivated aquatic and marginal plants. This volume is also more compact—the earlier book was sized and priced

more for decorative coffee table use—and has much better quality color in the abundant illustrations than the earlier book had.

Waterlilies and Lotuses: Species, Cultivars, and New Hybrids does an excellent job of surveying its subject matter. A picture gallery is followed by chapters devoted to various species, different groups of cultivars, non-Nymphaea members of the Nymphaceae, and lotus. Appendices present the Hardinesss Zone maps and commercial sources. A wide range of species is shown in the many color plates which come near the front of the book, along with illustrations of important features such as tropical Nymphaea tubers, the various types of rhizomes used in classifying hardy Nymphaea cultivars, viviparous reproduction on leaves and flowers, and even a lovely closeup of a flower of Ondinea purpurea ssp. petaloidea. Besides the color photographs in the gallery, abundant line drawings supplement the text.

Many of the latest things in watergardening are presented. Not only is the well-known Vicotoria hybrid 'Loongwood' shown, but so is some of the new material bred by Kit Knotts such as 'Adventure.' The Australian Nymphaea species which have been increasing greatly in popularity in the US are also represented along with the first waterlily with white-blotched purple petals, the prolific 'Islamorada."

Of course, there are a few oddities. Anyone who has spent a little time looking at catalog of waterlily nurseries will be familiar with the "blue" flowered cultivars whose pictures are over-enhanced with filters to the point of the normally green leaves looking like they are made of cobalt glass, and the picture of the cultivar 'Green Smoke' on p. 18 does have a very odd, solarized appearance, but all-in-all, this is a wonderful book.

Who should buy a copy of Waterlilies and Lotuses: Species, Cultivars, and New Hybrids? Certainly it belongs in college and university libraries, and given the popularity of watergardening today, many amateur and professional botanists will want a copy for strictly personal reasons. It would also be useful for teaching both botany and horticulture, since waterlilies and lotuses tend to be one of those plants which, when well grown and in full bloom, elict a "wow," even from jaded undergraduates.

-Douglas Darnowski, Department of Biology, Indiana University Southeast.

Carotenoids Handbook. Britton, George; Liaaen-Jensen, Synnove; Pfander, Hans P. (Eds.), 2004. Compiled by A.Z. Mercadante and E.S. Egeland. 660 p., hardcover $159, ISBN: 3-7643-6180-8. Birkhäuser Verlag, P.O. Box 133, Ch-4010 Basel, Switzerland.

If you work with a lot of carotenoids, or simply need a good reference book containing fundamental data to help with laboratory work involving the isolation, quantitation, or identification of carotenoids this is a tremendous reference. Data on the physical properties of about 750 different carotenoids are given. Note that this book is not a stand-alone tutorial on carotenoids, but is intended as a reference book. Readers are referred to Volumes 1A and 1B of a carotenoid series by the same editors for more in-depth information on isolation and structure elucidation procedures, as well as more information on this class of compounds in general.

The book is divided into 3 sections: an introduction, a main list of carotenoids, and a supplementary list. The introduction is well worth reading before using of any of the tables in the book. It explains the organization of the book, how the data in the tables are presented, and useful information on how to use that data. Only a few minor problems caught my eye in using this book, two of them in the introduction: the description of the ordering scheme for end groups other than ², ³, µ, and È was not given, on page 21 the bottom arrows used to help explain the layout of UV/VIS spectral data are shifted to the right, and in the data tables on entry #258 reference 7 is missing. None of these are major problems or detract from the usefulness of the book.

The main section of the book and the supplementary list provide data on individual carotenoids. These two sections are distinguished by the amount and reliability of the information available. Carotenoids that the editors considered the structures and characterization to be reliable are found in the main section. Other carotenoids and some derivatives of carotenoids in the main list are found in the supplementary list. The key information provided for each carotenoid includes as available the common names, IUPAC semi-systematic names, molecular formula, structure, UV/VIS data and the spectrum, mass spectral data, circular dichroism information, literature references to NMR data and the type of NMR data presented, synthesis if done with a reference, natural and recommended sources for isolation, and remarks. Having the UV/VIS spectra along with numerical data on extinction coefficients and absorbance ratios at different wavelengths is a strong plus for this book.

The isolation procedures briefly summarized in the tables are those used during some of the initial work for a given compound and not necessarily the best isolation or currently recommended procedures. Not all details are given and the information is given primarily as a history and guide.

The remarks are a valuable inclusion as they often provide important information on a variety of topics including derivatives, stability, cis and trans isomers, and sometimes optical isomers. Most optical isomers are given a separate entry unless only mixtures of optical isomers have been isolated.

An index of common and IUPAC names for carotenoids is included at the end of the book to aid in finding carotenoids in the tables based on the editors numbering system.

-Paul Peadon, Nature's Sunshine Products, Spanish Fork, UT.

Immunology in Plant Health and its Impact on Food Safety. P. Narayanasamy, 2005, ISBN 1-56022-287-5 (hard cover 79.95), 412 pp, Food Products Press, An Imprint of The Haworth Press, Inc. 10 Alice Street, Binghamton, NY 13904-1580

The book "Immunology in Plant Health and Its Impact on Food Safety" is authored by Professor P. Narayanasamy, an accomplished researcher and a former professor with wide experience on microbial plant pathology. The professor's other works include two books, "Plant Pathogen Detection and Disease Diagnosis and Microbial Plant Pathogen and Crop Disease Management". Professor Narayanasamy has done notable research on crop plant diseases and to his credit developed a whole range of immunological methods for detecting viruses infecting various crop plants.

P. Narayanasamy has very strong credentials; indeed he is an expert on the main issues presented in this book. He has impressive knowledge about many immunodetection protocols and their various applications. These are presented here with amazing simplicity, making the book pleasant to read and use.

Immunology in Plant Health and Its Impact on Food Safety; the title of the book under review does reveal certain key attributes about the book. However, to a potential reader who needs to get a clear idea about the main subject of the book, this title is confusingly long. Reading through the book, the main theme is the application of immunological protocols in detecting various plant diseases and how such diseases in food plants can pose problems in humans. Considering the scope and content of the book, a shorter title would perhaps be even more confusing. This book in a nutshell is about application of immunology in detection of plant diseases and assessment of their impact on food safety.

In the first part, the author takes you through the fundamentals of immunological reactions, and the procedures used for generating both polyclonal antibodies (PABs) and monoclonal antibodies (MABs). This section is highly useful for students and researchers planning on using immunological techniques. Included, are a wide range of traditional and novel immunodetection protocols. The second part of the book includes structure and function issue as they relate to plants. Here, constituents of healthy plants are included. This information is invaluable as it prepares the reader for later chapters on plant responses to abiotic and biotic stresses. For example, in the section following the above, changes of plant biochemical constituents in response to various stresses and infections are discussed. Plant resistance to infection, environmental stresses, and engineering of resistance in plants are all covered in a well organized and highly professional manner. Food safety is covered in the last section. Here, various toxins associated with infectious agents and residues of manmade chemicals are discussed.

This very broad yet intense coverage of such diverse but connected issues makes the book a compendium of information. This boosts the validity of this text as a desk copy and a reference companion, for those in laboratory research.

A close look at the book shows the probable purpose of the book is to give the postgraduate, and beginning, or even established researcher an affordable source of very robust immunological methods, and ideas for their myriad applications. For every major immunological protocol, this book empowers the user to pursue a whole range of application options, unlike other similar books that put the user in some kind of straight metal jacket.

The text book is very readable considering the technical issues it addresses. The author did an excellent work of explaining highly technical process using clear English. Most of the issues discussed were given thorough but not overbearing consideration. This book, through the many new ideas, has the potential of bringing issue regarding plant health and food safety to the center stage.

There are instances where long sentences that are amenable to reduction or cutting into shorter sentences appear. Example p5 line #5. Sentences like this appear elsewhere and where possible these need to be shortened. In some areas too, many sentences begin with the word "The". When more than two sentences begin in the same way some level of unintended monotony sets in.

There are areas that need addition of subheadings. Subheadings are needed in areas where solid text extends for several pages without a break. Breaking these into segments would reduce the never-ending-feeling to the reader without loss of information.

Possible confusion: p12, 4th line of 2nd paragraph: "The L chains may be of two types, namely *k* (kappa) and l (lambda) chains, but the light chains of any one IgG molecules will be of the same type." The underlined parts of the sentence sound conflicting and needs revision.

All in all, this book is well structured and its overall development is very orderly. The main issues have been developed in a logical manner.

This is a timely book that details traditional and recent or pioneering protocols in use of immunochemical methods in monitoring and detection of viral, bacterial, and fungal plant diseases. In 14 chapters, this book brings together, many highly useful protocols some developed by professor Narayanasamy himself and many selected from writings by experts in the field. This book will prove to be of special interest, and indeed an essential one to postgraduate researchers and established researchers involved in both plant health and food safety. It will be a highly valuable addition to any lab reference collection or departmental library.

I highly recommend this text to postgraduates, beginning researchers and established researchers alike.

-William Jira Katembe, Delta State University, Cleveland, MS 38732

Plant Diversity and Evolution: genotypic and phenotypic variation in higher plants. Robert J. Henry, editor. 2005. ISBN 0-85199-904-2. US $120 (cloth). *viii* + 332 pages. CABI Publishing: Wallingford.

Biodiversity and evolution of plants often takes a backseat to biodiversity and evolution of animals. This is unfortunate because plants provide rich insights into evolutionary processes and patterns of diversity. It is therefore commendable seeing the new edited volume *Plant Diversity and Evolution*, which contains contributions from molecular, organismal, and ecological perspectives, many of which have a distinctive Aussie flavour (a refreshing change from a literature dominated by Europeans and Americans).

There are some stellar papers in this volume. Wendel and Doyle's chapter on the role of polyploidy in plant evolution is possibly the finest paper that I have seen on this topic. I especially enjoyed their final section on the influence of polyploidy on epigenetic signals, which brilliantly reviews and synthesizes some very new work. Harris's chapter on cell walls, which is appropriately set within an evolutionary framework, is also extraordinary. It is especially commendable that he couched his review within the framework of generally accepted contemporary phylogenies, including that of the Angiosperm Phylogeny Group (APG). The many-authored paper on floral evolution by Soltis *et al*. is also fabulous, albeit at times suffering from having a few too many chefs. Their chapter provides a nice introduction to evo-devo (evolutionary developmental biology) in plants, a subject that can often be unfathomable to non-practitioners, especially because of its unsettled taxonomy of genes and gene families (all with creatively idiosyncratic names and abbreviations). In fact, most of the chapters in this volume are broad in scope, at a minimum covering most flowering plants (okay, I do not understand why the one chapter confined to a single family, Brassicaceae, by Mitchell-Olds *et al*. was included in this volume, even though it was well written). Virtually all chapters provide a nice review of some specific facet of plant diversity, making this volume – or a subset of chapters – an interesting choice for a lower-level graduate text. That's the good news.

Unfortunately, there is too little coherence or consistency in this volume. Other than the title of the volume, I could not ascertain what was supposed to be the scope of the volume or the papers therein. The editor provides no synthesis nor umbrella. There is no stated impetus for this volume, such as possibly a meeting or symposium. There is not even a definition given of the highly normative phrase

'higher plants'. Some authors in this volume only discuss flowering plants; others discuss all seed plants; others discuss all vascular plants; while some others discuss all land plants including bryophytes.

There was also too little structural consistency imposed upon the contributors. There was disturbing lack of consistency in the figures. For example, the chapter on ecological importance of species diversity (Beierkuhnlein & Jentsch) contains absurdly large fonts and characters, while the chapter on evolution of the flower (Soltis *et al*.) contains absurdly small, faint and faded fonts, even including some labels that are upside-down! The one consistent – albeit disconcerting – feature of this volume is that all chapters lack abstracts. Equally disconcerting, many of the chapters also lack conclusions and/or discussions. A small subset of the chapters read like book reports, with no new insights nor interpretations. Fortunately, this lack of consistency also allowed several chapters to really shine, with authors being allowed to stick their necks out in wonderful ways and/or to present more molecular diagrams than there usually would be space for.

As with any volume of this size, there are several minor typographical errors, including by the editor, who disconcertingly misspelled the surname of the famous John Doebley! There were also errors of omission, such as a particularly spartan index. For example, the evolutionarily fascinating phenomenon of pseudogamy was broached in several chapters, but does not appear in the index.

I found the lack of discussion of evo-devo to be conspicuous, except for the chapter on floral evolution by Soltis *et al*. Plant secondary metabolites discussed in the chapter by Waterman and fruit shape and embryo position discussed in the chapter by Mitchell-Olds *et al*. would seem to fit beautifully into an evo-devo framework, especially in light of the recent focus on evo-devo in *Arabidopsis* (Irish & Benfey, 2004) and, to a lesser extent, in all other land plants (Svensson & Engstrom, 2002). As zoologists have realized, evolutionary developmental biology provides a wonderful synthetic link between molecular genetic and the fossil record (Carroll *et al*., 2005). Thus, the chapter on angiosperm phylogeny by Chase – which asserts that phenotypes should *never* be used in generating phylogenies – is completely contrary to the synthesis that evo-devo biologists are constructing. When will we finally learn that some small genetic (and epigenetic!) changes can have enormous phenotypic effects? Temporal and spatial placement of regulatory transcripts can matter much more than the mere presence or absence of those transcripts throughout the aggregation of tissues of an organism.

Despite the unevenness and inconsistency within this volume, the good chapters are so good that I am glad to have read through the entire volume. It forces you to think more broadly about plant evolution and realize that people in different subdisciplines may be arriving at conclusions that can steer your own work in interesting directions. But, be prepared to skip through this volume, spending many hours on some chapters and possibly giving up on others after only a few pages. Because of the relatively steep price and the limited number of stellar chapters, botanists and evolutionary biologists should at least recommend that your libraries acquire this volume.

-Root Gorelick, Arizona State University

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Plant Life of Kentucky: An Illustrated Guide to the Vascular Flora. R.L. Jones. 2005. ISBN 0-8131-2331-3 (hardcover $75) 834pp. The University Press of Kentucky, Lexington, Kentucky.

In the book's preface, the author states "It has become increasingly obvious in recent years that the state is greatly in need of [a complete flora]." Consider that need filled. With 2,600 species included in the flora and ten years in the making, Dr. Jones's work is substantial in content, quality, and physical size (the book weighs a respectable 1.9kg). He should be commended for the effort involved and the high caliber of the finished product.

The book is divided into two sections – the introductory matter and the taxonomic treatment of Kentucky's plant life. The introduction, comprising just over 10% of the book, includes the general introductory material expected in such a work (such as Kentucky's physical and climatic setting and plant community descriptions), as well as some novel additional material. For example, the author describes quite extensively the history of botany in Kentucky, focusing on key participants in the science.

Of this additional material, the most delightful is the listing of national champion tress in the state. Apparently, oaks are king in Kentucky.

The taxonomic treatment section contains the 40 major keys, allowing identification to family level (with a very handy index of the 179 included plant families printed on the inside back cover), and the individual family treatments, allowing identification to species level. Native and naturalized exotic species are both included in the flora, being differentiated by a symbol. The basis for the flora is the sizeable collections held in various herbaria through the state.

The "illustrated" in the title comes from the almost 2000 line drawings included in the book. More than 75% of the species listed have accompanying drawings, most of these being derived from the classic Britton & Brown manual. The drawings are very finely printed, and useful, especially those in the glossary. Sometimes, however, the line drawings of plant specimens included enlarged details that weren't identified as diagnostic in the key. Also, the location of the drawing for a particular species isn't listed with the descriptions (only in the index), and species with accompanying drawings aren't specially identified.

One limitation of the book is the absence of good distribution information, a lack readily acknowledged by the author. Currently, the description of species distributions is limited to listing in which of the three physiographic provinces the species are likely to be found, a level of detail that is not particularly helpful. A final limitation is the limited detail in the family and species descriptions regarding the expected size of plants. Granted, there is tremendous variation in this characteristic, but knowing whether to expect a 20cm tall plant or a one meter tall plant can be helpful, particularly for novices.

For botanical professionals in Kentucky, this book is likely to become a key reference in their libraries. Botanists in states surrounding Kentucky will also benefit from this resource, particularly those in Tennessee, whose flora overlaps significantly with Kentucky's (according to the author). Non-professionals may find the key difficult to use as the botanical vocabulary is quite detailed, despite efforts of the author to make it accessible. Due to its size, I doubt the book would become a field guide for Kentucky botanizers. However, it certainly makes for a comprehensive reference text. The first thing a new owner of this book should do is open to page 731, Jones's epilogue to the taxonomic section, and enjoy his prose.

-Ella Ingram, Department of Applied Biology and Biomedical Engineering, Rose-Hulman Institute of Technology, Terre Haute IN 47803

Dogwoods: The Genus *Cornus*. Paul Cappiello and Don Shadow. 2005. ISBN 0-88192-679-5 (Hardcover US $39.95) 224 pp. Timber Press, 133 SW 2nd Ave., Ste. 450, Portland, Oregon 97204.

Many consider *Cornus florida* L. to be a perfect tree, with beautiful color in spring and fall, excellent winter form, and lovely summer foliage. Cappiello and Shadow would agree, but they lead us on a journey through all the other *Cornus* that are just as deserving as *C. florida*, if less often touted. *Cornus mas*, for example, has always been a personal favorite but is largely ignored in the South because the plant rarely produces fruit. Cappiello's notes on this species were very good and affirmed our feelings that the early, abundant blooming is sufficient to warrant a place for this plant in any landscape.

The first chapter provides an overview of Cornaceae, and the remainder of the book is organized by *Cornus* groups, as definted by the authors. The real strong points of the book are the excellent photographs of distinctive cultivars, which are particularly good in the *C. kousa* and *C. florida* sections. We also found the information on typical growth by region extremely helpful. Gardeners in the Pacific Northwest will be happy to know that they can grow almost any *Cornus*, while Southerners can quickly find out when not to waste their time.

The section on anthracnose was well written and truly tried to highlight the differences between the two types of the disease. We thought that a picture would have been worth a thousand words, however, since the described differences are so slight as to be almost indistinguishable. Dogwood anthracnose lesions are described as 0.25 inches in diameter, tan to brown in the center, and surrounded by purplish rims. Spot anthracnose is described as 0.25 inches in diameter and light brown in the center. See the problem? The same can be said of other dogwood diseases; side-by-side pictures of *Discula*, *Elsinoe*, and *Septoria* would have been incredibly helpful for the general public who have trouble differentiating insect eggs from coated time release fertilizers. In a similar vein, the problem of overfertilizing is mentioned several times, but fertilizer recommendations are not given.

Personal enjoyment of the book may depend on one's objective when taking the book in hand. The stated goals of this book (pp.10-11) are to 1) share an appreciation of the diversity of dogwoods, 2) share a love of exploration, 3) add to horticultural knowledge about dogwoods, and 4) write from the perspective of and for gardeners. The authors draw a line in the sand between the aims and interests of horticulturists and plant systematists, and make no bones about where they stand. This rather

defensive posture is taken apparently to ward off criticisms of the authors' decision to not discuss contemporary understanding of the systematics of *Cornus* or to use this as an organizing framework for presenting the diversity of dogwoods. Unfortunately, this simplistic strategy for dealing with the discomfit that gardeners and other enthusiasts feel about the dynamic nature of classification undermines the laudable goals set forth in the preface. Rather than scoff (p. 18) at the utility of classifying herbaceous dwarf dogwoods (e.g. *C. canadensis* L.) in the same subgenus as the Cornelian cherry tree (*C. mas* L.), the authors could surely impart a greater appreciation of dogwood diversity by musing on the origin of dwarf dogwoods from their arboreal ancestors. Actually, systematists now believe that the closest relatives of the enigmatic dwarf dogwoods lie among the showy-bracted American species, like *C. florida* L. (see, for example, Fan and Xiang 2003). There is a sufficient level of understanding of relationships in the genus *Cornus* to have included a simple summary that would broaden the appreciation of all readers, regardless of whether their interests are more evolutionary or more horticultural in focus.

We were interested to see how the shrubby dogwoods of the eastern U.S. would be presented, as covered in the heterogeneous Chapter 3 (the *Cornus alba* L. group). The authors seem to delight in the taxonomic morass of this group and the challenges it presents to systematists and naturalists alike. We admit that we have been highly vexed by these plants. Understandably, there are no new insights here concerning species delimitation. *Cornus asperifolia* Michx. is treated as a species with a more pubescent form treated as *C. asperifolia* Michx. var. *drummondii* (C.A. Mey.) J.M. Coult. & W.H. Evans, rather than as a species. *Cornus foemina* Mill. is considered conspecific with *C. racemosa* Lam. and *C. stricta* Lam. is not mentioned anywhere in the book. (It should be noted that although Latin binomials are used throughout, taxonomic authors are not.) Given the strictly horticultural perspective of authors, perhaps readers would be better served by grouping difficult to distinguish entities under single entries, rather than using an arbitrary selection of taxa.

It is easy to see that this book was a work of love for Cappiello. The photographs and attention to cultivar detail are obviously the result of years of work. We also appreciated Cappiello's sense of humor. For gardeners and nurserymen, this work is key to understanding the genus.

-Lane Greer, West Linn, Oregon and Mark Fishbein, Dept. of Biology, Portland State University, Portland, Oregon

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Tococa (Melastomataceae). Michelangeli, Fabián A. 2005. ISBN 0-89327-466-6 (Cloth, US$30.00). 114 pp. The New York Botanical Garden Press, 200th Street & Southern Blvd., Bronx, NY 10458 USA. http://sciweb.nybg.org/science2/PressHome.asp.

The Melastomataceae, a predominantly tropical group and the seventh largest angiosperm family, includes life forms ranging from herbs to trees, epiphytes, and lianas. Most melastomes are medium-sized shrubs or small trees, and in many tropical forests they are the dominant plant family represented in the understory. In the last 20 years or so, the systematics of many melastome tribes have been revised and updated, and the overall phylogenetic structure of the family is now reasonably well-understood (Clausing and Renner 2001).

Nearly half of the melastomes – approximately 2000 species – are placed in 20-30 genera within the tribe Miconieae. The genus *Tococa*, reviewed and revised by Michelangeli in the monograph under review, is particularly notable for the many species that have ant domatia. This genus has a long history of systematic attention, beginning with Aublet's description of the genus in 1775, and continuing through Cogniaux's revisions at the end of the 19th century. Michelangeli's revision is the first thorough analysis of the genus since 1891, and this monograph is a significant contribution to our overall understanding of the ecology, evolution, and phylogeny of genus, the tribe Miconieae, and the family.

The work presented in this monograph derives directly from Michelangeli's dissertation work, and the cladistic treatment is based exclusively on 64 morphological characteristics (his more recent work [Michelangeli et al. 2004] examines phylogenetics of the Miconieae from molecular data). Key findings from the morphological analysis (amplified in Michelangeli 2000) are that our current concept of *Tococa* is polyphyletic, with some species being more closely related to *Miconia* than they are to other species of *Tococa*, and that the genus *Myrmidone* is nested clearly within *Tococa*. Ant domatia (and myrmecophytism) occur in two-thirds of the species, have evolved at least twice, and have been secondarily lost once within the clade of

Tococa sensu strico. It is particularly curious that many of the myrmecophytic species do not have specialist co-evolved ants associated with them, but instead host a broad range of ants, themselves in several subfamilies. This suggests a fairly recent and perhaps rapid evolution of myrmecophytism in *Tococa*, but this hypothesis has not yet been addressed either in *Tococa* or in the other unrelated myrmecophytic melastomes.

The bulk of Michelangeli's monograph is devoted to the systematic treatment of the 47 individual species in *Tococa* sensu lato. The treatments are detailed, and include brief notes on how to discriminate among similar species. Few details on the ecology or habitat of each are given, reflecting the broad need for detailed studies of individual taxa. Twenty of the species are illustrated, some with original drawings by Bruno Manara, and others reprinted from Berry et al. (2001). Range maps are given for 45 of the species; the remaining two, *T. stellata* and *T. undabunda* are known only from type specimens. The distribution maps are not always placed within or adjacent to species descriptions, and so I often found myself hunting for the range map to map the species under discussion.

Overall, this monograph is a significant contribution to our understanding of the systematics of a large, diverse, and difficult plant family. It highlights the value of careful analysis of morphological data, and provides the basic information necessary for comparative ecological studies of *Tococa*, and of ant-plant relationships in the Melastomataceae. For the growing cadre of melastom-ologists, this monograph will be a welcome addition to the library.

– Aaron M. Ellison, Harvard Forest, Harvard University, Petersham, MA 01366.

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Michelangeli, F. A., D. S. Penneys, J. Giza, D. Soltis, M. H. Hils, and J. D. Skean. 2004. A preliminary phylogeny of the tribe Miconieae (Melastomataceae) based on nrITS sequence data and its implications on inflorescence position. Taxon 53: 279-290.

Photographic Atlas of Botany and Guide to Plant Identification. Castner, James L. 2004. ISBN 0-9625150-0-0 (Spiral US$40.00) 310 pp. Feline Press, P.O. Box 357219, Gainsville, FL 32635.

Photographic Atlas of Botany and Guide to Plant Identification is James Castner's newest book and is formatted similarly to his Photographic Atlas of Entomology and Guide to Insect Identification that was released by Feline Press in 2000. Castner is well known for his many other works focusing primarily on aspects of entomology and the Amazon Rainforest, and the photographs featured in this book are of the same high quality as those of his previous works.

The book consists of two sections: one on plant anatomy and a second on plant taxonomy. The plant anatomy section focuses on the form and function of roots, stems, leaves, fruits and flowers. Macroscopic and microscopic photographs of plants demonstrate the wide variation within Kingdom Plantae, and each photograph is labeled for easy identification of the discussed plant features.

Castner does an admirable job of clearly distinguishing structures that are confusing to beginning botany students, e.g. thorns, spines and prickles. Definitions are reinforced by detailed photographs that illustrate anatomical structures on common plants that many students will find familiar.

The plant taxonomy section focuses on the distinguishing characteristics of 153 commonly studied families of seedless vascular plants, non-flowering seed plants and flowering plants. Vivid photographs featuring important characteristics of each family are accompanied by brief descriptions of anatomical and ecological attributes that allow easy identification of living specimens. On a visit to the Missouri Botanical Garden, I was able to use the general taxonomic information provided to correctly identify the families of several plant species I previously knew little about.

This work would be a wonderful guide for any educator teaching introductory plant anatomy or diversity, as well as an easy to understand resource for students in the classroom or laboratory. The clear photographs and concise definitions and descriptions allow anyone, especially those without a botanical background, to easily grasp all the topics covered within the book. Although the actual book is a bit large to be a convenient resource when working in the field, its spiral binding and glossy pages make it an ideal reference manual in the laboratory.

-Kasey Hames, Department of Biological Sciences, Saint Louis University.

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Begonias: Cultivation, Identification, and Natural History. Tebbitt, Mark C. 2005. ISBN 0-88192-73303 (Cloth US$34.95) 360 pp Timber Press, 133 S.W. Avenue, Suite 450, Portland, OR 97204-3527.

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